

# Case Reopened

## *Reassessing Refillable Bottles*



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Discarding beer and soft drink containers after just one use is a relatively new concept. Before World War II, nearly all packaged beer and soft drinks were sold in refillable glass bottles meant to be used as many as 50 times. Today, only about 6 percent of packaged beer and soft drinks are sold in refillable bottles.

Yet refillable bottles are gaining attention once again, this time as a possible strategy for preventing the generation of solid waste that must be recycled, incinerated, or landfilled. A bottle that is filled 20 times eliminates the need for making 19 more bottles, avoiding the environmental effects of materials extraction, processing, manufacturing, and recycling or disposal of those 19 bottles.

### **Beverage containers in the solid waste stream**

Beverage containers' contribution to the US municipal solid waste stream is significant. In 1990, 249 million US residents generated 196 million tons of solid waste, or 4.3 pounds of garbage per person — 50 percent more than 30 years ago. Beer, soft drink, milk, and wine containers comprised more than 10 million tons of waste in 1990, or 5.5 percent of the national total. Beer and soft drink containers alone accounted for 7.8 million tons, or 4 percent of the total.

### **Expanding the use of refillable bottles: A worthwhile environmental goal**

*Case Reopened: Reassessing Refillable Bottles* identifies several ways in which refilling and then recycling bottles can reduce the toll on our environment, not only by reducing solid waste but also by reducing energy use and air and water pollution. If bottles are filled enough times, these benefits more than offset refillable bottles' greater weight and use of material (to withstand additional handling); their washing requirements; and their potential need for additional transportation.

The environmental advantages of refilling depend heavily on the number of trips a refillable bottle makes (the bottle's trippage). The obstacles to achieving high trippage arise from the lack of a collection and refilling infrastructure, not from any physical limitations of bottles. Today's refillable beer, soft drink, and milk bottles can withstand at least 25 trips.

### **Refillable bottles: Clear-cut advantages over one-way bottles made of the same material**

**Material use and solid waste:** Refillable glass or polyethylene terephthalate (PET) bottles use less material and generate less solid waste than their single-use counterparts if the bottles make enough trips. Refillable glass bottles weighing 10.5 ounces and making 25 trips use 93 percent less glass (mea-

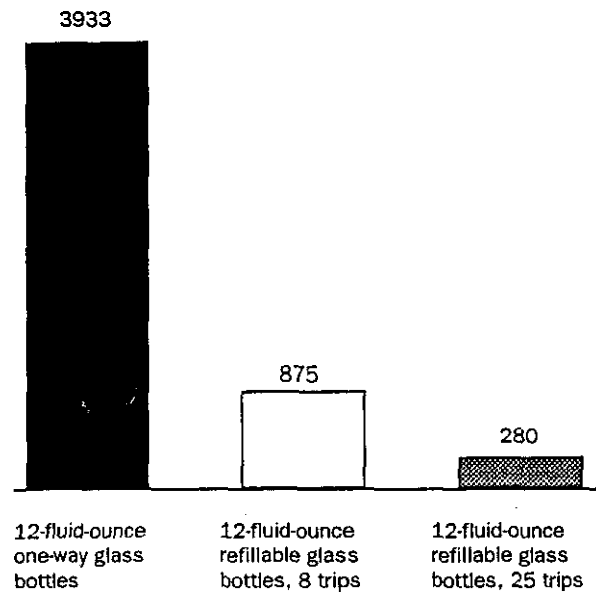
sured in weight) and require handling 96 percent fewer bottles as solid waste than one-way bottles weighing 5.9 ounces that deliver the same amount of beverage. Even at eight trips, refillables use 78 percent less glass than one-way glass bottles delivering the same amount of beverage. Refillable PET bottles show similar advantages over one-way PET bottles.

