

## Rating Methodology by Sector

### Glass

#### 1. Business base

Glass is mainly categorized into architectural glass, automotive glass, and flat panel glass. Because each product sector and each sales area features different market trends and business structures, it is important to understand the leading products and sales areas of the subject glass manufacturers.

##### (1) Characteristics of the industry

###### (i) Market overview

Architectural glass is principally used for residential houses, condominiums, commercial facilities, and offices. As a result, its demand is affected by trends in demand from the building market. The building market itself is highly susceptible to economic trends and policies. The building market in Japan and other advanced countries is mature, and so is unlikely to experience significant medium- to long-term growth. However, demand for architectural glass has been consistently strong in markets in Asia, Latin America, and other emerging economies, driven by rising populations and changes in housing conditions.

In automotive glass, because auto manufacturers in Japan enjoy strong global brands and sales capabilities, the export ratio of their products is high. As a result, compared to the market for architectural glass, the automotive glass market is not as heavily influenced by trends in the domestic economy. However, auto manufacturers in Japan have been gradually shifting their production overseas, driven by unfavorable costs and exchange rates. As a result, the automotive glass market in Japan is likely to weaken in the future. Globally, demand for automobiles in developed countries is mostly affected by economic trends and the level of replacement demand. On the other hand, demand for automobiles in emerging markets is strong, given the progress of motorization. Given trends in demand for automobiles in these countries, glass manufacturers are striving to reduce their production capacity in developed countries, while increasing it in emerging countries.

Glass for flat panel displays mainly comprises glass for liquid crystal displays and for plasma televisions. Glass for liquid crystal displays is mainly used for televisions. Until the early 2000s, the overwhelming majority of glass for televisions was used for cathode-ray tube displays. From the late 2000s, however, the market for liquid crystal displays grew sharply. Glass for liquid crystal displays is used in PCs and other equipment, in addition to televisions. As a result, glass for liquid crystal displays now shares the greater proportion of the market for glass used in flat panel displays. Although growth is slowing compared with past performance, the market for glass used in liquid crystal displays should be able to achieve sustainable growth in the future, given the rising popularity

of liquid crystal display televisions in emerging countries, and the increasing number of applications, including digital signage that use liquid crystal panels and mobile equipment. Meanwhile, demand for glass used for plasma televisions has been sluggish, but that in the large television market has held steady.

The market for cover glass for photovoltaic generation has also expanded recently. Although the market is still small, it is growing rapidly. It will need to be continually monitored going forward.

#### (ii) Competitive situation

Three major companies (Asahi Glass, Nippon Sheet Glass and Central Glass) account for almost 90% of the sheet glass market in Japan. However, as demand has weakened, competition is severe. Also facing severe price competition, these companies are struggling in a situation in which even the extra costs incurred from higher raw material and fuel prices cannot be transferred to product prices.

In the global sheet glass market, three major companies (Asahi Glass, Nippon Sheet Glass, and Saint-Gobain) hold a share of approximately 40%. Because there are also a number of local glass manufacturers in each country, competition is severe. In emerging countries, however, many businesses maintain strong earnings. At any rate, because general-purpose products tend to face severe price competition, manufacturers have been increasing the share of value added products in their product lineups.

The global market for glass used in liquid crystal displays is effectively an oligopoly, dominated by four companies (Corning, Asahi Glass, Nippon Electric Glass and AvanStrate). Because demand has been steady and the manufacturers have adopted conservative capital investment policies, the balance between supply and demand has been maintained soundly. Meanwhile, although manufacturers are offering some reductions in prices of their products to reflect the effects of their streamlining efforts, the industry maintains a highly organized price structure and has managed to avoid unnecessary price competition. Excessive competition has also been deterred because the operations require sophisticated technologies and substantial capital investment, creating a high barrier for newcomers.

