

Glass



After being severely hit by the oil crisis and fall-off in demand at the beginning of the 1980s, the EC glass industry has undergone extensive restructuring, involving the introduction of new technology, cuts in staff, improved productivity, greater concentration via mergers and acquisitions and internationalisation. By 1986 production had returned to 1980 levels and has grown constantly ever since. In 1989, production grew by 3.4% in terms of volume and 4% in value, and an annual growth rate of approximately 2.5% is expected between now and 1994. The glass industry accounts for less than 1% of EC manufacturing output.

Description of the industry

The glass industry falls into NACE category 247 and comprises five main sub-segments. Container glass (also known as hollow glass) represents the glass industry's main outlet, i.e. approximately 66% of EC glass production. Flat glass, which is primarily used in the construction and transport equipment sectors, constitutes approximately 22% of glass production. Glass tableware represents over 4%. The remaining 8% is divided up between glass fibre, specialised glass (high-tech products, included in the category entitled "others") and various products not listed in the above categories.

Economic importance of the Industry

Current situation The EC glass industry produced almost 21 million tonnes of glass products in 1989, with a value of approximately 20 billion ECU, i.e. slightly less than 1% of total manufacturing output. The sector employs nearly 220 000 people.

In 1981, the glass sector was marked by a steep decline in production which only returned to 1980 levels in 1986. The volume of production increased by 3.4% in 1989. In terms of both quality and quantity, the EC glass industry ranks number one worldwide. In 1989, its output stood at 19.9 billion ECU, compared with 14.7 billion for the United States and 12.6 billion for Japan.

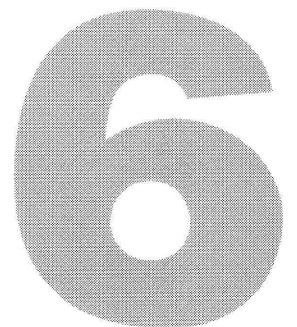
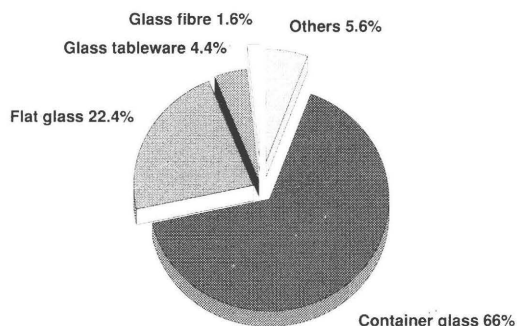


Figure 1
Glass
Industry production
Share of the total production, 1989

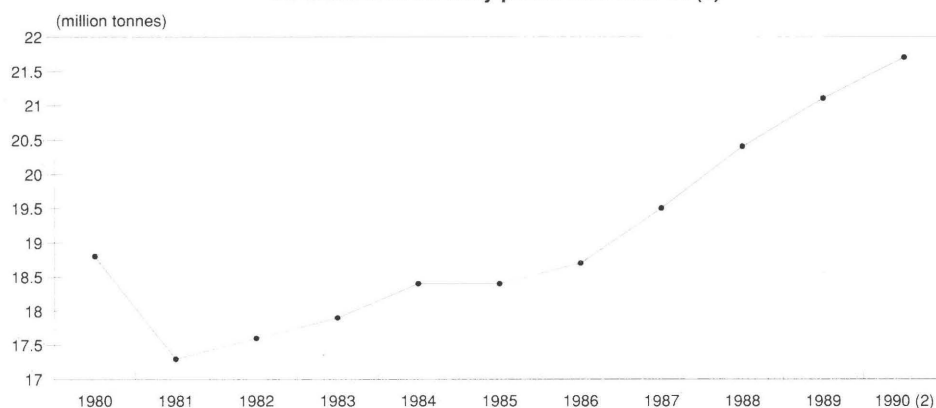


Source: Eurostat

Japanese production has made significant progress. In 1980, it represented 30% of EC production; by 1989 the figure had increased to 63%.

a slow, gradual recovery. By 1987, the industry was back on a sound footing, production and consumption having caught up with their 1980 levels. By 1989, the vol-

Figure 2
EC Glassware industry production 1980-90 (1)



(1) Includes production of cast glass

(2) Estimated

(3) Source: Eurostat

Production and consumption

1989 saw an increase in production in terms of both volume (3.4%) and value (4%), in every sector:

Container glass: The downturn witnessed at the beginning of the 1980s gave way to

ume of production stood at 13 643 000 tonnes, i.e. 1.9% up on 1988. The agro-food industry (75%), cosmetic and pharmaceutical industries (25%) remain the principal markets. By opening up the possibility of raw material and energy savings,

recycling has enabled the glass industry to fend off competition from plastics and metal.

Flat glass: In the early 1980s, the EC flat glass industry underwent major structural reorganisation: production capacities were reduced and the industry gradually abandoned the old technique of drawing or casting sheets of glass in favour of the flat glass process, which is much more highly automated. EC production increased by an average of 1.7% per year between 1980 and 1989, peaking at 4 800 000 tonnes in 1989. During this period the industry operated at a high level of capacity. The industry's growth is linked to the activity of the two main consumers of flat glass: construction (80%) and the carmaking industry (20%).

Glass tableware: production, like consumption, suffered from the very low level of growth in household purchasing power at the beginning of the 1980s. By 1989, production of glass tableware within the EC stood at 950,000 tonnes, which was 5.5% up on 1988 but still 8% lower than its 1980 level.

Glass fibre: In 1989, production increased by 6%. This increase stemmed from the rapid expansion of the carmaking, sports and leisure and construction sectors, all major consumers of reinforcement fibres. Special glass products: In 1989, production grew by 3%, largely as a result of the

Table 1
Glass (1)
Main indicators, 1980-1989

(million tonnes)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Apparent consumption	18.4	16.9	17.1	17.3	17.9	17.7	18.1	19.1	20.2	N/A
Net exports	0.4	0.4	0.6	0.6	0.6	0.8	0.6	0.4	0.2	N/A
Production	18.8	17.3	17.6	17.9	18.4	18.4	18.7	19.5	20.4	21.0
Employment (thousands)	285.0	266.0	253.0	240.0	235.0	230.0	225.0	223.0	219.0	N/A

(1) Includes production of cast glass

Source: CPIV

growth in household appliances and electronics (fibre optics).

External trade External trade in glass and glass products is restricted by the weight of the products and the high transport costs involved. Glass products account for 0.5% of world trade and 0.6% of EC exports.

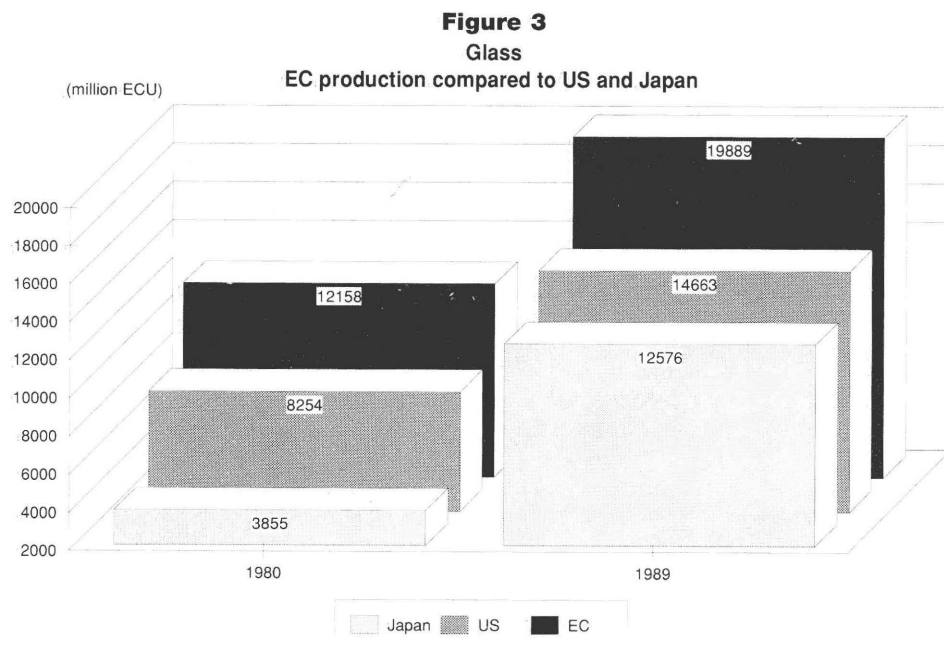
Intra-EC trade represents 4.9 billion ECU, i.e. around 25% of production. In 1980, it represented a mere 16%.

