SUMMARY OF GLASS RECYCLING IN SELECTED EUROPEAN COUNTRIES

Rhea Hamilton *
Solrun Figenschau Skjellum*
Miguel A. Rodriguez**

* Student, MBA Program, IESE
** Lecturer of General Management, IESE

IESE Occasional Papers seek to present topics of general interest to a wide audience. Unlike Research Papers, they are not intended to provide original contributions in the field of business knowledge.
Abstract

The overall objective of this study is to provide recommendations to Pricewaterhouse Coopers with regard to their client, Ecovidrio, to help recycling initiatives in Spain increase glass recycling levels (currently at 40%) to comply with the requirements of the European Packaging Directive. According to the directive, Spain must reach a recycling rate of 60% or 75% by mid-2006, depending on which of the two options for revised targets are agreed upon.

The first part of this study explains the strategic importance of glass as a packaging material in Europe and the environmental and economic benefits of its 100% recyclability, as well as the European Packaging Directive and its implications.

The second and critical part of the report is based on the comparative study entitled Summary of Glass Recycling in Selected European Countries. The country studies performed therein have been used to identify the main recycling drivers and barriers. The lessons learnt from these countries have been used to provide recommendations as to how Ecovidrio may contribute to bring Spain’s recycling rate into compliance with the directive.
SUMMARY OF GLASS RECYCLING IN SELECTED EUROPEAN COUNTRIES

Background Report for study on Glass Recycling in Spain

Introduction

On December 20, 1994 the European Parliament and the Council adopted Directive 94/62/EC on packaging and packaging waste, which was to be incorporated into national law by the Member States by June 30, 1996. The recycling targets defined in the directive were currently under review (see main report for more information on the European glass situation and the Directive).

In order to meet the targets set in the European packaging directive, Member States had to ensure the establishment of recycling and recovery systems in their respective territories. Most Member States had transferred economic and administrative responsibility for this task partially or entirely to the glass industry.

Most systems allowed for the “off-loading” of packaging recovery obligations onto an industry organisation against payment of a membership fee (Ireland, the Netherlands, UK) or a license fee (e.g. Green Dot fees in Austria, Belgium, France, Germany, Italy, Spain, Portugal; recycling fees in Norway, Sweden). The size of the fee varied greatly from Member State to Member State.

The Green Dot originated in Germany and was merely a logo indicating a “recuperation guarantee”, which informed the consumer that the producer had paid a license fee in order to finance the collection and recycling of the glass container. As long as the consumer brought the container to a collection point, it would enter the recycling chain.

Due to national differences, the packaging recovery systems varied in the Member States, but many of the systems displayed common features. Some variations were necessary to make the systems work in different settings. In what follows, some of these systems will be explained.

One of the recycling parameters to be studied in particular was the recycling rate, which was defined as follows:
Theoretically, the numerator should include only domestic containers, but this was not always the case. In countries with deposit systems, some industry glass was included as non-returnable bottles were handed in by breweries/soda producers. The error this represented tended to be small (3–10%). Some countries, such as Portugal, seemed to be deliberately manipulating the rate by including window glass etc. in the numerator.

Also, measuring the denominator required accurate monitoring. In some countries, this was facilitated through a recycling fee which had to be paid for every glass container placed in the market. An accurate quantity of glass could normally be calculated based on the fees received. Other countries forced reporting of glass placed in the market from all agents which were involved with such activities (container manufacturers, bottlers, importers, etc.). In other countries, the glass amount was fairly poorly monitored. All in all, the varying quality in the information diminished the value of direct comparisons. With the exception of Portugal, the overall picture painted for the studied countries was, however, correct.

The countries studied in this report are: Austria, Belgium, France, Germany, Ireland, the Netherlands, Norway, Portugal, Sweden, Switzerland and the United Kingdom.

1. Austria

1.1 Organisation and results

Austria Recycling initiated the recycling of glass from domestic sources in the mid-'70s. In 1989, Austria Glas Recycling GmbH (AGR) was spun off from Austria Recycling. The founding companies of AGR were VetroPack Austria GmbH (a major packaging company), Stölzle Oberglas AG and Lutzky Glas GmbH.

AGR was responsible for collecting glass from households and industry (hotels/restaurants/wine producers/breweries/producers of mineral water, soda and fruit juices, etc.). The company decided which glassworks to deliver the collected glass to and guaranteed that 100% of the glass would be returned to the market as raw material for new glass containers.

In 1993, the Austrian Packaging Regulation (VVO) came into effect. One of the main purposes of the regulation was that the costs of the collection and treatment of packaging waste should be borne by the entity that put the packaging onto the market (producer, importer, etc.). By paying license fees (Green Dot fee) based on packaging volume, the responsibility for recycling could be transferred to Altstoff Recycling Austria AG (ARA), which assumed responsibility for recycling. Austria Glas Recycling was the ARA company for glass. Like the other organisations specialized in a particular material, it was a non-profit organization which used all the license fees it received to pay for the collection, sorting and processing of packaging waste. All the recycling services were outsourced, as AGR itself had only nine employees. In 2000, AGR generated revenues of 20.2 million euros.
AGR was present throughout Austria and worked closely with the local authorities and more than 30 private recuperators/waste specialists, supplying glass to Austrian and German glassworks.

In short, AGR:

- Assumed responsibility for compliance with the packaging regulation (VVO) on behalf of associate companies (licensed companies)
- Guaranteed collection and processing for all licensed glass packaging companies
- Financed packaging collection
- Organized packaging collection
- Improved the collection systems continuously (costs, containers, locations, pick-ups, frequency of emptying)
- Provided services to communities and waste associations (communication, counseling)
- Provided information to the public.

Glass from households was collected in bottle banks (“bring-system”). All Austrian communities had bottle banks. In total, there were about 90,000 bottle banks in Austria, which corresponded to about 100 inhabitants/container and an average distance to containers of 300 m for the consumers. Glass was collected separately as colored and non-colored glass by means of combi-containers. Attempts to separate in three colors had resulted in no additional savings and so had been cancelled.

The industry (hotels/restaurants/wine producers/breweries/producers of mineral water, soda and fruit juices, etc.) had special agreements with AGR with regard to pick-up of their glass packaging (the industry presumably paid for these services).

The evolution of the Austrian recycling rate can be seen in Figure 1.1. The recycling system ran parallel to a deposit system for bottles used for sodas and beers. Returnable bottles were not included in the recycling rate given below, except when returned from the industry at the end of their useful lives or when incorrectly placed in a recycling container by consumers. 1997 shows a peak at 88%, which was in fact due to a major change in the bottle park. In that year, new beer bottles (so-called NRW bottles) were placed on the market and all existing beer bottles were withdrawn from the industry and recycled.
Due to the recycling of glass, the following savings were made in 2000:

- 140,580 tons of quartz sand
- 45,190 tons of limestone and dolomite
- 35,150 tons of soda
- 182,750 m$^3$ landfill site volume for disposable glass containers
- 192.4 million kWh

1.2 Key factors for success

- High environmental awareness due to massive movement in the ’70s
- Long Austrian general recycling tradition
- Extremely high density of containers (100 inhabitants/container; 300 m average distance for consumers)
- Strategic location of containers
- 25 years of glass recycling
- Color-separation (colored/non-colored) facilitated by combi-containers

1.2.1 Communication strategy and target audience

AGR had been able to lever the general awareness for the benefits of recycling. The awareness stemmed from a strong environmental movement in the ’70s. The public was informed through:
– Poster campaigns
– Newspapers (articles and ads)
– Direct information to households

Current marketing efforts were limited, although the communities and the renovation companies provided occasional information to households. The company was unable to provide information on marketing costs or on the direct consequences of the marketing efforts undertaken.

1.3 **Consumer incentives to separate and recycle glass**

– Generally high environmental awareness
– High awareness of benefits of recycling

1.4 **Producer incentives to use recycled glass in production**

In Austria, recycled glass was the most important raw material for glass production. In 2000, the content of recycled glass was up to 60% for non-colored glass, up to 70% for brown glass and up to 100% for green glass.

This implied a great cost reduction, due to
– Savings in energy costs: in the year 2000, 192.4 million kWh were saved
– Savings in raw material costs as virgin material, according to AGR, was more expensive than recycled material

1.5 **Contacts and links**

Austria Glas Recycling GmbH
A-1020 Wien
Austria
Telephone: + 43-1-214-5600
www.agr.at

Altstoff Recycling Austria AG, ARA
www.ara.at
2. Belgium

2.1 Organisation & Results

The structure of Belgian production was very different from that of other producer countries. Flat glass was the most important sector, with some 60% of the total produced. Production (around 150 kg per capita) was almost three times greater than apparent consumption (50 kg per capita), whereas in the other EU countries the volume of glass production was roughly equivalent to glass consumption (=production+imports-exports).