**Energy use:** Where refilling leads to the use of less material for bottles, less energy is needed to extract raw materials and manufacture new bottles. If the percentage of recycled content is the same for refillable and one-way beer bottles, refillable 12-fluid-ounce glass beer bottles that average 25 trips will consume 93 percent less energy than one-way glass bottles that deliver the same amount of beverage. Energy used in washing refillable bottles is more than offset by savings in energy needed to make additional new bottles.

**Recycled content and energy use:** Using recycled content further reduces the need for new materials and energy required to make new containers. Making a ton of glass from 100 percent recycled glass (cullet) uses 26.5 percent less energy than making a ton of glass from virgin material, and using all recycled aluminum requires 96 percent less energy than using virgin material. Recycled PET content in bottles is limited by a number of factors, and the extent of energy saved when recycled PET is used in making bottles is not clear.

**Air and water pollution:** The net use of less material in a refillable system means that less air and water pollution is generated during manufacturing. Differences in pollution generated by refillable and one-way bottles made of the same material are generally differences in the amount, not the type, of pollution. A refillable 1-liter glass bottle making 10 trips generates a smaller quantity of each of nine different air pollutants than a one-way 1-liter glass bottle, according to one study reviewed by INFORM; according to another, refillable PET bottles also generated less air pollution throughout their life cycle than one-way PET bottles. Two other studies show that refillable glass bottles making enough trips generate less

**Comparison of glass (in pounds) used in refillable and one-way bottles to deliver 1000 gallons of beer in 12-fluid-ounce bottles**



Source: INFORM

water pollution than one-way glass bottles.

**Water use:** The amount of water needed to wash refillable bottles is small in comparison with the water used in making new one-way bottles. The two studies identified by INFORM that analyzed water use found that the washing process for refillable bottles uses between 47 percent and 82 percent less water than is needed to manufacture new one-way bottles for the delivery of the same amount of beverage.

**Secondary and transport packaging:** Secondary packaging (six-pack holders, rings, and other components that are removed by the consumer) and transport packaging account for a large portion of the solid waste generated by all beverage container systems. The use of material and energy in secondary and transport packaging depends on whether this packaging is reusable and whether and how many times it is reused. Many beverage companies in the United States use reusable crates designed to last for five years or more, reducing the material and energy used in making transport packaging.

## Comparing refillable and one-way containers made of different materials: A much tougher challenge

Comparing the environmental effects of containers made of different materials is a complex task that is complicated further when considering whether containers are single-use or refillable. The raw materials and processes used to make glass and PET bottles and aluminum cans vary greatly. However, it is possible to measure the weight and quantity of containers needed to deliver a given volume of beverage; it is also possible, with less precision, to measure and compare the energy needed to make these containers. Still there is no one container type that can be considered environmentally superior overall. Container systems must be evaluated on a case-by-case basis.

**A national perspective on materials use and solid waste:** Under a scenario in which the 1990 market share of aluminum cans remained constant and all glass and PET bottles were refillable and made 25-35 trips, the weight of beer and soft drink container waste would be reduced by 73.6 percent from 1990 levels.

Refillable glass and PET bottles at 8, 25, or 35 trips require fewer containers to deliver a given quan-

tity of beverage than one-way glass or PET bottles, or aluminum cans. The refillable glass bottle at 25 trips uses 95.7 percent fewer containers to deliver 1,000 gallons of beer than the aluminum can.

**Energy use:** Less energy is needed in manufacturing refillable glass or PET bottles than in manufacturing one-way containers to deliver the same volume of beverage. At current levels of recycled content (30 percent for glass, 55 percent for aluminum), nearly 76 percent less energy is needed to make glass for refillable 12-fluid-ounce glass beer bottles that average eight trips and deliver 1,000 gallons of beverage than to make aluminum for cans that deliver the same amount of beer. At 25 trips, 92 percent less energy is needed to make the bottles. However, the energy advantages made possible by refilling may be lost if distribution distances are too great.