The sector's extra-EC trade balance remains largely positive, with exports (2.6 billion ECU in 1989, 13% of production)

exceeding imports (1.4 billion ECU, 7% of production) by over 50% in terms of value.

The balance seems to be deteriorating, however: the export/import ratio dropped from 2.2 in 1980 to 1.8 in 1989 as imports increased at a higher rate than exports (9.5% from 1980 to 1989 compared with 7.2% for exports).

The EC market is now having to contend



Source: Eurostat

with an increasing number of imports from the Comecon countries, mainly in cheap, low quality glass. In 1988, world trade in glass products approached 13 billion ECU, twice the 1982 level. The EC accounts for 8.4% of world imports of glass and 17.4% of exports.

The main EC trading partner for glass pro-

ducts is EFTA. Over 30% of EC exports go to EFTA nations compared with 23% in 1980. During the 1980s, EC imports from EFTA also increased and now account for 36% of total glass imports (34% in 1982). The European Community is the largest exporter of glass products, but has lost ground at a world level. Exports from the

Table 2
Glass (1) - Production, value added and investment

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Production in current prices										
EC	12 158	12 420	13 097	13 861	14 866	15 781	15 970	17 184	18 528	19 889
Index	77.0	78.7	83.0	87.8	94.2	100.0	101.2	108.9	117.4	126.0
USA (1)	8 254	11 333	12 844	14 717	17 226	18 252	15 033	13 115	13 399	14 663
Index	45.2	62.1	70.4	80.6	94.4	100	82.4	71.9	73.4	80.3
Japan (1)	3 855	5 355	5 624	7 012	8 763	9 713	9 874	9 965	11 747	12 576
Index	39.7	55.1	57.9	72.2	90.2	100.0	101.7	102.6	120.9	129.5
EC										
Production in constant prices										
Index	14 994	14 033	14 312	14 931	15 420	15 781	15 670	16 733	17 192	17 873
	95.0	88.9	90.7	94.6	97.7	100.0	99.3	106.0	108.9	113.3
Productivity										
Index	26.1	25.6	26	27.5	28.1	29.6	31.7	34.4	36.7	N/A
	88.2	86.5	87.8	92.9	94.9	100.0	107.1	116.2	124.0	N/A
Value added in current value(2)										
Index	5 841	5 819	5 953	6 065	6 302	6 749	7 172	7 765	8 554	9 196
	86.5	86.2	88.2	89.9	93.4	100.0	106.3	115.1	126.7	136.3
Investment in current value(3)										
Index	808	706	775	819	871	881	971	1 162	N/A	N/A
	91.7	80.1	88.0	93.0	98.9	100.0	110.2	131.9	N/A	N/A

(1) Census of Manufactures and Eurostat estimates

(2) Excluding Portugal

(3) Excluding Greece, Spain, Luxembourg, Netherlands and Portugal.

Source: Eurostat(Inde)

Table 3
Glass
EC trade in current value (1)

(million ECU)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Exports extra-EC	1 373.8	1 592.5	1 706.5	1 938.8	2 196.9	2 379.2	2 187.6	2 122.5	2 263.4	2 566.7	2 445.5
Index (%)	58.0	66.9	71.7	81.5	92.3	100.0	88.5	85.9	91.6	103.8	99.0
Imports extra-EC	630.1	671.3	746.9	845.8	1 012.6	1 047.0	10 085.2	1 079.8	1 227.6	1 424.0	1 472.1
Index (%)	60.9	64.1	71.3	80.8	96.7	100.0	92.3	98.9	112.4	130.4	134.8
X/M	2.2	2.4	2.3	2.3	2.2	2.3	0.2	2.0	1.8	1.8	1.7
Trade intra-EC	1 891.6	2 019.9	2 242.5	2 485.6	2 724.3	2 996.5	3 589.3	3 929.3	4 392.7	4 918.2	N/A
Index	63.1	67.4	74.8	83.0	90.9	100.0	119.8	131.1	146.6	164.1	N/A
Share of total(%)	57.9	55.9	56.8	56.2	55.4	55.7	62.1	64.9	65.1	64.9	N/A

(1) 1980 EC9 1981-85 EC10
(2) Taking account of changes in EC membership.
Source : Eurostat (Comext)

European Community grew by 5.4% per year from 1982 to 1988, which was less than the rate recorded for other countries,

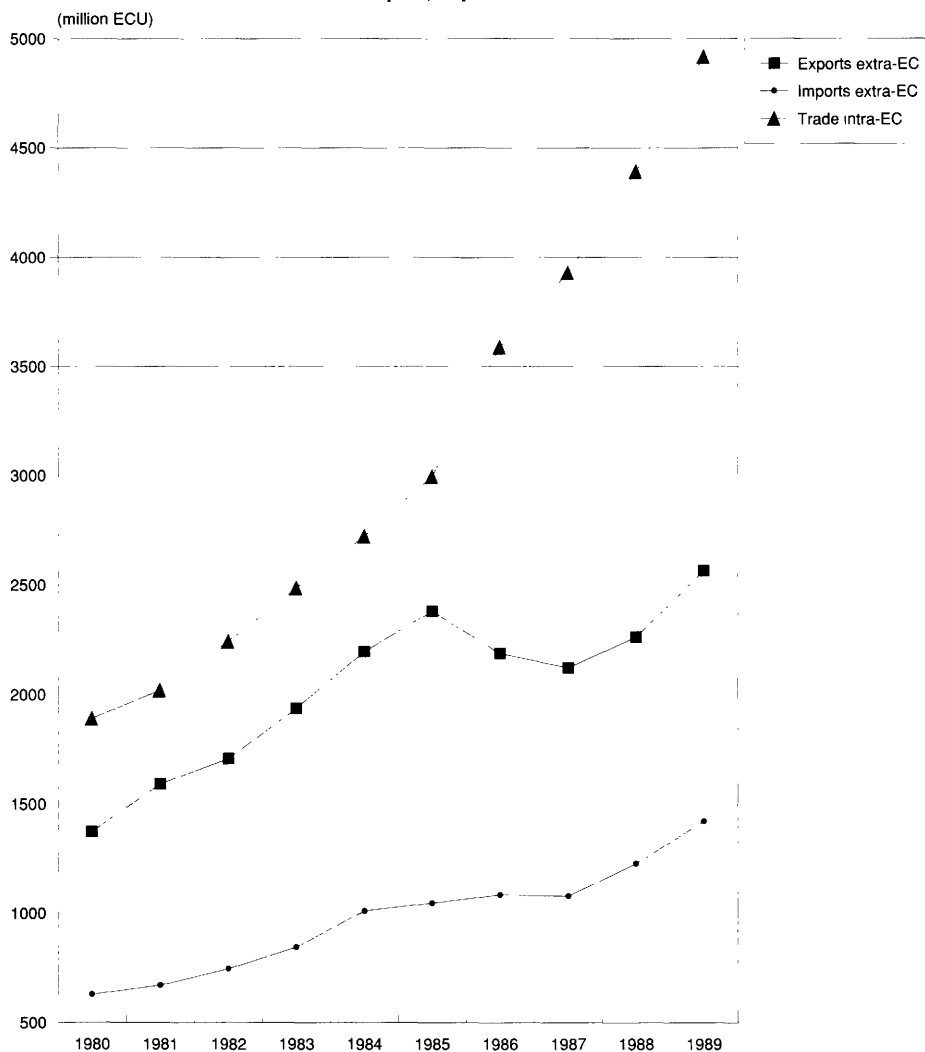
apart from the USA. The growth rate of exports from the Soviet Union, South-East Asia and the Pacific to OECD countries

was nearly 20%.