Because Belgium is such a small country, with little space, recycling was an essential part of both the industrial and domestic sectors. Over the previous three years the number of containers per inhabitant had gone from 1:2500 to 1:750. Unlike the open approach in Netherlands where consumers had a natural tendency to be concerned with the environment and therefore recycled, Belgium took a more forceful approach and would force polluters to pay via increases in taxes or through the bag-payment system.

2.1.1 The Private Sector

Most hotels and restaurants had elected to rent their own bottle banks from private collectors. These businesses could also choose to take their glass directly to the recuperator, though costs were extremely high (from 5000 to 6000 BEF/tonne).

2.1.2 Collection Process

Essentially, there were three methods for collection.

\textit{a) Bottle Banks}

– Rented out or paid for by City Councils
– Poor quality
– Glass was separated into three colors

\textit{b) Door to Door}

– Collected once per week
– No separation of colors
– Financed by the Government
– Most expensive!
– Very small percentage of total glass recycled

\textit{c) Container Parks}

– Rented out or paid for by City Councils
– Picked up twice per month
– Excellent quality
– Colors were separated
2.1.3 The Recycling System

FOST PLUS was a government-approved, non-profit-making organisation born of voluntary action by the private sector to finance, co-ordinate and promote the selective collection, sorting and recycling of household packaging waste. It was created to help comply with the European packaging waste directive (94/62/CE of 20/12/94) and the Co-operation Agreement (which came into force on 5/3/97) relating to the prevention and management of household packaging waste.

FOST PLUS used its budget to pay the City Councils, which in turn contracted out the collection and transportation of recycled glass from bottle banks, container parks and the door-to-door service. The collection agencies then brought the glass to the recuperators to have the glass separated, washed and treated to be made into cullet. The cost of returning glass to the recuperators could be anywhere from 0 to 1000 BEF (25 Euro) per tonne returned.

Some statistics relative to the activities of FOST PLUS:

- 5400 FOST Plus members in August 99
- 32 intensified projects for packaging collection
- 6 300 000 inhabitants covered by the projects (early 99)
- 419 communes affected by these projects (early 99)
- Cost in Belgian francs/inhabitant/year of the intensified projects: 350 BEF
- 90% consumer participation level 12 months after start of intensified sorting and collection project
- On average, more than 24 kilos/inhabitant/year of glass were collected in 1998 thanks to bottle banks, door-to-door collections and container parks.

2.1.4 The Use of Cullet

About 96%-97% of the recycled glass was from green bottles. Approximately 70% cullet was used in the glass fabrication stage, as required by government regulation. In general, there was a shortage of clear glass bottles, so clear glass cullet commanded a much higher price.

2.2 Key Success Factors

This success was explained by the widespread implementation of selective collection in Belgium, but also by the introduction of appropriate complementary measures, such as:

- the introduction of paid-for bags for household waste;
- regulations enforced by towns and communes;
- very intensive communication in the press at commune, local and national level.
- All FOST PLUS members contributed, through the financial support symbolised by the Green Dot, to the higher recycling rates of packaging waste.
2.3 Consumer incentives to separate and recycle glass

– Tax reductions for increased recycling rates
– Limited amount of “paid” bags collected (500 BEF (12.5 Euro) per extra bag!)

2.4 Contacts & Links

GRL-GLASRECYCLING
Dellestraat 10
B-3560 Lummen

+ 32 13 / 53 06 60
+ 32 13 / 53 06 69

Glass Industry Federation
Telephone + 32 (0) 2 542 61 20
Email: info@vgi-fjv.be
http://www.vgi-fjv.be

Glass Science Institute
Telephone: +32 (0) 71 272911
Email: inv@charline.be
http://www.charline.be/inv

FOST PLUS
http://www.fostplus.com
3. France

3.1 Organisation and Results

3.1.1 History

The history of glass recycling in France began in the late ’70s when the French glass manufacturers signed the first recycling contract, committing themselves to calculated objectives. By 1984 one in four bottles was being recycled. In 1994 1.4 million tons of domestic glass was being recycled, with over 60,000 containers placed at the public’s disposal. Almost 30,000 districts were equipped with a selective collection system for glass by 1997. There were over 70,000 containers at the public’s disposal, that is, about one container per 800 inhabitants.

3.1.2 Domestic Glass Collected

The average quantity of glass collected per inhabitant per year was 20 kg. Cullet was the main glass manufacturing raw material and was employed up to 80% in glass production.

Of the 3 million tonnes of glass in the French market (average 50 kg/inhabitant/year), three-quarters (2.3 million tonnes) corresponded to public usage, whereas one-quarter (0.7 million tonnes) made up the market for cafes, hotels and restaurants. Of that, 87% of the glass came from bottles and was separated into three components: champagne bottles, beer bottles and other (water, alcohol etc.).

Household collection had been increasing rapidly. Thanks to the use of 70,000 container parks, the French had an average deposit rate of 20 kg of glass per year.

| Table 3.1. Number of Container Parks and Tonnage of Glass Recovered |
|-----------------------------|----------------|----------------|----------------|----------------|
| Glass Tonnage Recovered     | 600,000 t | 900,000 t | 1.3 Mt | 1.5 Mt |

Source: Verre Avenir

These results were dependent also on variables such as population density and placement of containers.
Table 3.2. Recycled Glass Statistics for France

<table>
<thead>
<tr>
<th>Population</th>
<th>Inhabitants per container</th>
<th>Recycled Glass per inhabitant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 5,000</td>
<td>300 to 350</td>
<td>24 kg</td>
</tr>
<tr>
<td>From 5,000 to 20,000</td>
<td>400 to 600</td>
<td>21 kg</td>
</tr>
<tr>
<td>From 20,000 to 100,000</td>
<td>800 to 850</td>
<td>14 kg</td>
</tr>
<tr>
<td>More than 100,000</td>
<td>1000 to 1500</td>
<td>5 to 10 kg</td>
</tr>
</tbody>
</table>


**Glass Treatment**

The French used an SIG system much like Germany or Spain. Glass collected had to be treated prior to reutilization, including: separation and washing. The elimination of non-recyclable items was done electronically as the recuperated items were passed over a camera that verified the material according to transparency and density.

The other saving was a reduction of costs for local administrators. Currently, the recuperation and recycling of glass cost between 50 and 100 FF a tonne. That was much less than landfills at 350 to 750 FF, or incineration at 400 to 900 FF. For example, the 1.5 million tonnes of glass recycled in 1997 would be equivalent to a saving of between 500 and 750 million French Francs.

Table 3.3. Costs of Separating and Recycling Glass in 1996
(frans per tonne where approx. 100 francs=15 Euro)

<table>
<thead>
<tr>
<th>Operation</th>
<th>Operator</th>
<th>Cost</th>
<th>Separation of Finances</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Collector</td>
<td>5</td>
<td>Collector 5</td>
</tr>
<tr>
<td>Place of Containers</td>
<td>Collector/Glass recuperator</td>
<td>83</td>
<td>Collector 53</td>
</tr>
<tr>
<td>Financing and Maintenance</td>
<td>Collector/Glass recuperator</td>
<td>230</td>
<td>Organization 30</td>
</tr>
<tr>
<td>Collection and Transport</td>
<td>Collector/Glass recuperator</td>
<td>14</td>
<td>Recuperator 200</td>
</tr>
<tr>
<td>Other</td>
<td>Glass recuperator</td>
<td>332</td>
<td></td>
</tr>
<tr>
<td>Total Collection Cost</td>
<td>Glass recuperator</td>
<td>58</td>
<td></td>
</tr>
<tr>
<td>Loss (5%)</td>
<td>Glass recuperator</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Treatment</td>
<td>Glass recuperator</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Transport</td>
<td>Glass recuperator</td>
<td>97</td>
<td></td>
</tr>
<tr>
<td>Cost total per tonne treated</td>
<td>Glass recuperator</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Management</td>
<td>Glass recuperator</td>
<td>454</td>
<td>58 60 336</td>
</tr>
<tr>
<td>Management</td>
<td>Glass recuperator</td>
<td>20</td>
<td>na na 20</td>
</tr>
<tr>
<td>Total Cost</td>
<td></td>
<td>474</td>
<td>58 60 356</td>
</tr>
</tbody>
</table>