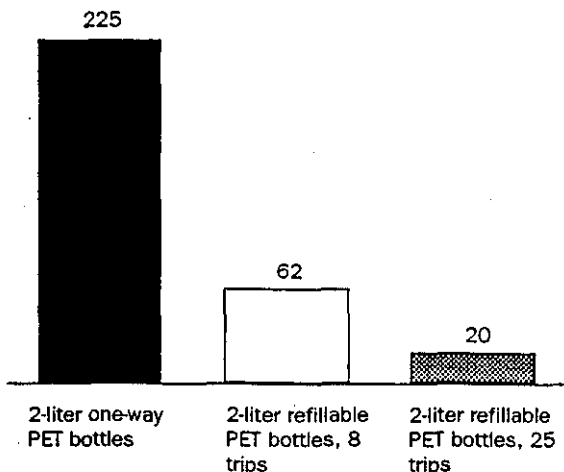
## Why one-way containers predominate today

Despite the environmental benefits of refilling, one-way containers predominate in US markets. Cans command 69 percent of the beer market and 52 percent of the soft drink market; one-way PET bottles' share of the soft drink market is 30 percent. Where refillable bottles are used for beer and soft drinks, average trippage is between five and eight, much lower than most refillable bottles can withstand and too low to realize the maximum environmental and economic advantages of refilling.

The reasons for the decline of refillable bottles since World War II include the consolidation of ownership in the US beer and soft drink industries; increasing home consumption of beer and soft drinks; changes in the relative costs of container materials, labor, and capital; the availability of lightweight container materials (aluminum and plastic); and the rise of supermarket chains, which prefer to avoid handling bottle returns.

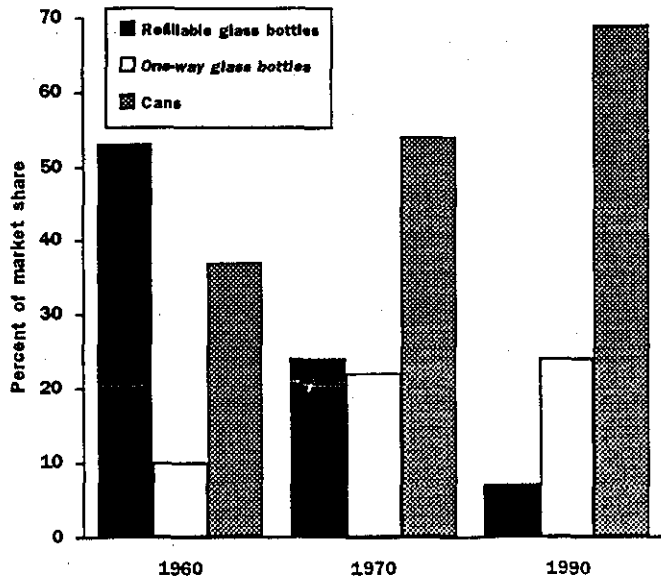
Other factors include the willingness of the public sector to pay to recycle or dispose of one-way containers and industry's promotion of recycling as the most desirable way of addressing container litter

Comparison of PET (In pounds) used in refillable and one-way bottles to deliver 1000 gallons of soft drink in 2-liter bottles



Source: INFORM

**Change in market share of beer containers in the United States (glass and cans), 1960-1990**



Source: R.S. Weinberg & Associates, 1993.

and waste concerns. Government and environmental groups also have emphasized recycling.