The growth rates of imports from the Soviet Union however (23% per year during the 1986-1988 period), Eastern Europe (12%), South-East Asia (17%) and the rest of the world (18%) have been gathering pace since 1986, reflecting increased competition from countries with low labour and energy costs (e.g. the Soviet Union and Eastern bloc countries).

Investment, employment and productivity During the 1980s, the introduction of the float glass process revolutionised production methods and led to surplus production capacity. These factors in turn led to extensive restructuring of the EC industry and major job cuts, sometimes by as much as 50%. Large-scale investment was also needed in order to adapt the industry to the float glass technique. At present, investment represents over 7% of the value of production - a clear sign of the industry's efforts to expand and modernise its facilities. Large sums of money have also been invested in research, technology being a key factor in competitiveness. Such investment accounts for around 1 to 2% of turnover. Measures in innovation and technological development are aimed at improving the

Figure 4
Glass
EC import, export in current value



(1) 1980 EC9 1981-85 EC10
Source: Eurostat (Comext)

characteristics of existing products and developing new products.

Production per employee has grown steadily since 1980, from 66 tonnes in 1980 to 93 tonnes in 1988.

Structure of the industry

Glass production based on modern processes, whether it be container or flat glass, requires large-scale investment and considerable financial resources. The sector's activities therefore tend to be fairly concentrated. This tendency became more

marked during the 1980s. Fresh investment was needed, and major restructuring took place, thereby reinforcing the move towards greater concentration.

The major groups around which the industry revolves, e.g. Saint-Gobain in France and Pilkington in the United Kingdom, have already internationalised their operations.

Users are increasingly demanding a uniform level of quality, regardless of where they are based. This has forced glass manufacturers to internationalise their operations. In addition, the sheer size of the world market enables firms to make large-scale investments pay, in a way that would simply not be possible with markets confined to a single continent.

With these large groups, one finds small and medium-sized firms, particularly in the glass tableware and container sectors.

As regards geographical distribution, West Germany accounts for nearly 28% of EC production in terms of value, followed by France (22%), Italy (15%) and the United Kingdom (15%).

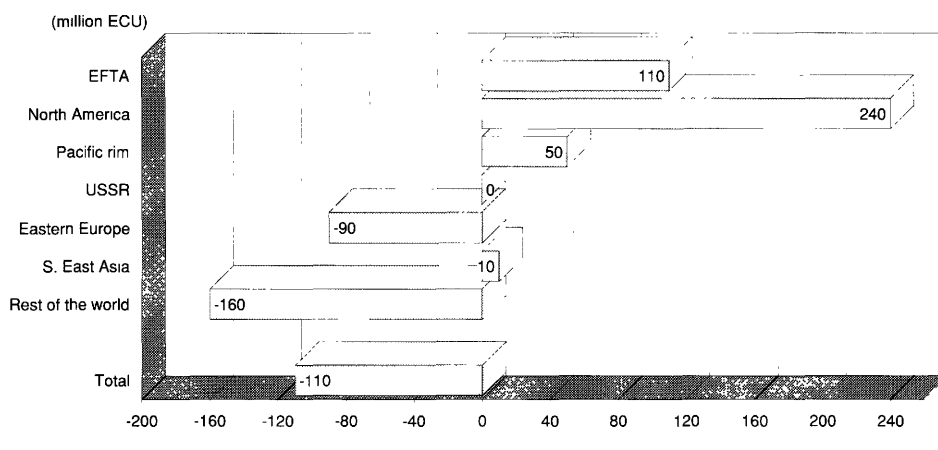
Risks and opportunities

Thanks to the particular nature of its structure and products, the glass industry should be able to respond positively to the various changes liable to affect its environ-

Figure 5

Glass

Total change in the EC trade balance between 1982 and 1988



Source: DRI Europe

Table 4

Glass

Production by products and forecasts

(thousand tonnes)	1989	1990	1991/90	1992/91
Container glass	13 643	14 350	3.0	3.0
Flat glass	4 887	4 850	1.5	1.5
Glass tableware	950	940	1.0	1.0
Glass fibre	340	360	4.5	4.5
Technical glass	780	790	1.5	1.5
Others	410	420	N/A	N/A
Total Glass industry	21 010	21 710	2.5	2.5

Source: CPIV

ment.

1992 Given the already high level of concentration in the sector, the advent of the single market should not influence its development to any significant extent, particularly since international trade, even between Member States, is relatively limited.

Extra-EC competition While extra-EC imports account for only a small percentage (2%) of the container glass sector, owing to the low unit value of the product and its considerable weight, they represent 11% in the case of flat glass, 10% for hollow glassware, 28% for glass fibre and 13% for all the other products on the internal market. Half of these products come from Comecon countries.

They tend to be lower quality, low-cost products, mainly in the flat glass and glass fibre sectors.

Environment Glass containers can be easily recycled. Recycled glass already accounts for 30% of consumption of container glass and offers considerable savings in terms of raw materials and energy. Viewed against a backdrop of rising energy prices and tighter regulations governing the environment, ease of recycling is a major asset.

Outlook

The prospects for the glass industry within the European Community vary according to the sector. In the container sector, glass should at least stabilise, if not increase, its market shares in the face of substitute products such as paper or plastic. Flat glass, which is heavily dependent on the building and car manufacturing markets, could suffer the adverse effects

(drop in prices and profitability) of increased competition from Comecon countries and surplus production capacity in Europe.

After a few years of large-scale expansion, the glass fibre sector will encounter a sharp drop in demand from the mid-1990s onwards; the decline will be more pronounced in the case of glass fibre for textiles than those for reinforcement purposes. Bearing in mind the growing number of imports and staggered exports, we

can expect to see business contract by around 15 to 20% with possible repercussions in the take-up of capacity and financial profitability. Overall, it seems unlikely that 1991 will be a good year for the EC glass industry.

**Written by: Sema Group Management
Consultants**

**The industry is represented at EC level by: CPIV
Standing Committee for the glass industry of the
European Economic Community;**

**Address: Av. Louise 89 B1050 Brussels
Belgium; tel: (02) 538.44.46; fax: (02) 537 84 69**

The container glass sector represents 66% of the production of the glass industry. It has experienced a slow and progressive recovery since 1981.

An average annual growth of production of about 2-3% is anticipated in the medium term. Profitability has recovered, mainly as a result of companies restructuring, productivity improvement, takeovers and mergers, as well as technological developments.

The sector operates in a strongly competitive environment since there are a number of possible substitutes. Moreover the effect of environmental and recycling regulations is of particular importance for the evolution of the sector.

Current situation

The container glass sector represents 66% of the EC glass industry.

Its main markets are agrofood (75%) and cosmetics and pharmaceuticals (25%).