Source: ADEME study, 1996 data.
Table 3.4. International Comparison of Recycling Costs

<table>
<thead>
<tr>
<th></th>
<th>Germany</th>
<th>Switzerland</th>
<th>France</th>
<th>Belgium</th>
<th>Italy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tonnes collected</td>
<td>2,839</td>
<td>259</td>
<td>1,400</td>
<td>224</td>
<td>894</td>
</tr>
<tr>
<td>Recycling Rate</td>
<td>795</td>
<td>89%</td>
<td>50%</td>
<td>66%</td>
<td>53%</td>
</tr>
<tr>
<td>Cost of recycling (1)</td>
<td>886</td>
<td>763</td>
<td>431</td>
<td>428</td>
<td>392</td>
</tr>
<tr>
<td>Price paid by glass recuperator FF</td>
<td>329</td>
<td>298</td>
<td>400</td>
<td>302</td>
<td>303</td>
</tr>
<tr>
<td>% of total</td>
<td>37.1%</td>
<td>39.1%</td>
<td>92.8%</td>
<td>709.6%</td>
<td>77.3%</td>
</tr>
<tr>
<td>Price charged to the councils FF</td>
<td>557</td>
<td>465</td>
<td>31</td>
<td>126</td>
<td>89</td>
</tr>
<tr>
<td>% of total</td>
<td>62.9%</td>
<td>60.9%</td>
<td>7.2%</td>
<td>29.4%</td>
<td>22.7%</td>
</tr>
</tbody>
</table>

(1) Price per tonne in francs.  

3.1.4 Improving the System

France, currently at an average recycling rate of 55%, was working at increasing its rate to 75%. Their objective was to be reached via the following routes:

– Improve management of communities and Container Parks.
– Increase containers per inhabitant from 800 to 500.
– Continue door-to-door collection with glass separated by color.
– Improve content of containers.

3.1.5 Separation of Glass by Colour

The question asked by the French was: Why did the Germans separate their recycled glass into three colors – white, brown and green? In Germany 50% of the glass was white glass, whereas in France 70% of the glass was green and only 20% was white (10% other). This meant the French had less incentive to separate their colored glass. However, in order to attain the desired 75% recycling rate, they were planning to increase the recycling rate not only of green glass, but also of white and other colored glass.

The first trials separating glass by color began in 1997, using two different recycling containers (white glass & colored glass). The initial results were good even without a large promotional campaign.

On the one hand, one might ask why it was necessary to separate the glass, as the glass recuperators would accept mixed glass. On the other hand, it was absolutely fundamental to separate the three in the case of the door-to-door service. The message to the public had to be consistent for both ways of recycling glass in order to encourage the highest and most efficient participation rates.
3.1.6 Difficulties for the Future

There were doubts as to whether the recuperators had enough capacity to handle the increases in recycling rates. The glass recycling processors had a capacity of between 1.8 and 1.9 million tonnes per year. Considering the rate the society had agreed upon in order to reach 2.15 million tons, there was about 200,000 tonnes of glass recycling capacity unaccounted for.

What would happen if glass usage in the market declined? Glass had managed to fight off cartons, steel, aluminum. But what about plastic? The first warning sign came with the sale of mineral water in plastic bottles. Currently, glass represented only 30% of the packaging used in the mineral water industry (47% in Europe and 100% in Germany).

<table>
<thead>
<tr>
<th></th>
<th>Germany</th>
<th>France</th>
<th>Italy</th>
<th>UK</th>
<th>Europe (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (millions of litres)</td>
<td>7,155</td>
<td>5,540</td>
<td>7,540</td>
<td>561</td>
<td>np</td>
</tr>
<tr>
<td>Glass</td>
<td>100%</td>
<td>30%</td>
<td>28%</td>
<td>15%</td>
<td>47.9%</td>
</tr>
<tr>
<td>Plastic</td>
<td>np</td>
<td>70%</td>
<td>70%</td>
<td>85%</td>
<td>47.4%</td>
</tr>
<tr>
<td>Others</td>
<td>np</td>
<td>np</td>
<td>2%</td>
<td>np</td>
<td>4.7%</td>
</tr>
</tbody>
</table>

(1) Europe = European Union + some other non-Member States.
Source: GISEMES, Groupement international des eaux minérales et eaux de source.

3.2 Contacts & Links

http://www.coberec.be/fr/coberec/f_coberec.htm
http://www.senat.fr/rap/

4. Germany

4.1 Organisation and results

German recycling was initiated by municipalities in 1974. In 1991, a new regulation, the Packaging Ordinance, came into force. The ordinance required the recycling of sales packaging to be organized by way of a nationwide “dual” system, that is, a second system operating parallel to municipal waste collection and disposal. The Product Recycling and Waste Management Act of 1994 also transferred responsibility for “waste for recovery” to the private waste management industry in other industrial fields, while the municipal residual waste collection and disposal system was responsible for “waste for disposal”, i.e. by means of landfilling and incineration.

In anticipation of this change, Duales System Deutschland AG, the Dual German System, was founded on September 28, 1990. Initially structured as a private limited company, it was converted into a public limited company in 1997. In 2001 it had around 600 shareholders from industry and trade. The shares were not traded on the stock exchange.
It was organised as a non-profit company on account of the purpose for which it was set up: the Dual System fulfils the obligations prescribed by the German Packaging Ordinance of 1991 and the Amendment of 1998 on behalf of industry and trade. As an umbrella organisation for the recycling of sales packaging, the company neither owned nor ran any sorting or recycling plants itself. Instead, it organised the collection, sorting and recycling of packaging in line with the specifications of the Packaging Ordinance, with the support of 537 waste management partners in the Federal Republic of Germany. The objective of the company was to prevent and recycle sales packaging.

The Dual System took over product responsibility in the sales packaging sector after payment of a Green Dot license fee. The Green Dot was a logo indicating to the consumer that the producer had paid the fee necessary to provide proper recycling if the consumer returned the bottle to the appropriate location. The Green Dot was in fact invented by the German Dual System, but had since spread to various European countries, including Spain.

More than 18,500 licensees used the Green Dot and thus financed the separate collection, sorting and recycling of sales packaging. Licence fees and hence company turnover amounted to around DM 3.9 billion in 1999. The company was currently planning to reduce turnover and expenditure in order to lower costs for licensees. Around 379 employees worked at company headquarters in Cologne-Porz.

When the Dual System was being established, between 1991 and 1993, the company was faced with the task of harmonising the new system with existing municipal collection systems. This requirement, which was also stipulated by the Packaging Ordinance, explained why there were so many different collection systems in Germany.

The Dual System documented its collection and recycling performance in the so-called Mass Flow Verification, which had to be submitted to the environment ministries of the German federal states at the beginning of May each year.

The Dual System cooperated with municipalities, which were responsible for putting in place the necessary infrastructure for separate waste collection (funds from the Dual System). Used glass packaging was normally collected in bottle banks for differently colored glass (‘bring system’). The bottle banks were placed in strategic locations, with a density of about 500 inhabitants/container. Mostly, the glass containers were located together with containers for paper, metal, and other recyclables in order to reduce transport for consumers.

In the early ’70s, door-to-door collections were performed, but were unsuccessful. Due to high pick-up costs, collections were done only once or twice a year, forcing consumers to store large amounts of glass containers in their homes. This was not deemed acceptable by consumers, who chose instead to dispose of their glass together with normal waste.

Material-specific organisations were in charge of organizing the actual recycling. In the case of glass, the guarantor was Gesellschaft für Glasrecycling und Abfallvermeidung (GGA). GGA took ownership of the glass, organized and funded separate collection and transport, including transport to recuperation plants. The transportation of cullet to manufacturers of glass containers was paid for by GGA. The funds came from the sale of the cullet to the container manufacturers.

Figure 4.1 shows the evolution of German recycling. More detailed figures on German recycling are given in Appendix A-1. The recycling system ran parallel to a deposit system for soda and beer bottles. Returnable bottles are not included in the recycling rate.
given below, except when returned from the industry at the end of their useful lives or when incorrectly placed in a recycling container by consumers.

Figure 4.1. The evolution of the German recycling rate
(In percentage)

Source: www.umweltbundesamt.de

To further boost the recycling of glass containers, the German government was currently debating whether to expand the deposit system to include non-disposable containers (jam jars, etc.). A tentative date of 2002 had been set, but as yet no final decision had been made.