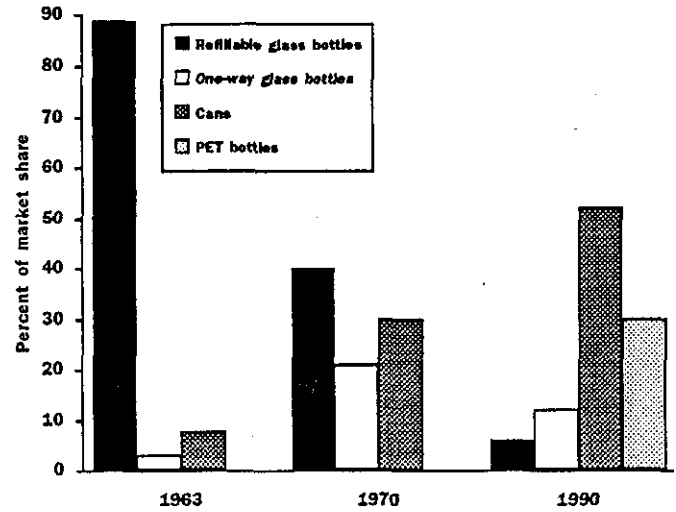
**Why companies refill**

Companies' chief motive for refilling is to save on packaging, the single largest cost in making and distributing beer and soft drinks. Companies may also respond to consumer preference for refillables or use them to encourage consumers to return to company-owned stores. Community interest in solid waste prevention may also play a role. School districts in Connecticut, New York, and Ontario have helped persuade dairies to sell milk in refillable plastic bottles instead of one-way cartons, and a coalition of recyclers and community groups helped convince Rainier Brewing Company in Seattle to resume refilling after a hiatus.

**Obstacles to refilling**

Some beverage companies cite various obstacles to greater use of refillables, including: low return rates;

**Change in market share of soft drink containers in the United States (glass, cans, PET), 1963-1990**



Source: 1963 and 1970 figures from Organization for Economic Cooperation and Development, "Beverage Containers: Reuse or Recycling," 1978. 1990 figures from Edgell Communications' Beverage Industry Annual Manual 1991-1992.

lack of space for storing and washing empty bottles; major capital investments needed for space, equipment, and bottles; retailers' and wholesalers' resistance to handling returned bottles; and consumer resistance to the scuffed appearance of refillable bottles after several trips. Third-party companies that collect, sort, inspect, and wash bottles offer a solution for some beverage companies that lack space or equipment to wash bottles. Still, beverage companies base their choice of containers on a variety of considerations, and using the lowest-cost package does not always translate into lowest overall system costs.

**Special settings where refillables work well**

In areas of the United States, refillable bottles are used for a variety of beverages, including beer, soft drinks, milk, juice, and water, usually in one of four settings that may overlap:

- **Nine states with container deposit laws** Mandatory deposits entail a system for container collection, mostly for recycling. However, such sys-

tems have also helped to preserve a refilling infrastructure for some beverages. Deposit-law states' average market share for refillable beer bottles was 13.2 percent in 1991, compared with 3 percent in non-deposit states.

- **On-premise consumption in restaurants, taverns, and cafeterias** Beverages are purchased and consumed on-site, where bottles are returned. The top five US beer makers package 5-10 percent of their beer in refillable bottles for on-premise sales. Several dairies sell milk in refillable plastic bottles to schools and other cafeterias.
- **Simplified distribution systems** A limited number of parties handle empty bottles. Examples include soft drink bottlers or dairies that sell beverages through their own retail operations; companies that deliver beverages to homes or workplaces; and areas such as Pennsylvania and Ontario that limit the number of beverage retail outlets.
- **Local loyalty to a brand sold in refillables**

### **Opportunities, costs and savings in expanded refilling**

**Beer:** Unlike major soft drink companies, which have scrapped much of their washing equipment, most brewing companies still have washing equipment on-site. For those that do not, refilling glass beer bottles would require a capital investment in equipment that can be amortized over time as reduced packaging costs result in net savings. A brewery would need washing, inspection, and other equipment. But brewing companies can realize significant savings through the use of refillables. A 1985 survey of New York State brewing companies found that some companies that switched from one-way containers to refillable bottles saved between \$4 and \$15 a barrel (one barrel contains 31 gallons).