Production and apparent consumption fell significantly in 1981, due to the economic crisis at the beginning of the decade, but this was followed by a slow and progressive recovery. By 1987 the industry had completely recovered. By 1988 production was up by 6% on 1987 and by 10% on 1980. Production and apparent consumption are balanced.

In the 1980s, container glass faced tough competition from substitute products, plastic, cardboard, aluminium and metal particularly in the mass-market beverages sector (such as soft drinks).

Containers made of glass are estimated to represent 7% of all packaging used in the EC. By comparison paper/cardboard accounts for 30%, plastics 30%, light metal

16%, heavy metal 4% and wood 4%.

Exports only represent 2.4% of production, and are more or less balanced with imports. About 50% of imports originate from Eastern Europe. Intra-EC trade has been growing steadily, and represents 12% of EC production.

Industry structure

In response to these challenges there have been significant changes in the industry. Glass manufacturers have started to restructure their companies and restore profitability by adapting their production capacities to current demand, raising productivity, and by reducing costs (especially for employment and energy). Takeovers and mergers of companies took place. As an example, St Gobain Emballage (European leader with a turnover of 9 billion FF and 25% of the market), has reinforced its European position through acquisitions and participations (setting up in Portugal in 1987, 35% share in Oberland - Germany in 1988,

Table 1
Container glass
Main Indicators, 1980-89

(thousand tonnes)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989 (*)	1990 (*)
Apparent consumption	12 190	11 291	11 452	11 619	12 004	11 781	12 030	12 572	13 332	N/A	N/A
Net Exports	- 17	- 14	26	4	- 32	39	130	59	62	N/A	N/A
Production	12 173	11 247	11 478	11 623	11 972	11 820	12 160	12 631	13 394	13 950	1429

(*) Sema Group Management Consultants estimates
(*) Estimated
Source: FEVE

Table 2
Container glass
EC trade in current value

(thousand tonnes)	1980	1981	1982	1983	1984	1985	1986	1987	1988
Exports extra-EC	335	246	309	345	343	378	357	320	321
Index	88.6	65.1	81.7	91.3	90.7	100.0	94.4	84.7	84.9
Imports extra-EC	352	290	284	341	375	339	227	261	259
Index	103.8	85.5	83.8	100.6	110.6	100.0	67.0	77.0	76.4
X/M	1.0	0.9	1.1	1.0	0.9	1.1	1.6	1.2	1.2
Import penetration (%)	3.0	3.0	2.0	3.0	3.0	3.0	2.0	2.0	2.0
Intra-EC imports/production(%)	8.0	8.0	8.0	9.0	10.0	9.0	10.0	11.0	12.0

*Source: FEVE, Eurostat (Comext)."

acquisition of Vetri - Italy in 1989,
acquisition of Ruhr Glass - Germany in
1990).

Some plants were closed, production lines
were stopped, staffing levels were reduced.

The production process was improved
through application of the latest technologi-
cal developments.

Investments have been up to 5 to 10% of
turnover.

As a result of these measures, the improve-
ment in the general economic climate and
the fall in energy prices, the container glass
industry's situation improved significantly. By
1988 the utilisation rate of the industry's ca-
pacity was approximately 92%.

The main EC producers of container glass
are:

- ❖ A.V.I.R. (I);
- ❖ Gerresheimer Glas (D);
- ❖ Groupe PLM (D -UK -NL);
- ❖ Hermann Heye (D);
- ❖ Nienburger Glas (D);
- ❖ Oberland Glas (D);

- ❖ Rockware Glass (UK);
- ❖ Saint-Gobain Emballage (F);
- ❖ United Glass (UK);
- ❖ Vereenigde Glasfabrieken (NL);
- ❖ Verreries Souchon Neuvesel (F);
- ❖ Vetri (I);
- ❖ Vicasa (E);

The positive evolution of this sector during
recent years was not only a result of the
reorganisation of the production process,
but also of the adaptation of the manufac-
tured product to new economic circum-
stances.

Glass recycling

In terms of environmental impact, glass
has been recycled for many years.

Between 1980 and 1988 some 22.5 million
tonnes of glass waste (cullet) were re-
cycled in the EC Member States. In 1988,
3 531 000 tonnes of glass were collected.

As well as diverting huge quantities of
glass away from the domestic refuse chan-
nel, recycling creates large savings in raw
materials (1 tonne of recycled glass re-

places 1,2 tonnes of raw material) and en-
ergy (100 kg fuel oil per tonne of recycled
glass).

Within the EC the recycling levels are very
variable. The Netherlands recycled 53% of
its glass in 1988, Ireland only 10%. These
percentages are expected to rise in the
next years. For example,
the French industry intends to recycle 50%
of its consumption by 1992.

Recycling is of strategic importance to the
future of the glass industry, if it wishes to
continue to expand without being ham-
pered by regulation.

The 1985 EC Directive on containers of
liquids for human consumption is being re-
vised and reinforced in terms of objec-
tives. It aims at countering energy and
pollution problems, linked to all packaging
materials for food and beverages, through
recycling and returning of used containers.

Technological developments

Technology in the glass industry has con-

siderably improved in the past few years, and there is still a lot of potential for better performances in the production process and for improvements in efficiency.

The energy performance of furnaces has already been improved, enabling appreciable energy savings. Furnaces currently use a vitrifiable mixture with more than 50% cullet. Some glass furnaces for green glass even produce glass of very high quality with 100% cullet.

It has also become possible to manufacture glass at a lower cost and with more flexible production rates through the automation and computerisation of production lines. A glass forming machine that used to produce 70 000 bottles per day in 1976 can now generate 270 000 bottles per day. Technology and productivity have improved, enabling glass containers to be sold at very competitive prices.

The container glass industry has constantly increased its quality controls in order to deliver reliable products able to cope better with shocks and friction from packing lines and during handling and transport. At present a glass bottle undergoes several internal and external examinations. It receives some surface treatment as well.

Measures to make glass lighter have been a constant preoccupation in the glass industry. Technical regulation by microprocessors and the technique of press-and-blow enable the creation of a lightweight glass container with equal resistance at all points. For example, the weight of a beer bottle was reduced by 33% in a few years. A number of glass companies in Europe (Rockware Glass and Wiegand Glass), the United States (Consumer Glass and Brockway Inc.), Australia (ACI International) and

Japan (Yamamura) and a large glass-forming machine manufacturer (Emhart corp.) have formed a consortium whose aim is to develop a glass container 10 times stronger and half the weight of present glass containers.

Concerning hygiene in the process of container production, the container industry has "clean pack" lines, an aseptic filling process and a complete handling, wrapping and palletising of products.

As a result of its technological progress, the glass industry can now trade in new types of containers, such as bottles with plastic sleeves, wide mouth bottles, pre-labelled bottles, jars scaled by a metallic sheet, etc.

Media and advertising

The glass industry has reacted to the policies of some competitive materials in several Member States countries by taking a more vigorous stance on marketing policies. Important media and advertising campaigns for container glass and recycling have been launched in recent years in Spain, France, the United Kingdom and Italy. In some cases, clients and retailers were involved.

Outlook

The container glass industry aims to supply competitive products to fulfil the demands of a society which is showing increasing concern about the quality of life and environmental protection.

Prospects for the container glass sector are optimistic. The industry expects stable growth over the coming years, with a rate of capacity utilisation above 90%.

An average annual growth of production of about 2-3% is anticipated in the medium term. Container glass will successfully compete against substitute products and its

Table 3
Container glass
Recycling of glass in the EC in 1988

Country	Collected % of national tonnes glass consumption	
Belgium	166 000	50
Denmark	46 000	27
Germany	1 176 000	39
Greece	14 000	16
Spain	278 000	23
France	676 000	34
Ireland	9 000	10
Italy	610 000	40
Netherland	261 000	53
Portugal	31 000	13
United Kingdom	264 000	15
Total EC	3 531 000	

Source : FEVE

market share in the packaging sector should increase.