Attempts had also been made to increase the quality of the returned glass. A higher price was paid for clean, correctly sorted glass. The following premiums were paid: green glass: 1 DM/tonne; white glass: 2 DM/tonne and brown glass: 8 DM/tonne.

4.2 Key factors for success

– High environmental awareness.
– Long German general recycling tradition.
– High density of containers (500 inhabitants/container).
– Strategic location of containers.
– Three decades of glass recycling.
– Color-separation (green, brown, clear) facilitated by combi-containers.
– Mostly houses also in urban zones.
4.2.1 Best performers

A German study performed by the Institut für Demoskopie Allensbach on behalf of the Dual System showed that the most committed waste separators lived in rural districts and towns with up to 20,000 inhabitants.

A demographic study showed that women, singles and older people were the better performers. Although there was room for improvement, people were fairly satisfied with the organisation of German waste management. Finally, a wide majority of Germans felt that “collection and recycling” was the best waste disposal concept. 77% gave preference to recycling over waste incineration and landfilling. This broad consensus was held by all age groups.

More information on the results of the study are given in Figures 4.2 and 4.3.

**Figure 4.2. Demographic study on separation of waste in Germany**

<table>
<thead>
<tr>
<th>Separation of waste based on demographics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Families</td>
</tr>
<tr>
<td>Singles</td>
</tr>
<tr>
<td>19-29 years</td>
</tr>
<tr>
<td>30+ years</td>
</tr>
<tr>
<td>Men</td>
</tr>
<tr>
<td>Women</td>
</tr>
<tr>
<td>Total population</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>75%</th>
<th>80%</th>
<th>85%</th>
<th>90%</th>
<th>95%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 4.3. Study on Germans’ satisfaction with their waste management system**

<table>
<thead>
<tr>
<th>Satisfaction with German waste management</th>
</tr>
</thead>
<tbody>
<tr>
<td>More serious problems locally</td>
</tr>
<tr>
<td>Well organized locally</td>
</tr>
<tr>
<td>More serious problems</td>
</tr>
<tr>
<td>Well organized</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>0%</th>
<th>20%</th>
<th>40%</th>
<th>60%</th>
<th>80%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
4.2.2 Communication strategy and target audience

Ms Lodescher at GGA explained that communicating the benefits of glass recycling had been facilitated by a generally strong environmental awareness. GGA had run a few –very few– marketing campaigns on TV and in the press. The company was unable to provide information on marketing costs or the direct consequences of the marketing efforts performed. The company had various kinds of information material at hand, which could be obtained by contacting the company. Most of the communication strategy was aimed at schools, and various educational tools such as videos and brochures were provided.

The glassworks and manufacturers of glass containers ran some commercials on their own, as including cullet in their production greatly reduced their production costs (see section 3.4 in main report on Spain).

The Dual System had recently also launched a TV campaign about various types of recycling. The stars of the spots were talking bottles and cans, as well as a famous and popular German actor. Additionally, the Dual system organized various initiatives for kids, the basis of which was fun, imagination and action. They included mascots for recycling, websites, competitions, etc. Also, the Dual System published quarterly newsletters, a collection diary and general literature on recycling practice.

4.3 Consumer incentives to separate and recycle glass

– Generally high awareness of environmental benefits of recycling
– Vary in the different Bundesländer (states), but some which have been proven successful are
  – Renovation fees based on weight (and glass is heavy)
  – Random checks of trash cans: if they contain glass, the trash is simply left standing until the resident of the house sorts it out
  – Reduced landfill costs - Landfill charges (1999) range from £48 (e.g. street cleaning waste) to £96 (commercial waste including recyclable components).

4.4 Producer incentives to use recycled glass in production

Recycled glass was an essential raw material for German glass production. For colored glass, 30% of the raw material was cullet and for green glass, 90%, up from 10% in 1972.

This implied a great cost reduction, due to

– Savings in energy costs: in the year 2000, energy costs were reduced by 16.3% due to the use of recycled glass in glass production.
– Savings in raw material costs – according to Ms Lodescher at GGA, prices for recycled raw material were lower than for virgin raw material (prices not disclosed due to confidentiality issues).
5. Ireland

5.1 Organisation & Results

The governing body in Ireland, Repak (http://www.repak.ie), was an approved not-for-profit limited company established under a voluntary agreement between industry, the Department of the Environment and local government. It was established as industry’s response to the obligations placed on Ireland by the EU Directive on Packaging and Packaging Waste (94/62/EC) and was the only Approved Body under the Waste Management (Packaging) Regulations 1997. National targets were set at recovering 25% of packaging waste by 2001.

The Repak fee structure introduced in January 2000 was fixed for a three-year period and costs were reviewed annually. It was based on the principle of “Shared Responsibility”, which ensured that the cost of recovery and recycling of packaging waste was spread across the supply chain. Fees were generated twice yearly via statistical submissions made by each member. As can be seen in Table 5.1 below, the parties were charged on the quantity and type of packaging handled. The sum of these figures equated to 100% of the cost of recycling 1 tonne of the material in question.
Table 5.1. Participation Fees for Year 2000 & 2001 membership

<table>
<thead>
<tr>
<th>Activity Supply Chain</th>
<th>in Cost/Tonne IEP</th>
<th>EURO</th>
<th>Fee Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer</td>
<td>1</td>
<td>1.27</td>
<td>Participation Fee</td>
</tr>
<tr>
<td>Converter</td>
<td>1</td>
<td>1.27</td>
<td>Participation Fee</td>
</tr>
<tr>
<td>Brandholder/Importer</td>
<td>See Below</td>
<td></td>
<td>Material Specific Fee</td>
</tr>
<tr>
<td>Distributor/Wholesaler</td>
<td>1</td>
<td>1.27</td>
<td>Participation Fee</td>
</tr>
<tr>
<td>Retailer</td>
<td>2</td>
<td>2.54</td>
<td>Participation Fee</td>
</tr>
</tbody>
</table>

Participation fees were charged at a flat fee per tonne, irrespective of the material type, and were charged depending on the activity, or activities, of the Member.

Table 5.2. Fees collected Per Material

<table>
<thead>
<tr>
<th>Material</th>
<th>Cost 2000 IEP/tonne</th>
<th>Cost 2001 EURO/tonne</th>
<th>IEP/tonne</th>
<th>EURO/tonne</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass</td>
<td>4.40</td>
<td>5.59</td>
<td>4.40</td>
<td>5.59</td>
</tr>
<tr>
<td>Paper</td>
<td>10.89</td>
<td>13.83</td>
<td>10.89</td>
<td>13.83</td>
</tr>
<tr>
<td>Plastic</td>
<td>36.31</td>
<td>46.10</td>
<td>46.00</td>
<td>58.41</td>
</tr>
</tbody>
</table>

Credits for minimisation, reuse, reduction and recycling of packaging will result in lower fees for the Member.

6. The Netherlands

6.1. Organisation & Results

The Netherlands was fast becoming the most efficient recycling center in the world. In the Netherlands, the recycling bins were three cubic metre cylinders buried under the ground. The collection trucks could remotely monitor the level of the bins to know exactly when they were full. This saved on diesel fuel and cut down on wage cost. Being underground, the bins were not an eyesore. Statistic showed that trucks picked up 50% more recycled material than under previous methods. Because the Netherlands had no natural resources of its own and was the most crowded country in the EU, recycling was an important part of life for consumers.

In 1999, the Netherlands collected 380 million tonnes of disposable domestic glass and 50 million tonnes of industrial glass for recycling. For the collection of domestic glass more than 22,000 containers had been placed near shopping malls, supermarkets and in residential areas throughout the country. Total glass recycling grew to over 91% in 1999, including collections from industry and commerce. The jump from 1998 (84%) appeared to be in part due to a new way of calculating the rate whereby there was no longer a differentiation between “new” non-returnable glass and returnable glass. Nonetheless, these figures were among the highest in the world. By the year 2005, the recycling companies hoped that the number of containers would have been increased to 20,750, with more than 70% of all collected glass being separated by color.
6.1.1 History

Glass recycling in the Netherlands began in the 1970s and had nearly 30 years of history. In the late 1980s, bottle banks were introduced just for the recycling of glass. More than 6,000 bottle banks were installed in urban and rural areas, and from there the number of bottle banks steadily grew throughout the country (see Table 6.1).