**Refillable PET soft drink bottles:** Refillable PET bottles, widely used in northern and central Europe and Latin America, offer soft drink companies an opportunity to refill without sacrificing the advantages of one-way PET bottles (light weight, large sizes, and unbreakability). Introducing a refill-

able PET system at a soft drink plant would require washing, inspection and additional equipment, such as sorting equipment and conveyors. But if an expanded market for refillable PET bottles led to a decrease in their price, and if bottles made 20 trips, INFORM's analysis of industry data suggest that soft drink companies would save nearly \$0.04 per 1.5-liter bottle per trip over time by switching from one-way to refillable PET bottles.

**Milk:** In 1990, 23.2 billion single-use milk containers contributed 0.9 million tons to the US municipal solid waste stream. Although less than 5 percent of milk is sold in refillable bottles in the United States today, the milk industry's logistics lend themselves to refilling for three reasons. Because of its perishability, milk is usually delivered directly from dairies to stores, simplifying the return of bottles to dairies; milk is shipped in reusable crates that return to dairies; and shipping distances rarely exceed 200 miles.

The cost of converting a dairy to use refillable polycarbonate milk bottles can range from \$200,000 to \$1 million. Dairies that refill can save enough money on bottles to offset additional handling costs. Stewart's Processing Corporation in Saratoga Springs, New York, estimates that it saves \$0.025 per bottle per trip when it uses half-gallon refillables instead of paper cartons.

### **Government policies that promote refilling**

Other than mandatory deposits, governments in the United States, Canada, and Europe have used a variety of policies designed to promote refilling, including:

- Taxes on one-way containers that give a price advantage to beverages sold in refillable bottles (Finland, Norway, Ontario, New York State)
- Quotas for refillable bottles as a percentage of beverage sales volume (Ontario and Germany)
- Bans on one-way containers (Denmark, Prince Edward Island)
- Separate retail systems for beverages, apart from food retail stores (Ontario, Pennsylvania)

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There are at least five other public policy options that could promote the use of refillable bottles, including:

- ◆ Requiring the use of generic (standardized) bottles
- ◆ Providing financial incentives for companies that switch from one-way containers to refillable bottles
- ◆ Establishing broad materials policies, such as taxes on virgin materials or energy consumption, as an incentive to reduce the environmental effects of materials use
- ◆ Establishing government procurement guidelines that require or give preference to refillables
- ◆ Setting two-tier quantity-based user fees (QBUFs) for collection of recyclable and non-recyclable solid waste, giving consumers an incentive to use refillables.

### Industry initiatives that promote refilling

Industry has used at least five initiatives to create or enhance an infrastructure for refilling, including:

- Charging deposits in non-deposit environments or setting deposits higher than those required by law
- Using standardized refillable bottles, enabling companies to reduce shipping distances for used bottles and to reduce investments in bottles
- Making bottle returns more convenient for consumers and retailers by installing “soft-drop” reverse vending machines and establishing special return areas within stores or return centers outside of stores
- Promoting bottle returns by educating the public

about the advantages of refilling and bottle-return procedures

- Developing third-party collection and washing enterprises

### Other considerations in promoting refilling

Creating a widespread refilling infrastructure in the United States would require some form of deposit legislation in combination with other policies and industry initiatives. Deposits provide an essential framework for returning bottles but are not enough to create a refilling system or to ensure that bottles will be refilled rather than recycled. Deposit systems can be enhanced in several ways, including:

- Establishing multi-tier deposits in which consumers receive a full-deposit refund with refillable bottles, a “half-back” refund with recyclable containers, and no refund if they return one-way containers
- Broadening deposit laws to cover all beverages
- Setting mandatory handling fees for retailers who accept returned bottles and for wholesalers who handle empty refillable bottles.

**Public education:** Education is vital to the success of a refilling program. Many US residents do not understand the differences between refilling and recycling. Consumers would need to understand that under a refilling system, bottles are reused before they are recycled, that refilling may offer greater environmental advantages than recycling, and that a successful refilling system requires high return rates.

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*Case Reopened: Reassessing Refillable Bottles* (David Sapphire) 1994, ca. 310 pp., \$25.

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