It therefore looks to the future with confidence, a feeling reinforced by the favourable economic prospects that the creation of the single European Market is expected in 1993 to bring in its wake.

FEVE: Fédération Européenne du Verre d'Emballage; Address: Avenue Louise 89, B-1050 Brussels; tel: (32 2) 539 34 34; fax: (32 2) 539 37 52

Reviewed by: Sema Group Management Consultants

The Community flat glass industry, which was severely hit by the oil crisis and low demand at the beginning of the 1980s, has been the scene of major restructuring involving technological change and reductions in the workforce. Since 1980, production has grown on average by 1.4% a year.

Current situation

At the beginning of the 1980s, the Community flat glass industry was severely affected by external economic factors such as the oil crisis and low demand.

Over this period, the industry was the scene of major structural re-organisation; production capacities were cut and the industry progressively abandoned the traditional drawing or casting of sheets of glass in favour of the more automated float glass process.

This restructuring produced a large fall in employment levels as much as 50% in some cases. Between 1980 and 1988, Community production rose progressively by an average of 1.4% a year, reaching a peak of 4,638,000 in 1988. By 1989, an increase of 2% was being forecast.

Since 1980, world sales in float glass and sheet glass (i.e. the major portion of flat glass sales) has risen faster than growth in Gross Domestic Product (25% on average). This strong growth is the result of intense activity in the two main flat glass user sectors, the motor vehicle industry (20% of flat glass consumption (wind-screens, side windows, rear windows, roofs) and the building sector (80% of flat glass consumption: doors and windows, display cabinets, double glazing, partitions, mirrors). Thus, in 1988, there was high

demand caused by the rise in refurbishing and renovation work carried out in existing homes, by a slight upturn in the building sector in some countries and by healthy car sales.

Consumption in the Community reached 4,689,000 tonnes in 1988, i.e. annual average growth of 2.1% since 1980 and growth of 11.5% compared to 1987. Since the second half of 1989, the rate has begun to level off. In building, growth fell to 2-3%, while it slipped to 3% in motor vehicles.

Structure of the industry

The main Community producers are Saint Gobain (France), Pilkington (United Kingdom) and Glaverbel (Belgium, a subsidiary of the Japanese firm Asahi). Saint Gobain has a bigger production capacity than Pilkington within the EC, although the British firm remains the world leader in flat glass. Business in flat glass accounts for 78% of Pilkington's total turnover. St Gobain's business fields are more diversified, with flat glass accounting for a mere 19% of turnover (FF 12 thousand million in 1989).

EC producers have operations not only in Europe but also in North America, Asia, Africa, and so on, either directly or in the form of joint ventures. Acquisitions and joint ventures have been high in number in the last few years.

Two American companies, PPG and Guard-

ian, who are respectively the number 1 and 3 American producers, also manufacture in the EC.

The EC can count at present 34 floats, each of 150 000 tonnes to 200 000 tonnes. Two new projects are presently being studied, to which can be added new operations in Eastern Europe (Saint Gobain in what used to be the GDR, Guardian in Hungary).

Employment, productivity and investment

The restructuring triggered at the beginning of the 1980s has produced an appreciable fall in employment levels as great as 50% in some cases.

Productivity and sales per employee have shown marked increases (for example, they stand at FF 750,000 for the windows division of St Gobain).

Industrial investment accounts for 10% of turnover, reflecting efforts towards expansion and replacement. Efforts made in research are also extensive, with technology

a determinant factor in competitiveness. These account for around 1-2% of turnover.

Innovation and technological development revolve around enhancing the characteristics of products; heat-capturing and reflecting windows, electronic tinted windows, complex forms, layered glass, composite glass.

Table 2
Number of flat glass industries in Western Europe

Country	Number	Industry
Belgique/België	5	St Gobain (2), Asahi (3)
BR Deutschland	7	St-Gobain (3), Pilkington (4)
España	3	St. Gobain (2), Guardian-Vilosa (1)
France	5	St Gobain (3), PPG (2),
Italia	6	PPG (2), SIV (2), St. Gobain (1), SIV-St-Gobain (1)
Luxembourg	2	Guardian (2)
Nederland	1	Asahi (1)
Portugal	1	St-Gobain-Etat portugais (1)
United Kingdom	4	Pilkington (4)
Sweden	1	Pilkington (1)

Source: Usine Nouvelle

Table 4
Flat glass
Forecasts 1990-92

(thousand tonnes)	1989	1990	1990/91	1992/91
Production	4 750	4 850	1.7%	1.5%

Source: Sema Group Management Consultants

External trade

The flat glass industry is particularly affected by competition from COMECON imports which are penetrating EC markets at very low prices. Investigations have been launched by the Community to clarify this situation, although these have not yet reached their conclusion.

In addition, the low \$US rate is making it

accounted for less than 10% of production in 1988, with a marked growth in imports in 1988 of 11%.

- ❖ Trade between Member States, which accounted for 23% of production in 1980, reached 33% in 1988.

Outlook

Demand for flat glass in Europe will probably experience a slight fall for a few

Table 1
Flat glass
Main Indicators, 1980-89

(thousand tonnes)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989(*)
Apparent consumption	3 946	4 007	3 948	3 951	3 956	4 046	4 184	4 204	4 689	N/A
Net exports	144	153	228	330	300	431	257	131	- 51	N/A
Production	4 090	4 160	4 176	4 281	4 256	4 477	4 441	4 335	4 638	4 750

(*) Estimated
Source: Flat and Sheet Glass from GEPVP.

difficult to export to the United States and other dollar markets.

Lastly, the building abroad of an ever growing number of flat glass factories is tending to cut export opportunities.

- ❖ The balance of payments went into the red in 1988 (- 51 000 tonnes) for the first time since 1980. Extra-EC exports, which are in decline compared to recent years,

years, before an upturn when the Single Market becomes a reality. There are good grounds to expect a rapid growth in imports from non-European countries, in particular from countries in Eastern Europe, given their new float glass production units. Moreover, new capacities have been built in Europe. As a result, an overcapacity is likely to develop, which will depress prices

Table 3
Flat glass
EC Trade in current value

(thousand tonnes)	1980	1981	1982	1983	1984	1985	1986	1987	1988
Exports extra-EC	490	424	554	660	609	696	516	520	446
Index	70.4	60.9	79.6	94.8	87.5	100.0	74.1	74.7	64.1
Imports extra-EC	346	271	326	330	309	265	260	389	496
Index	130.6	102.3	123.0	124.5	116.6	100.0	98.1	146.8	167.2
X/M	1.4	1.6	1.7	2.0	2.0	2.6	2.0	1.3	0.9
Import penetration (%)	9	7	8	8	8	7	6	9	11
Intra-EC imports/production(%)	23	25	28	30	28	28	32	31	33

Source: Flat and Sheet Glass from GEPVP, Eurostat(Comext).

and have a detrimental effect to the profitability of major European flat glass producers.

Despite all the efforts made to perfect new products, the overcapacity observed in 1989 is set to increase in 1990 and 1991.

Written by: SEMA

This industry is represented at EC level by:

GEPVP: European Association of Flat Glass

Producers; Address: Avenue Louise 89, B-1050

Brussels; tel.: (32 2) 538 43 77;

fax: (32 2) 537 84 69

The glass tableware sector accounts for 4.5% of the glass industry's total output.

Hollow glassware is the largest sector of the industry (60% of output in terms of value) and France is the leading EC producer.