Since it became clear that Dutch consumers considered responsible management of the environment to be important and this meant there would be opportunities to expand glass collection, in 1982 the Bottle Bank Promotion Foundation (Stichting Promotie Glasbak) was established. Government bodies, trade and industry worked together in this foundation with the goal of promoting the separate collection of glass packaging waste. Promotional campaigns were started at that time, targeting both children and adults.
In 1992-93, a further large-scale survey was conducted. The results led to guidelines being established for local authorities on the most appropriate methods for separate glass collection. One recommendation was an ideal bottle bank density of 1 bottle bank for every 650 inhabitants.

In 1985, 210,000 tonnes of glass were collected, and by 1995 the figure had reached 342,000 tonnes, giving an 80% recycling rate. For a few years after this the rate leveled out at just above 80%. Natural growth ceased at a time when an agreement between central government, local authorities and the glass processing industry raised the target figure to 90%. In 1991, bottle banks were separated according to three colors. By 1996, over 50% of the bottles recuperated were already separated.

**Figure 6.3 Introduction of Separated Glass in the Netherlands**

6.1.2 Consumer Trends & Attitudes

A survey of bottle bank use, commissioned by the Bottle Bank Promotion Federation and conducted by research company Trendbox BV in 1999, showed that consumers in general were concerned about the environment and sustainable development. One thousand Dutch people aged 16 and over were interviewed to reveal the views of Dutch consumers regarding used glass, possible barriers to bottle bank use, and attitudes towards separation of waste in general and glass in particular. It emerged from the survey that Dutch consumers were both familiar with bottle banks and mostly willing to deposit used glass in them. They did not view using bottle banks as a chore and even considered it an integral part of the household routine. Some consumers took used glass to bottle banks several times a week while others did so once a week.
A distinction should also be made according to population density. In large towns and cities in the Netherlands, bottle banks were used proportionately less than in the country. Apartment dwellers in particular were more likely to admit to succumbing to the temptation of putting used glass into household refuse. Going to the bottle bank was not generally done at a specific time, but rather as and when convenient. In the main, it seemed that people went to the bottle bank when they were shopping or whenever a certain amount of glass had accumulated at home.

Currently, the number of containers per inhabitant was somewhere between 800 and 900. At one point the figure was as low as 1:650. However, the key factor was the actual distance a consumer had to travel. This distance was reduced to a maximum of 300 meters. If it was any more than 300 meters, consumers tended not to recycle as much. Some of the containers were placed close to shopping areas so that people could return their used glass products on the way to the store. Only 10 villages had a door to door service. This was a very inefficient and expensive method of collection.

6.1.3 Private Companies

Hotels, restaurants and bars etc. were not allowed to use the bottle banks. They had two choices: (i) bring their glass for recycling directly to the glass recyclers; or (ii) rent a small bottle bank for their premises and have glass picked up with the other bottle banks. In other words, they would have to hire a private collecting company to pick up the bottles. The second method was by far the cheaper and was the one most commonly used. Many restaurants or cafes worked with their neighbours to rent a bottle bank between several businesses.

6.1.4 Glass promotion

Even though more than three quarters of consumers were familiar with bottle bank advertising (mainly via television), information was still considered the most important stimulus for increasing glass collection. No doubt, as consumers still put some glass packaging into their household waste, providing more information had been shown to lead to even better results.

With a budget of approximately 600,000 Euros, promotional techniques in the Netherlands included TV advertising (3 times per year over one-week periods), plus billboards and large posters. The objective of the campaigns was to educate the public. Education included:

– How to use the Bottle bank.
– How glass was made & the importance of cullet.
– The energy and environmental savings associated with glass recycling.

Promotional techniques were targeted at children. For example, a competition was run in all schools.
6.1.5 The Recycling System

The following are some of the distinctive features of the Netherlands’s recycling system:

– The municipal authorities were responsible for waste contracts with private companies, which collected the glass from the bottle banks. These contracts were paid for with the revenue from a local tax that was determined separately by each individual authority.

– There was no government intervention or subsidies for promotion. Funds were provided from a glass industry budget.

– Companies placing new glass on the market paid a fee based on the kilograms injected into the market.

– In 2001 no Green Dot system was in place.

– About 30% of white glass was derived from cullet, whereas about 90% of amber/green glass came from cullet.

– Tourism played a small role in recycling rates in the Netherlands. There were strictly enforced regulations for campsites and how to deposit waste. All had bottle banks.

– People were convinced that the glass would be used and, in all cases, in a much more efficient way. This was due largely to the education and knowledge of residents about the glass industry.

6.1.6 Should the Government play a role?

Currently, there was some controversy as to whether or not the government should play a more active role. For example, at present everyone in a village paid the same fixed tax. One of the recommendations made was to allow people who recycled more to pay less taxes. In this scenario, each resident paid per kilogram of garbage put on the street. Bottle banks suffered under this arrangement as people would throw anything into them merely to get rid of trash. In addition, the community suffered as there would be more trash left in the streets (unclaimed). As the quality of the material in the bottle bank worsened, costs would increase and there would be a financial strain on the system. As a result, residents would see an increase in taxes. Clearly, this was a vicious circle, though it was still in the testing stage.

In the eyes of the Dutch, two factors stand out as essential to recycling:

1. Educate the public!
2. Maximise the efficiency of the whole collection system!
6.2 Contacts & Links

Stichting Kringloop Glas
Contact: Mr. Robert Vanknotten
Telephone: +31 183-405613

TNO Milieu
P.O. Box 342
7300 AH Apeldoorn, The Netherlands
Telephone +31-55-5493493
Fax +31-55-5419837
(Environmental Research and Test Institute)

Directoraat-Generaal Milieubeheer
Rijnstraat 8
Postbus 30945
2500 EZ Den Haag, The Netherlands
Telephone +31-70-3393939
Fax +31-70-3394565

Branchevereniging Kringloopbedrijven in Nederland
6828 PZ Arnhem, The Netherlands
Telephone 31-26-3514014 Fax 31-26-3892796
(Association of recycling companies)

Other links:
http://strategis.ic.gc.ca

7 Norway

7.1 Organisation and results

The body in charge of Norwegian Recycling, Norsk Glassgjenvinning, was founded in 1989 as a cooperative venture between the Oslo City Council and Moss Glassverk (a glass producer). In that year the recycling rate was low, at 24%, but when the system went national in 1992 it quickly rose to about 70%. As can be seen in Fig. 7.1, it reached 83% in 1999.

Used glass packaging was normally collected in bottle banks (‘bring system’). Some collection sites had one big combi-container, which was also used for other recyclables, such as paper, metal, etc. Other sites, especially in the city, had separate bottle banks, which were normally located next to containers for other recyclables in order to reduce transport for the consumers. In all cases, colored and non-colored glass was separated. The bottle banks were located in strategic positions, with a density of about 1500 inhabitants/container.

All glass containers placed in the Norwegian market were subject to a recycling fee, which was used to finance the recycling. Norsk Glassgjenvinning cooperated closely with local authorities (town councils), which were responsible for installing the appropriate infrastructure for recycling.
The Norwegian authorities were able to calculate an accurate recycling rate based on the total fees received in a year, from which it was possible to calculate the actual amount of glass placed in the market.

A black market due to smuggled goods and tax-free goods represented a source of error, as recycled glass from these sources increased the recycling rate, but according to Jakob Schmidt, director of Norsk Glassgjenvinning, the error was low.

The recycling system ran parallel to a deposit system for soda and beer bottles. More than 90% of returnable bottles were brought back to the store. Returnable bottles were not included in the recycling rate given below.

However, the recycling rate included some industrial glass (about 10%), which primarily came from breweries and bottlers and consisted of returnable bottles which had been taken out of the deposit system and sent to recycling because they were too damaged to be reused.

In 1994, the recycling rate dropped. This was due to the product responsibility introduced by the EU directive. Figure 7.1 shows that transferring responsibility from the Community Councils to the producers temporarily halted the growth in the recycling rate.