#### (iii) Cost structure

Glass production involves two main steps: the furnace step (heat melting) and the processing step (shaping). Many manufacturers conduct all processes from heat melting to shaping. Certain manufacturers of architectural and automotive glass only carry out the processing step. As a result, each manufacturer has different cost structures. Because it is difficult to make production adjustments once furnace processing has started, the manufacturers are required to secure customers, processing plants, and other steady consumers.

Being an apparatus industry, the burden of fixed costs, such as depreciation and amortization, is significant. With respect to the costs of raw materials and fuels, the effects of fuel costs, particularly

prices of heavy oil, are noticeable. Transferring higher costs to product prices is not straightforward, as the industry deals with many customers with a powerful ability to negotiate prices, such as major general construction companies and global auto manufacturers. Consequently, when crude oil prices surge, the industry's earnings are often suppressed.

## (2) Important factors in market position and competitiveness

### (i) Market position and sales areas

In the architectural glass market, because market trends differ in each country, it is important to identify the main sales areas of the subject companies for rating, and understand trends in demand for construction and price characteristics in the relevant sale areas.

In the automotive glass market, performance is affected by the sales abilities of customers, namely auto manufacturers. For this reason, we focus on the control of shares of customers in the market. In particular, because the auto market in emerging countries is expected to grow, we confirm whether or not the companies to be rated have operations and customers in these countries.

The market for glass used in liquid crystal displays is an oligopoly of four major companies, a result of the difficulties for new comers in entering the market. Demand is also relatively steady. As a result, the players do not aim to unnecessarily expand their market share. However, an excessive dependence on specific customers means that operations are susceptible to the performance of these customers. For this reason, we pay more attention to the operating trends of major customers and the progress of diversification of customers, rather than looking at sales shares.

### (ii) Technical strength

The technical strength creates an added value, and makes significant contributions to earnings. The key point in analyzing product lineups is the constitution ratio of high-value added products in the overall product lineups.

As general purpose architectural glass is often subject to price competition, manufacturers of architectural glass need to transform their operations to produce more technologically advanced, value-added products. The manufacturers are, in fact, striving to secure earnings by bolstering sales of value-added products, such as the Low-E (low reflective) glass and cover glass for photovoltaic generation.

Automotive glass has higher added value than architectural glass, because manufacturers are required to have sophisticated processing technologies to achieve a broad array of designs, in addition to ensuring product strength. Each glass used in the front, side, and rear of cars has different processing levels. Products with a high processing level, such as front glass, generate higher earnings. It is necessary to determine whether or not the companies to be rated are able to deal with diverse needs, mainly by examining transactions with auto manufacturers.

In the market for glass used in liquid crystal displays, there are companies who failed on entering

the market. For this reason, the technical strength of the four major companies is judged to be reasonably high. Until recently, the manufacturers in the market strove to produce large-size glass substrates, but they are now required to produce thin substrates. The product yield rate of glass for liquid crystal displays is not as good as that of other sheet glass. While we value production experience, in addition to technical strength, we check the operating rates of plants and the level of product yield rates to verify whether or not there are any technical problems behind the fluctuations.

#### (iii) Production structure and streamlining capacity

It is difficult to flexibly stop and restart furnace processing, once it has started operating. While the manufacturers can secure steady production, it is difficult for them to adjust supply to meet demand in the short-term. As a result, they need to carefully make decisions on the closure or construction of plants by taking into account long-term demand. In areas and products whose markets are mature, we pay attention to the ability to reduce production levels. In areas or products that enjoy strong demand, in contrast, we focus on whether or not the companies to be rated are making appropriate capital investments in tandem with growth in the market, and whether they are effectively carrying out regular repairs and work to strengthen their production capacities.

The production bases of architectural and automotive glass are often established in demand areas. Meanwhile, some manufacturers of glass for liquid crystal displays concentrate their production bases in specific areas. Concentrating production bases enables the manufacturers to achieve an accumulation of production know-how, reducing risks of the leaking of technological information. Concentration, however, also has disadvantages in terms of the dispersion of risks in the event of disaster, and inflexibility in communicating with panel manufacturers about production. As the production facilities of glass for liquid crystal displays require heavy investment, it is essential to confirm medium- to long-term facility policies, even when demand is steady.