The sector makes a positive contribution to the EC balance of trade.

Definition of the sector

Glass tableware covers a group of hollow glass products which are used in everyday life and which are subject to rigorous requirements in terms of appearance, design and price.

In terms of value, drinking glasses (hollow glassware) account for around 60% of glass tableware products. The remaining 40% cover other glass tableware items (plates, dishes...) as well as kitchenware (oven dishes, cake tins, jars, casseroles,...) used by households, the hotel trade, state institutions.

With an output of 950 000 tonnes, glass tableware accounts for roughly 4.5% of the glass industry's total output.

Production

Glass is produced by melting a combination of silica, calcium carbonate and carbonate of soda. In the case of cooking utensils, the glass also contains boron which makes it resistant to heat and variations in temperature.

Opal glass contains fluorides which give it its milky appearance; coloured glass, on the other hand, contains metal oxides.

All these various components are melted in furnaces at a temperature of around 1500°C: the mixture flows in channels towards distributors which deliver the drop of glass at regular intervals. It then drops into a mould, after which the object is formed by means of pressing or blowing.

Two techniques are then applied: annealing, which prevents the breakage of objects which have been abruptly cooled after manufacture; tempering gives the glass a high level of resistance.

Finally, certain special types of glass can be treated so that they become glass-ceramic. Such products can withstand temperatures of over 400°C, making them suitable for use in the oven or on the hob. They come in white opaque or coloured transparent glass.

In the case of crystal and lead glass, most of the lime is replaced by barium, zinc or lead, while the soda is partly replaced by potassium. According to EC standards, crystal must contain over 24% lead oxide.

Output and consumption

In 1988, EC glass tableware output amounted to 900 000 tonnes, 3.4% up on

Table 1
Glass tableware (1)
Main indicators, 1980-89

(thousand tonnes)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989(2)
Apparent consumption	805	553	588	601	644	639	665	676	720	N/A
Net exports	220	248	234	260	249	256	216	194	180	N/A
Production	1 025	801	822	861	893	895	881	870	900	950

(1) Excluding Spain

(2) Estimated

Source: CPIV

1987. A large portion of this output, approximately 80%, was intended for the domestic market, which grew at a rate of approximately 6.5% in 1988. Both output and consumption suffered from the very low growth in disposable income at the beginning of the eighties; as a result, both output and consumption were still more than 10% below their 1980 levels.

The glass tableware sector mainly produces consumer products and its growth is closely linked to changes in life style and disposable income.

Other factors, too, influence the sector's development:

- ❖ the development of mechanisation which has brought with it a significant drop in prices and an increase in the number of product ranges;
- ❖ the development of new forms of distribution, particularly mass distribution;
- ❖ the emergence of new technological needs linked to the rapid spread of dishwashers and microwave ovens;

❖ competition from metal, ceramics and plastics, particularly as regards kitchenware.

France occupies a dominant position since it accounts for over half of the total EC output.

External trade

Over 30% of EC glass tableware output (i.e. 269 000 tonnes) was exported outside the EC in 1988, compared with 28% in 1980. Imports (89 000 tonnes) from third countries (Eastern Europe, Turkey, Asia,...) are much weaker than exports, thus explaining the sector's positive contribution to the total EC trade balance, in terms of both volume (180 000 tonnes) and value. Imports however are increasing at a faster rate than exports and the export/import ratio dropped from 4.3 in 1980 to 3 in 1988.

Intra-EC trade has grown constantly since 1980, increasing from 20% of output to 33% in 1988. France is the leading exporter insofar as it exports over 70% of its out-

put, followed by Italy. The main EC importers are West Germany and the United Kingdom.

Structure of the industry

The hollow glassware and glassware industry is a very open, international market.

The manufacturers are large EC and American glassmakers capable of exporting on a large scale in order to supply part of Europe and the developing countries. Their task is made all the more easy by the fact that transport costs are relatively low compared with the value of the articles. The world leader in the sector is "Verrerie Cristallerie d'Arques" (France) which employs 11 000 people, produces 5 million articles, exports 75% of its output and has a turnover of 3 billion Francs. The American glassmaker Corning has extensive operations throughout the EC and is the world leader in the dish sector. Alongside these large glassmakers one also finds smaller, family-based glass and crystal manufacturers producing tableware.

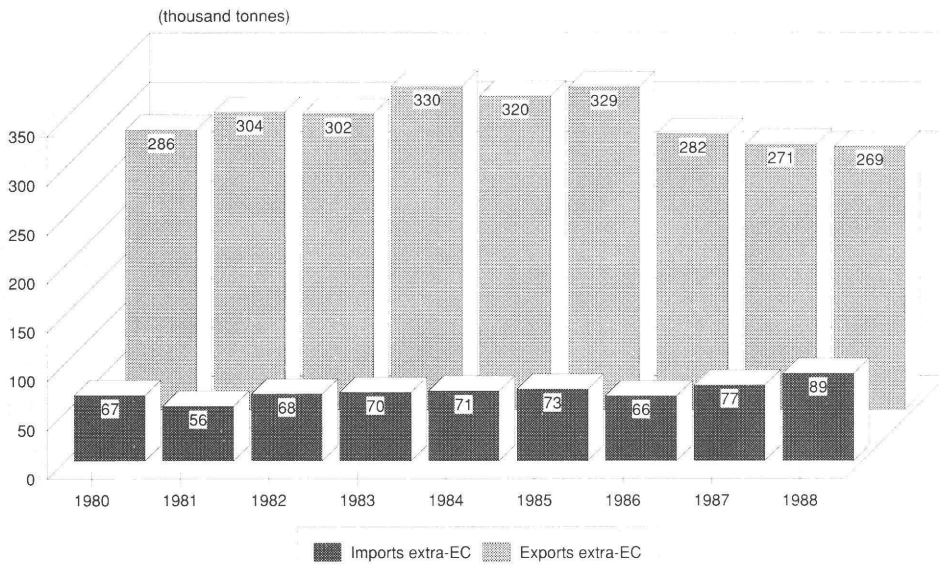
Table 2
Glass tableware (1)
EC trade in current value

(thousand tonnes)	1980	1981	1982	1983	1984	1985	1986	1987	1988
Exports extra-EC	286	304	302	330	320	329	282	271	269
Index	86.9	92.4	91.8	100.3	97.3	100.0	85.7	82.4	81.8
Imports extra-EC	67	56	68	70	71	73	66	77	89
Index	91.8	76.7	93.2	95.9	97.3	100.0	90.4	105.5	121.9
X/M	4.3	5.4	4.5	4.7	4.5	4.5	4.3	3.5	3.0
Import penetration (%)	8	10	11	12	11	11	10	11	10
Intra-EC imports/production (%)	20	27	26	26	29	30	37	32	33

(1) Excluding Spain

Source: CPIV, Eurostat (Comext)

Figure 1
Glass tableware (1)
EC trade in current value



(1) Excluding Spain
 Source: CPIV, Eurostat (Comext)

A large number of amalgamations have taken place recently at this level. Saint Louis (France) for example, was taken over by Hermès after being courted by Brown Forman, the leading US tableware manufacturer.

Outlook

Glass tableware, derived from hollow glassware, is currently seeking to increase its market share:

- in the tableware sector, where it com-

mands around one quarter of the market in terms of volume, alongside earthenware (30%), china (25%) and miscellaneous materials (20%). In terms of value, glass has a market share of approximately 15%;

- in the oven-proof and hob cookware sector, to the detriment of metal, clay and composite materials (for microwaves).

The development of the microwave tends to favour more general-purpose glass (it

accounts for 75% of sales of microwave dishes).