According to Jakob Schmidt, the current objective was not to increase the recycling rate any further as doing so would require enormous investment. Rather, the goal was to optimize the existing system, both on the consumer and on the process side.
7.2 **Key success factors**

Schmidt claimed that the key factors accounting for Norway’s high recycling rates were:

- Norwegian attitudes
  - Norwegians did not like to throw glass into normal garbage sacks because they worried about hurting the refuse collectors who picked them up (the Norwegian participating in this study was herself brought up to always wrap glass thrown in the trash in newspaper; this was a habit passed on to her by her grandmother, who always talked about the danger of hurting someone else). This attitude had been fomented through black and yellow warning stickers placed on people’s trash cans by the refuse collectors.
  - Norwegians generally regarded glass as a material of high value, most likely due to the deposit system, which had long been in place for returnable bottles. Comparatively, the recycling of metal had not been as successful as the recycling of glass, even though recycled metal did in fact have a much higher value, even though it was not perceived as such by the consumer.
  - Neighbor control: one motivation for separating the trash was to avoid having neighbors think of you as a bad citizen.
  - Discipline.
- A good logistical system. Norwegians wanted to recycle, but only if it was facilitated by a good recycling infrastructure, including:
  - appropriate location of containers (shopping centers or other places commonly frequented);
  - number of containers (distance to transport recyclables);
  - appropriate emptying of containers (should not be allowed to fill up).

7.2.1 **Best performers**

In Norway, the best recyclers lived in villages and towns with fewer than 20,000 inhabitants. The reason was believed to be that these people paid particular attention to information from their Community Council, as well as worrying about their neighbors. In the cities, the media noise was high and reaching the audience was more difficult. Additionally, only a small proportion of city dwellers lived in one-family houses, so for many it was relatively easy to “anonymize” their trash. Also, it was more difficult to locate collection containers in the cities.

7.2.2 **Communication strategy and target audience**

Norsk Glassgjenvinning had focused its efforts on optimizing the running of the system, as consumers’ motivation to recycle had been seen to be very strong. No above-the-line advertising campaigns (press, TV, radio, movie theaters, etc.) had been run. The importance of recycling had been communicated to the public through:

- Direct mail from the City Council informing consumers about the recycling system and its benefits for society (glossy marketing material was not read, material of an informational nature was)
- Schools and kindergartens, and TV programs targeted at kids.
– Children were seen as instrumental (idealistic and unopinionated) and were trained to act as an “environmental police force” in their own homes.
– Various mascots symbolizing recycling had been used for kids. The mascots were the heroes of TV shows; they answered children’s questions and arranged games and competitions on the Internet.

The company was unable to provide information on marketing costs or the direct consequences of the marketing efforts performed.

7.3 Consumer incentives to separate and recycle glass

– Concern for renovators (danger of cuts from broken glass)
– Neighbor control (did not want to be seen as bad citizens)
– Possibly landfill costs in some communities (not yet confirmed)

7.4 Producer incentives to use recycled glass in production

Recycled glass was an essential raw material for Scandinavian glass production. For colored glass, 35% of the raw material was cullet; for brown glass, 50%; and for green glass, 90%.

This implied a great cost reduction, due to

– Savings in energy costs
– No numbers on prices for virgin vs. recycled raw material were available

7.5 Contacts and links

Mr Jakob Schmidt
Norsk Glassgjenvinning AS
PO Box 102 Økern
0509 OSLO
Telephone: +47-23173980
Fax: +47-23173999
www.glassgjenvinning.no
E-mail: norsk@glassgjenvinning.no

8 Portugal

8.1 Organisation & Results

The environmental sector in Portugal was expected to experience strong growth over the coming five to ten years. Demand for environmental products and services had so far
been driven mainly by regulations. This situation was changing, however, as polluters modified their attitude towards the environment, shifting from a passive approach dictated by legislation to a more pro-active approach of tackling the underlying problems. Government, local authorities, and industry were planning huge investments in the environmental sector.

The Portuguese government was concentrating on four of the many waste products that could be recycled: glass, paper, plastic and metal scrap. Specific equipment for recycling this type of urban waste had excellent prospects in the Portuguese market. However, Portugal failed to meet EU standards in its treatment of waste after collection. Only 15% of domestic glass was recycled and 42% of industrial glass.

Figure 8.1 and 8.2. Glass Recycling Containers in Portugal

8.2 Contacts & Links

Sociedade Ponto Verde, S.A.
Edifício Infante D. Henrique
Rua João Chagas, nº 53 - 1º Dtº
1495-072 ALGÉS
Tel: 21 414 73 00
Fax: 21 414 52 46
E-mail: info@pontoverde.pt
http://www.pontoverde.pt/vidro.html

Embalagens de Serviço
embalagens.servico@pontoverde.pt

Autarquias/Sistemas Municipais
autarquias@pontoverde.pt

Distribuidores
distribuicao@pontoverde.pt

Embalmadores
embaladores@pontoverde.pt

Fileiras de Materiais/Recicladores
fileiras@pontoverde.pt

Informação Geral
info@pontoverde.pt

Boletim Informativo SPV
recicla@pontoverde.pt

Hotelaria, Restauração e Cafetaria
verdoreca@pontoverde.pt
9 Sweden

9.1 Organisation and results

Swedish Glass Recycling (Svensk GlasÅtervinning AB, SGÅ) was founded in 1986 for the collection and recycling of used and graded glass containers. SGÅ was jointly owned by REXAM (19.6%), the Swedish Brewers’ Association (19.8%), the Swedish Wine & Spirit Distributors’ Association (18.8%), Swedish Food Industries (18.8%), the Convenience Goods Trade Development Council (18.8%) and LG Fredriksson Handels AB (5.1%).

In 1994, the Swedish Parliament passed a law on producer liability for packaging. Prior to the law, the Community Councils had also recycled glass on a voluntary basis.

With the new system, producers, importers, packagers etc. were responsible for recycling all glass without costs on behalf of the end-consumer. SGÅ administered the system, which was executed by local private contractors as well as those Community Councils that chose to do so. SGÅ bought the recycled glass on a weight basis. SGÅ received its funds from a recycling fee paid for all glass containers placed in the Swedish market, as well as from the sales of cullet to glass producers. The recycling fee was based on bottle size (see Table 9.1).

<table>
<thead>
<tr>
<th>Table 9.1 Swedish recycling fees</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average Recycling Fee</strong></td>
</tr>
<tr>
<td>14 Swedish öre/bottle</td>
</tr>
</tbody>
</table>

Used glass packaging was normally collected in bottle banks (‘bring system’). At each collection site there was a green bottle bank for colored glass and a white bottle bank for non-colored glass. The bottle banks were placed in strategic locations, with a density of about 1200 inhabitants/container. Mostly, these containers were located together with containers for paper, metal, and other recyclables in order to reduce transport for consumers.

In the center of the bigger cities, in which it could be difficult to find an appropriate site for bottle banks, some door-to-door collection was performed. Door-to-door collections were also occasionally done for restaurants.

All the glass collected was transported to the SGÅ reprocessing plant, Sweden’s only reprocessing plant, located in the middle of Sweden (with roughly half the population to the north of it and half to the south).

The law of 1994 decreed a recycling target of 70% for glass containers. This target was reached in 1996. In 2000, the recycling rate had reached 90%. The evolution of Swedish recycling can be seen in Figure 9.1 The flattening part of the curve corresponds to the introduction of the new law. The graph shows that the transfer of responsibility from the Community Councils to the producers temporarily halted the growth in the recycling rate.

Due to the recycling fee, the recycling rate was easily calculable. The amount recycled included a minor proportion of industrial glass, primarily from bottlers. Sweden had a separate deposit system and at the end of their useful life, returnable bottles entered the recycling system for disposable glass containers. This slightly increased the recycling rate due to an increase in the amount of recycled glass. If this glass is excluded, the recycling rate for 2000 drops from 90% to 86%. 
As for Norway, the objective is not to further increase the recycling rate, but to improve efficiency throughout the recycling chain, from consumer behaviors to process engineering.

### 9.2 Key success factors

Swedish Glass Recycling (SGÅ) saw the following as being key to their high recycling rates:

- High degree of public awareness and motivation
- Accessibility
  - Strategic locations such as residential areas, shopping centers and service stations were recommended
  - Clarity (information)
- To facilitate color separation, green containers were used for colored glass and white containers for non-colored glass. Color-based separation was highly successful. The error in separation was only 2%. According to Tomas Berg, the error was due to inappropriate emptying of the containers. Consumers separated correctly, but if one container was full (normally the one for colored glass), they would throw the bottles in whichever container had space.
- Information stickers further emphasizing color separation as well as stickers stating what was not to be put in the containers (ceramics, china, light bulbs etc.)
9.2.1 Best performers

In Sweden, the poorest-performing communities were the “forest communities”, in which the distance to the containers were greatest. Unlike its culturally similar neighbor, Norway, Sweden reported no specific trend for higher recycling rates in rural areas. In fact, the two biggest cities, Stockholm and Gothenburg, performed better than the national average. The reason was unknown, but door-to-door collection could be an explanation. However, the quality of the returned glass was generally lower in the cities, causing higher costs at recuperation plants.