#### (iv) Customers

Demand for automotive glass is influenced by the sales capabilities of customers, namely auto manufacturers. Therefore, transaction volumes with strong auto manufacturers are a key factor. It is also necessary to take into account the diversification of transactions from the perspective of risk concentration. Sales areas of the relevant auto manufacturers are other important factors. In particular, because the automobile market in emerging countries is expected to grow going forward, we will monitor the development of operations and customers in these countries.

When analyzing glass for liquid crystal displays, it is more important, as described above, to accurately identify customers than to monitor the trends of sales shares. Major panel manufacturers are divided into Taiwanese manufacturers and South Korean manufacturers, and it is believed that manufacturers in South Korea with final products, such as liquid crystal display televisions, are resilient to changes in the market conditions. In addition, extensive restructuring is taking place

among not only small and midsize panel manufacturers, but also among major manufacturers. Manufacturers of glass for liquid crystal display are likely to be affected by this restructuring among their customers in the future. It is necessary to monitor the impact on earnings in the future by examining the trends among major customers of each manufacturer, and the transaction situation with these customers.

(v) Portfolio of businesses and areas

When analyzing glass manufacturers producing glass fiber, chemical-related products, and other products, it is important to pay attention to the earnings trends of other businesses. Because the earnings characteristics of architectural and automotive glass and glass for liquid crystal displays are all different, it is necessary to take into account the earnings structure of companies to be rated. In addition, if the subject companies have overseas operations, the earnings characteristics, and the weighting of each area will be confirmed. The portfolio of these businesses and areas are important preconditions for determining rates.

## 2. Financial base

(1) Earnings strength

Because the market for architectural and automotive glass is mature and sales growth is likely to be limited in Japan and other developed countries, it is essential for manufacturers to improve profitability. We monitor earnings improvement measures, such as the streamlining of production and the appropriate transfer of higher costs to product prices at times when prices of raw materials and fuels surge. Meanwhile, because earnings in emerging countries are expected to grow, we focus on medium- to long-term strategies in these countries, including capital investment plans and the development of new business areas. The market for glass for liquid crystal displays has maintained relatively strong profitability, a reflection of the market characteristics. We analyze factors on which the above assumption is based, including trends in demand and the competitive situation, to determine if the market can maintain the same level of profitability in the future.

Key financial indicators:

- Operating income
- Gross income on sales
- Operating income on sales

(2) Cash flow

As an apparatus industry, the glass industry requires significant capital investment, exposed to a heavy burden of depreciation and amortization. There are certain cases when a high level of amortization of goodwill is recorded, as a result of M&A and other corporate activities. There are many cases when the ability to generate cash flow is strong despite low profitability. However, the industry

has relatively strong demand for financing, because reasonable investment will be needed to be made to maintain and update existing facilities, and capital investment in emerging countries and in production of glass for liquid crystal displays will continue to be needed in the future. We examine free cash flows of the subject companies to be rated, and confirm how they balance cutting interest-bearing debt as an initiative to improve their financial situation and make new capital investments to respond to strong demand.

Key financial indicators:

- EBITDA
- EBITDA margin
- Ratio of interest-bearing debt to EBITDA

### (3) Safety

Each company has different financial structures, because of their business portfolio, past M&A, and other factors. Therefore, it is important to focus on investments and financial policies that are based on each company's financial structure. We also closely examine the impact on the financial situation of each company over the medium to long term from the policies described above. When the level of interest-bearing debt is high, we analyze interest repayment capabilities, and confirm the situation of transactions with financial institutions and repayment schedules, among other matters. Moreover, because companies in the industry have a number of large-scale facilities, and opportunities for restructuring are constantly present, it is important to check the financial ability of the companies to absorb impairment and other extraordinary losses.

Key financial indicators:

- Shareholders' equity
- Debt equity ratio
- Equity ratio
- Interest coverage ratio

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