Output levels for 1989 are estimated at 950 000 tonnes. In the long term, the industry's solid footing in terms of technology, innovation and design should enable it to maintain and reinforce its market position.

Written by: Sema Group Management Consultants

The industry is represented at EC level by:
 CPIV: Standing Committee of the EC Glass Industries; Address: Avenue Louise 89, B-1050 Brussels; tel: (32 2) 538 44 46; fax: (32 2) 537 84 89

The glass fibre sector represents 1.5% of the EC glass market. Production has grown by an average of 4.8% per year. Strong price competition from non-Community producers remains a constant threat, exacerbated by international exchange rate fluctuations, and continuous adaptation to change and new end-uses.

The short-term forecast indicates a stable trend of (growth) around 4-5% per year, mainly based on the demand for reinforcement fibres in different sectors.

Definition of the sector

Fibreglass is produced from molten glass, heated in a modern furnace and pulled through tiny holes transforming the liquid mass into small glasswool fibres for insulation purposes, or into textile yarns for reinforcement products.

A clear distinction should be made between glasswool and continuous glass fibre. Although both are produced in glass furnaces, their industrial manufacture calls for different forms of technology and their products are aimed at different end-users. Glasswool as a final product is part of the insulation industry, and as such is dealt with in the monograph on heat insulation products.

The present monograph therefore only refers to the continuous glass fibre industry. Since its creation after the Second World War this industry has constantly evolved due to the many applications of its new products by industry.

The glass fibre sector manufactures the fol-

lowing products:

- ❖ rovings: used in a variety of processes, including spray-up, continuous laminating, filament winding, pultrusion and reinforcement for sheet moulding compounds;
- ❖ rovings consist of continuous glass strands, gathered together without any mechanical twist and wound to form a tubular, cylindrical package;
- ❖ mats: used as reinforcement in contact and compression moulded applications. Chopped strand mats, made from fine chopped strands bonded with a powder or emulsion binder, are used in both processes;
- ❖ chopped strands: widely used to reinforce thermoplastic compounds, polyester bulk moulding compounds and in the manufacture of wet-laid glass webs. Chopped strands consist of continuous glass strands chopped to the desired length and available with a wide variety of surface treatments to ensure compatibility with most resin systems;

Table 1
Glass fibre products - Main indicators, 1980-90

(thousand tonnes)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989 (*)	1990 (*)
Apparent consumption	215.0	181.9	203.3	222.5	251.6	279.4	287.8	303.3	346.9	N/A	N/A
Net exports	8	21.8	0.9	2.8	-2.3	-3.1	-2	-7.1	-26.9	N/A	N/A
Production	223.0	203.7	204.2	225.3	249.3	276.3	285.8	296.2	320.0	340.0	360.0

(*) Serna Group Management Consultants estimates

(*) Estimated

Source: APFE

Table 2
Evolution of the glass reinforced composites market in Western Europe

(thousand tonnes)	1980	1981	1982	1983	1984	1985	1986	1987	1988
Volume produced	610	576	633	708	769	815	858	963	1095
Index	74.8	70.6	77.7	86.9	94.3	100.0	105.3	118.2	134.4

Source: Vetrotex

❖ yarns: continuous filament and texturised yarns are among the variety of glass fibre textile products used for a wide range of purposes from electronic circuit boards to carpet backing. They are stronger than steel wire, will not burn or smoulder, have a high heat-resistance, will not stretch or shrink due to changes in atmospheric conditions, have excellent moisture resistance, low thermal conductivity and resist corrosion from most chemicals. Woven glass fibres are, among others, the basis of most reinforced printed circuit boards, used in computers, automobiles, robotic machines, military systems, telecommunications, TV and domestic appliances.

Production

From 1980 to 1988, fibre glass production has grown by an average 4.8% per year,

reaching 320 000 tonnes in 1988, which indicates the development of both products and markets in this sector.

The apparent consumption has grown even faster; 6.8% per year between 1980 and 1988.

Over the past five years, the increase in production has been higher for reinforcement than for textile fibres.

This is explained by the rapid development of the automobile, electricity-electronics, sports, leisure and construction sectors which are important users of reinforcement fibres.

The use of textile fibres declined in 1986, but there has since been a recovery in demand.

Profit margins for Community producers' were unsatisfactory in the early 1980s.

This was due to overcapacity and dumping prices by East European and Japanese producers. After 1985 price commitments by the latter and protective duties applied by the EC to imports originating from Czechoslovakia and the German Democratic Republic improved the competitive position of Community industry. However, strong price competition from non-Community producers remains a constant threat, which is exacerbated by international exchange-rate fluctuations. Continuous adaptation to change and new end-uses demand massive investment in both R&D and equipment.

Industry structure

The main companies producing in the EC are:

- ❖ European Owens-Corning;
- ❖ St. Gobain;
- ❖ Silenka;
- ❖ Bayer;
- ❖ Pittsburgh Plate Glass.

From a geographic point of view, the EC glass fibre production is distributed over the following main centres:

- ❖ Belgium, 1 centre - European Owens-Corning Fibreglass;
- ❖ France, 2 centres - Owens-Corning and

Table 3
Breakdown of fibre glass composites markets (1988)

(%)	USA	Western Europe	Japan
Electricity/Electronics	9	23	N/A
Transportation	26	22	4
Buildings/Civil works	19	17	49
Industrial/agricultural materials	18	17	27
Sports and leisure	17	7	10
Consumer goods	6	6	7
Others	5	8	3
Total market (1000 tonnes)	1207	1095	533

Source: Vetrotex

Table 4
Glass fibre products - EC trade in current value

(thousand tonnes)	1980	1981	1982	1983	1984	1985	1986	1987	1988
Exports extra-EC	44.2	53.4	42.8	47.8	52.0	56.7	54.0	59.0	63.4
Index	78.0	94.2	75.5	84.3	91.7	100.0	95.2	104.1	111.8
Imports extra-EC	36.2	31.6	42.0	45.0	54.3	59.8	56.0	66.0	90.1
Index	60.5	52.8	70.2	75.3	90.8	100.0	93.6	110.4	150.7
X/M	1.2	1.7	1.0	1.1	1.0	1.0	0.9	0.9	0.7
Import penetration (%)	17	17	21	20	22	21	20	22	28
Intra-EC imports/production(%)	50	54	60	60	63	62	73	78	86

Source: APFE, Eurostat (Comext)

Table 5
Forecast - Glass fibre production

(thousand tonnes)	1989	1990	91/90	92/91
Production	340	360	+4.5%	+4.5%

Source : Sema Group Management Consultants

- Vetrotex - St Gobain;
- ❖ Germany, 2 centres - BAYER and Gevetex - St.Gobain;
- ❖ Italy, 1 centre - Vitrofil - St. Gobain;
- ❖ Netherlands, 1 centre - Silenka (PPG);
- ❖ Portugal, 1 centre - St. Gobain;
- ❖ Spain, 3 centres - Owens-Corning, Cristaleria Espanola (St. Gobain) and Silenka;
- ❖ United Kingdom, 2 centres - PPG and Owens-Corning.

The fibre glass sector is characterised by major investment for extension or modernisation as well as takeovers or joint ventures (recent takeover of Pilkington assets

in fibre glass by Saint-Gobain).

Research and development programmes are rapidly expanding with all producers heavily involved in developing high-tech and high quality products.

Trade

Extra-EC imports during the years 1984-85 increased rapidly in 1988, reaching a level of 90 000 tonnes, coming mainly from Czechoslovakia and the USA (import/export ratio = 0.7). Intra EC trade has developed strongly, representing 86% of EC production in 1988 (50% in 1980).