9.2.2 Communication strategy and target audience

Initially, SGÅ concentrated principally on informing the public and the media in order to promote a general awareness about glass recycling. Hence, from 1986 to 1991/92, extensive information was given. The media used were:

– Newspapers
– Direct mail, in particular in cooperation with local communities (glossy brochures were thrown away, boring-looking letters were regarded as important information and so were read)
– Bought spots and articles in Community Council newsletters
– Information in cooperation with local recuperators

As of 2001, the public was judged to be very well informed and no campaigns about the benefits of recycling had been run since 1992. However, SGÅ was now focusing on information and training programs in order to upgrade the quality of the collected glass. Similar media were used (still no TV). In these communication efforts, SGÅ cooperated with other recycling organisations to bring down the total costs of informing the audience. Additionally, SGÅ had been a pioneer on the Internet, providing among other things a complete search base encompassing all collection points in Sweden. The company was unable to provide information on marketing costs or on the direct consequences of the marketing efforts performed.

However, information efforts had largely been switched to the country’s schools with the aim of developing sound habits among the consumers of tomorrow.
9.3 *Consumer incentives to separate and recycle glass*

- High awareness of the benefits of recycling
- Less frequent pick-up of trash; in some areas trash was now only collected every two weeks, or even once a month (people were forced to reduce their trash volume)
- Some communities charged consumers per kilo of trash (and glass is heavy)

9.4 *Producer incentives to use recycled glass in production*

Recycled glass was an essential raw material for Scandinavian glass production. For colored glass, 35% of the raw material was cullet; for brown glass, 50%; and for green glass, 90%.

This implied a great cost reduction, due to

- Savings in energy costs: in the year 2000, energy costs were reduced by 16.3% due to the use of recycled glass in glass production
- No numbers on prices for virgin vs. recycled raw material were available

9.5 *Contacts and links*

Mr Tomas Berg  
Svensk GlasÅtervinning AB  
69674 Hammar  
Telephone: +46-583-87103 (Mr Berg directly)/+46-583-87100  
www.svenskglasatervinningab.se

10 Switzerland

10.1 *Organisation and results*

Switzerland was the only country studied which was not affected by the EU packaging directive. Glass recycling started in Switzerland in the early 1970s. The recycling was handled by private companies. The biggest one was Vetro-Recycling AG, a daughter company of the Vetropack Group, one the biggest players in the Swiss packaging industry. The company was founded in 1973 and recycled about 40% of the glass in Switzerland.

From 1973 to 1976 glass was recycled through door-to-door actions, but in 1973 the first bottle banks were placed in the streets and door-to-door collections were abolished. Ever since the system was established, the glass containers had separated different colored glass; brown, green, white. The bottle banks were strategically located close to shopping centers, city halls, residential areas, etc.
Swiss recycling of glass was dictated by a national law, and the communities were responsible for the logistics of the system (containers etc.). As of 1994, communities also had to pay a fee per tonne of glass picked up by the recuperators in order to cover part of the transport costs. Due to this delivery fee, industry (restaurants, hotels, etc.) were not allowed to use the bottle banks; instead, they had to take the glass directly to the recuperation plants themselves.

The funds needed to finance the recycling costs for the communities had to be taken from general tax revenues. Recently, some communities had terminated their recycling efforts due to the cost burden. In order to alleviate the costs and maintain the motivation to recycle, the authorities were debating whether to introduce a recycling fee per bottle placed in the market by January 1, 2002. As in other European countries, a proportion (or all) of the accumulated fees would be handed over to local communities to fund collection.

The evolution of Swiss recycling is shown in Figure 10.1. In the late ’90s, the recycling rate had consistently stayed above 90%, which made Switzerland the best performer in the world. The calculation of the glass packaging placed in the market was based on reports from producers, imports, etc. and was assumed to be fairly accurate.

Like several other Northern European countries, Switzerland had a separate deposit system. At the end of their productive lives, returnable bottles were transferred to the recycling system. The resulting increase in the recycling rate was not known at Vetro-Recycling, but based on results from other European countries, it was deemed to be small.

Figure 10.1 Evolution of the Swiss recycling rate

10.2 Key success factors

- High environmental awareness largely due to strong environmental movement in the early ’80s (high press coverage, etc.)
– Long Swiss tradition of general recycling
– Strategic location of containers
– Three decades of glass recycling
– Color-separation (green, brown, non-colored) facilitated by combi-containers

10.2.1 Communication strategy and target audience

Vetro-recycling had been able to lever the general awareness for the benefits of recycling. The awareness stemmed from a strong environmental movement in the early ’80s, which included strong press coverage about recycling and information in community newsletters. Vetro-recycling had run no TV or other marketing campaigns. The company was unable to provide information on marketing costs or on the direct consequences of the marketing efforts performed.

Various efforts were, however, made to inform children. Swissrecycling, an umbrella organisation for the recycling of clothes, glass, steel, etc., ran a recycling bus, which visited schools. Vetro-recycling also had a special children’s section on its web site. It was named after a popular American detective series, the X-files, and the information in the files could only be accessed after answering fairly advanced questions about recycling. The information contained in the files was written by children and revealed a high level of knowledge about recycling among Swiss children.

10.3 Consumer incentives to separate and recycle glass

– Generally high environmental awareness
– High awareness of benefits of recycling
– A specific number of bags were available for trash from a household every year. If the bags were all used, new bags had to be bought by the consumer at a cost of 2.5 Swiss francs per bag. This gave an incentive to reduce trash left at the door (bring recyclables to collection points).

According to Margrit Huber at Vetro-Recycling, the high awareness and motivation were by far the most important factors.

10.4 Producer incentives to use recycled glass in production

In Switzerland, recycled glass was the most important raw material for glass production. In 2000, the content of recycled glass was, on average, 65%, and for green glass as high as 82%.

This implied a great cost reduction, due to

– Savings in energy costs: in the year 2000, energy costs were reduced by 16.3% due to the use of recycled glass in glass production
– Prices for virgin vs. recycled raw materials were not disclosed due to confidentiality
10.5 Contacts and links

i.A. Margit Huber
Vetro-Recycling AG
Schützenmattstrasse 266
CH-8180 Bülach
Telephone +41-1-863 36 36/+41-1-863-32 66 (directly to Ms Huber)
Fax: +41-1-863 36 26
E-mail: margrit.huber@vetropack.ch

11 The United Kingdom

11.1 Organisation and results

Bottle banks appeared for the first time in the UK in 1977. At the end of 2000 there were over 20,000 bottle bank sites in the UK, i.e. one for every 2,800 people. The average glass bottle contained over 25% recycled glass. Green glass bottles manufactured in the UK contained at least 60%, and sometimes as much as 90% recycled glass. In 1997, 425,000 tonnes of glass was recycled in the UK.

The evolution of the British recycling rate is shown in Figure 11.1.

Figure 11.1. The evolution of the UK recycling rate
Table 11.1 below reports glass recycling statistics for the year 2000. Although the domestic recycling rate calculated is very low (33%), the rate was calculated from the National production of container glass. No adjustments have been made for differences in imports or exports.

Table 11.1 Glass Recycling Statistics for the United Kingdom (Y 2000)

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Glass recycled in 2000</td>
<td>628,000 tonnes</td>
</tr>
<tr>
<td>Total Glass packaging recycled in 2000</td>
<td>567,000 tonnes</td>
</tr>
<tr>
<td>National production of container glass</td>
<td>1.71 million tonnes</td>
</tr>
<tr>
<td>Percentage of glass packaging recycled</td>
<td>30%</td>
</tr>
<tr>
<td>Percentage of glass recycled, including flat</td>
<td>33%</td>
</tr>
<tr>
<td>European average recycled</td>
<td>Over 50%</td>
</tr>
<tr>
<td>Number of districts with bottle bank sites</td>
<td>424</td>
</tr>
<tr>
<td>Total number of bottle banks at the end of 2000</td>
<td>22,772</td>
</tr>
<tr>
<td>Current number of public bottle bank sites</td>
<td>18,263</td>
</tr>
<tr>
<td>In year of first bottle bank scheme</td>
<td>4509</td>
</tr>
<tr>
<td>Glass as a percentage of average household waste</td>
<td>8-10%</td>
</tr>
<tr>
<td>Ratio of bottle bank sites to inhabitants</td>
<td>1 : 2,640</td>
</tr>
</tbody>
</table>


11.2 Contacts and Links

British Glass
Northumberland Road
Sheffield, S10 2UA UK
Telephone: (0114) 268 6201
Fax (0114) 268 1073
Web site: http://www.britglass.co.uk
### Appendix A-1 Detailed numbers for German recycling

<table>
<thead>
<tr>
<th>Year</th>
<th>Glass (container) production</th>
<th>Glass (container) domestic product</th>
<th>Glass (container) recycling</th>
<th>Recycling rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1974</td>
<td>2717157</td>
<td>2307874</td>
<td>150000</td>
<td>6%</td>
</tr>
<tr>
<td>1975</td>
<td>2676596</td>
<td>2413043</td>
<td>205605</td>
<td>9%</td>
</tr>
<tr>
<td>1976</td>
<td>2847067</td>
<td>2507587</td>
<td>264786</td>
<td>11%</td>
</tr>
<tr>
<td>1977</td>
<td>2777072</td>
<td>2383386</td>
<td>321856</td>
<td>14%</td>
</tr>
<tr>
<td>1978</td>
<td>2781922</td>
<td>2452187</td>
<td>407672</td>
<td>17%</td>
</tr>
<tr>
<td>1979</td>
<td>2946280</td>
<td>2513180</td>
<td>465318</td>
<td>19%</td>
</tr>
<tr>
<td>1980</td>
<td>2844620</td>
<td>2457529</td>
<td>566474</td>
<td>23%</td>
</tr>
<tr>
<td>1981</td>
<td>2790701</td>
<td>2407291</td>
<td>672939</td>
<td>28%</td>
</tr>
<tr>
<td>1982</td>
<td>2707821</td>
<td>2314410</td>
<td>749728</td>
<td>32%</td>
</tr>
<tr>
<td>1983</td>
<td>2722203</td>
<td>2306552</td>
<td>832173</td>
<td>36%</td>
</tr>
<tr>
<td>1984</td>
<td>2817672</td>
<td>2348244</td>
<td>883489</td>
<td>38%</td>
</tr>
<tr>
<td>1985</td>
<td>2958299</td>
<td>2416601</td>
<td>1050494</td>
<td>43%</td>
</tr>
<tr>
<td>1986</td>
<td>3130000</td>
<td>2545537</td>
<td>1139796</td>
<td>45%</td>
</tr>
<tr>
<td>1987</td>
<td>3171839</td>
<td>2552055</td>
<td>1249065</td>
<td>49%</td>
</tr>
<tr>
<td>1988</td>
<td>3251398</td>
<td>2663363</td>
<td>1312463</td>
<td>49%</td>
</tr>
<tr>
<td>1989</td>
<td>3518240</td>
<td>2911078</td>
<td>1556328</td>
<td>53%</td>
</tr>
<tr>
<td>1990</td>
<td>3966656</td>
<td>3324061</td>
<td>1791124</td>
<td>54%</td>
</tr>
<tr>
<td>1991</td>
<td>4182735</td>
<td>3760607</td>
<td>2295433</td>
<td>61%</td>
</tr>
<tr>
<td>1992</td>
<td>4335000</td>
<td>3797992</td>
<td>2288924</td>
<td>60%</td>
</tr>
<tr>
<td>1993</td>
<td>4197000</td>
<td>3693206</td>
<td>2390279</td>
<td>65%</td>
</tr>
<tr>
<td>1994</td>
<td>4432000</td>
<td>3694096</td>
<td>2721659</td>
<td>74%</td>
</tr>
<tr>
<td>1995</td>
<td>4400000</td>
<td>3718400</td>
<td>2711261</td>
<td>73%</td>
</tr>
</tbody>
</table>

Summary of Glass Recycling in Selected European Countries.
## Appendix A.2. Historical Glass Recycling Figures for the Netherlands

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total 10,000</td>
<td>770</td>
<td>700</td>
<td>700</td>
<td>700</td>
<td>647</td>
<td>647</td>
<td>647</td>
<td>647</td>
<td>633</td>
<td>572</td>
<td>564</td>
<td>550</td>
<td>530</td>
<td>504</td>
<td></td>
</tr>
<tr>
<td>Glass 13.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>800</td>
<td>1,500</td>
<td>4,300</td>
<td>8,720</td>
<td>11,900</td>
<td>12,100</td>
<td>12,200</td>
<td>12,200</td>
<td>12,500</td>
<td>12,500</td>
<td></td>
</tr>
<tr>
<td>Percentage 49%</td>
<td>50%</td>
<td>52%</td>
<td>55%</td>
<td>66%</td>
<td>70%</td>
<td>73%</td>
<td>76%</td>
<td>77%</td>
<td>80%</td>
<td>81%</td>
<td>82%</td>
<td>84%</td>
<td>91%</td>
<td>na</td>
<td></td>
</tr>
</tbody>
</table>

Results of glass recycling (source: Stichting Kringloop Glas)
Appendix A-3

Summary of Case Study Recycling Schemes and their Principal Drivers

<table>
<thead>
<tr>
<th>Principal Recycling Drivers</th>
<th>Denmark</th>
<th>France</th>
<th>Germany</th>
<th>Italy</th>
<th>Netherlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>– National waste taxes (based on disposal costs); – Volume based charging; – Deposit refund charges.</td>
<td>– Producer responsibility; – Good separate collection facilities; – Public information activities.</td>
<td>– Landfill disposal costs; – Producer responsibility; – Consumer waste management charges; – Strong public relations work.</td>
<td>– Landfill disposal charges; – Requirement to provide separate collection systems; – Markets for paper and glass; – Public information.</td>
<td>– Landfill ban for household waste; – Requirement for separate collection of different waste materials in household waste; – Producer responsibility; – High level of environmental awareness</td>
<td></td>
</tr>
</tbody>
</table>

| Population | 281,955 | 59,663 | 267,000 | 119,790 | 137,295 |
| Density of population | 601/km² | 631/km² | 1,300/km² | 3,619/km² | 1,350/km² |
| Urban/rural | Urban & rural | Urban | Urban & rural | Urban & rural | Urban |
| Recycling targets | National: 64% for all sectors by 2004. Municipal: 69% over the domestic, commercial and industrial sectors by 2004; 70% by 2012. | 50% of MSW must be recovered (energy recovery, re-use, recycling). | At a regional level: – collection: 125kg per capita per year – recycling set at 80% of collected recyclable material – bio-waste: a maximum collection of 120 kg per capita | At national level: Separate MSW waste collection: 35% by 2003. | National: 60% of MSW for re-use and recycling by 2000. |
| Management structure | Separate collection is contracted out. Sorting is carried out by a company that is part owned by the municipality. Treatment is carried out by the private sector. | The municipality collects waste. Waste sorting and treatment is contracted out to private companies. | A public company manages the collection, treatment and disposal of MSW. | Collection and treatment activities are contracted out to the private sector. | A privatised company has the responsibility for collection and treatment of waste. It has a 75% shareholding by the municipality. |
### Appendix A-3 (continued)

<table>
<thead>
<tr>
<th>Denmark</th>
<th>France</th>
<th>Germany</th>
<th>Italy</th>
<th>Netherlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Legal/regulatory</td>
<td>− Statutory obligation to provide separate collection of paper and glass; − Companies that produce 100 kgs of waste per month must recycle.</td>
<td>− National packaging recycling target: 75%. An agreement made between the compliance organisation, EcoEmballages, and the government guarantees prices for sorted materials.</td>
<td>− 1997 Decree requires local authorities to provide separate collection facilities.</td>
<td>− 1993: Action Programme for Waste Separation; − 1992 &amp; 1993: tightening up requirements for incineration and landfilling; − Landfill ban on household waste from 1995; − Producer responsibility for various waste streams.</td>
</tr>
</tbody>
</table>


| Public awareness tools                        | − Advertisements in the local paper; − Information campaigns; − Energy centre that provides schools education on recycling; − Development of a waste information booklet. | − Press conferences; − Public meetings; − Door to door literature distribution; − Guided tours of compost sites; − Free helplines | − Quarterly newsletters; − Collection diary for DSD yellow bags; − Literature on recycling practice. | − Creation of an information “shop”; − Free composting courses; − Schools environmental education programmes; − Public meetings. − Waste calendars. | − Environmental awareness is generally high. Historically, there have been many public information campaigns. |