Forecast and Outlook

After an upsurge in recent years in de-

mand for reinforcement fibres the short-term forecast now indicates a stable trend around 5% per year. This resulted from the development of new products in, for example, the construction and the transport sectors and in the booming electronics industry. In contrast, the outlook for textile fibres is more gloomy, in line with the poor expectation of the Europe-based textile industry as a whole.

APFE: Association des producteurs de fibres de verre européens; Address: Avenue Louise 89, B-1050 Brussels; tel: (32 2) 538 44 46, fax: (32 2) 537 84 69

CPIV: Comité permanent de l'industrie du verre - Standing Committee of the EC Glass Industries; Address: Avenue Louise 89, B-1050 Brussels, tel: (32 2) 538 44 46; fax: (32 2) 537 84 69

Reviewed by: Sema Group Management Consultants

Other glass products represent 5.7% of glass consumption of which specialized glass (with high chemical, optical and technological properties) represents about 65%. This market will continue to expand in the 1990s based on fast growing markets such as opto-electronics. Most threatened applications are classical glass sectors.

Sector definition

"Other glass" includes the category "specialised glass" which accounts for around half of this sub-sector, the other half comprising many smaller industries, about which data are difficult to gather.

Specialised glass is identified by its use and applications. The term is used to describe a wide range of specialised glass with high chemical and thermal durability and with a wide variety of optical, electrochemical or special technological properties. These glasses are used in such fields as chemistry, pharmacy, electrotechnology, electronics, apparatus and instrument construction, optics, illumination engineering, household appliances, certain sectors of the construction industry and in other technical applications. Special-glass types and their respective applications include the following:

Main markets expressed in value are electrotechnical electronic (50%), chemical-pharmaceutical (20%) and optical (15%) industries.

Current situation

In 1988 the gross EC production of specialised glass reached 1.55 billion ECU and 756 000 tonnes (+7% compared to 1987). About 93% of the Community production comes from France, Italy, Great

Britain and BRD, representing an intra-EC market share for specialised glass of 88%.

In the other EC countries there are virtually no processing plants, and a production of 100 million ECU only.

In 1988 the market for specialised glass was characterised by a further rapidly growing demand in all applications for domestic appliances as well as inputs to the electronics industry in general. Specialised glass for the optical, chemical and pharmaceutical industries was less successful. Exports of specialised glass, especially in the United States, grew rapidly and were able to balance even stagnant or decreasing demand in the EC home market. Net exports reached 51 000 tonnes in 1988. Exports penetration decreased in 1987 and 1988 to 13 and 11% of production respectively while intra-EC trade represented 84% of production in 1988.

The world market for specialised glass in 1988 was estimated at 6.03 billion ECU, and distributed as shown in Figure 1.

The changes in the shares of the major regions between 1988 and 1987 reflect shifts in the exchange rates between the US-Dollar and the Yen as well as a continuing relocation of the production of electronic component industries.

EC producers (Shott, Pilkington, Glass

Table 1
Specialised and other glass products
Main indicators, 1980-90

(thousand tonnes)	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989(*)	1990 (?)
Apparent consumption	620.3	388.8	436.9	437.7	579.7	486.9	538.3	674.0	705.4	N/A	N/A
Net exports	59.8	59.4	51.3	36.3	31.1	26.6	5.5	32	50.6	N/A	N/A
Production	680.1	448.2	488.2	474.0	610.8	513.5	543.8	706.0	756.0	780.0	791.7

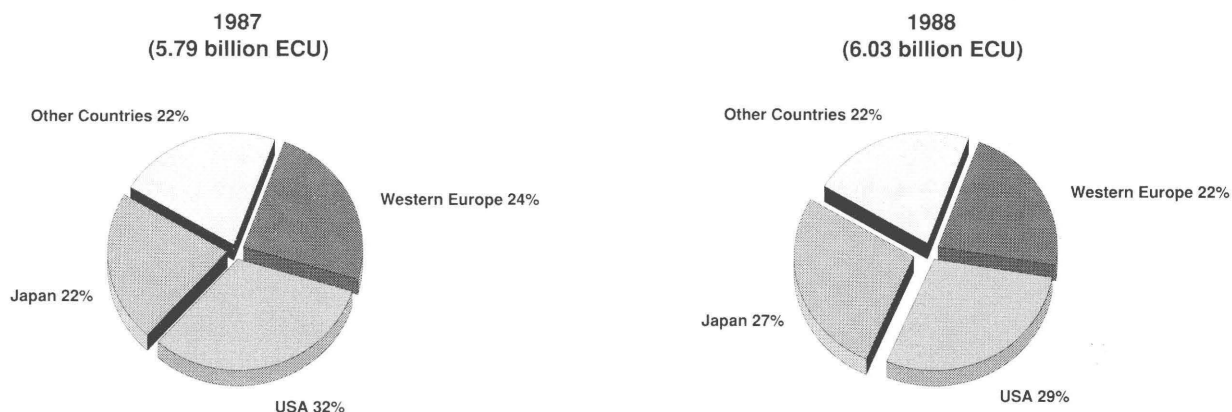
(*) Estimates by Sema Group management Consultants
(?) Estimated
Source: CPIV

Table 2
Specialised and other glass products
EC trade in current value

(thousand tonnes)	1980	1981	1982	1983	1984	1985	1986	1987	1988
Exports extra-EC	151.0	148.9	158.9	155.2	138.5	141.2	126.7	121.0	136.1
Index	106.9	105.5	112.5	109.9	98.1	100.0	89.7	85.7	96.4
Imports extra-EC	91.2	89.5	107.5	118.8	107.4	114.7	121.2	89.0	85.4
Index	79.5	78.0	93.7	103.6	93.6	100.0	105.7	77.6	74.5
X/M	1.7	1.7	1.5	1.3	1.3	1.2	1.1	1.4	1.6
Import penetration (%)	15	23	25	27	19	24	23	13	11
Intra EC trade/production (%)	58	91	90	86	71	92	93	91	84

Source: CPIV, Eurostat (Comext)

Figure 1
World market for specialised glass



Source: CPIV

Bulb Ltd...) face strong competition from the USA (where Corning INC dominates the sector with 24 plants in the USA and 10 worldwide) and Japan (Asahi Glass Co). Several joint ventures have been established to produce specialised products and to supply specific markets.

Outlook

The EC specialised glass market will continue to expand by 1-2% per year in the 1990's. Biotechnology is already one of the

future markets of specialised glass. Only a few outlets, such as laboratory and analysing techniques are facing growing competition, especially from plastics.

Opto-electronics is a strong growth market, also for the glass industry, and its turnover should triple for the next 10 years. The classical specialised glass sectors are under most threat - mainly optics and ophthalmics.

Text Table 1
Specialised glass types and their respective application

GLASS TYPE	APPLICATION
Borosilicate glasses	Chemistry Pharmacy
Alkaline earth Aluminium silicate glasses	High-temperature thermometers
Alkali lead silicate glasses	Electrical resistance TV-tubes
Glass ceramics	Astronomical mirrors Ceramic Hobs
Glass solder	Connections: Glass/Glass Glass/Metal passivation of semiconductor surfaces
Coloured and filter glasses	Glass filter
Ophthalmic glasses	Eye glasses
Optical glasses	Optical instruments
Laser glasses	Glass lasers
Cerenkov glasses	Radiator for detectors of storage rings (Accelerator)
IR glasses	Lenses for IR-Cameras

Source: Industrial Minerals

CPIV: Comité permanent de l'industrie du verre -
Standing Committee of the EC Glass Industries;
Address: Avenue Louise 89, B-1050 Brussels;
tel: (32 2) 538 44 46; fax: (32 2) 537 84 69

Revised by: Sema Group Management
Consultants