The glass industry is dominated by large international groups, most of which are European and, as worldwide leaders, already use the most efficient techniques to remain competitive and to reduce their energy consumption. The recent coming into force of the Kyoto Protocol, in February 2005, has and is creating many difficulties for industries worldwide. Glassmakers will have to face additional production costs linked with the emission trading scheme and other typical indirect applications resulting in CO2 emissions reduction.

THE BENEFITS OF USING RECYCLED GLASS

From June 2002 to May 2003, energy consumption by the glass container industry, over 70% of which was used by the furnaces to melt glass, was monitored. This resulted in findings collated by Glass Technology Services (GTS) Limited that the industry had consumed some 4.64 TWh (4.64 x 109 KWh) of delivered energy. Fuel-related CO2 emissions from these furnaces amount to approximately 650,000 tonnes per year.

The study proved that an improved furnace control regime, which is able to compensate for changes to cullet levels and moisture content, could produce energy savings of 2.1% of furnace energy consumption, equal to 13,650 tonnes per year less in CO2 emissions.

For each tonne of glass produced from virgin raw materials, this decomposition produces approximately 185 kilos of CO2. The UK container sector currently operates 32 typically fossil fuel fired furnaces, operating continuously, each melting an average of 207 tonnes per day of glass, consuming 304 MWh of energy.

Using recycled glass to produce new items reduces CO2 emissions in two ways:
- It is easier to melt than the individual raw materials so uses less fuel, and
- It contains no carbonates so it does not release any CO2 during the melting process.

Increasing glass recycling, therefore, has the potential to deliver significant reductions in CO2 emissions. In fact, each tonne of glass returned to the melting furnaces reduces the demand on raw materials by 1.2 tonnes.

To maximize this energy-saving potential, Glass Technology Services, together with, and thanks to funding from a group of leading glass container manufacturers and The Carbon Trust, have undertaken a project in two different stages:
- The first stage in the project was to develop a control strategy providing a fundamental understanding of the process and quantify the potential savings.
- The second stage involved the development of algorithms to allow process engineers to develop control routines to optimize furnace operation, ensuring that the furnace is always run in the most fuel-efficient manner.

As a result, a model has been developed that can be used as a forecasting tool able to calculate current (optimum) furnace efficiency at any combination of production level and cullet ratio.

Glass Technology Services is a subsidiary of British Glass, which operates independently and offers technical services and consultancy serving customers who manufacture, work with, or use glass.

The British Glass Manufacturers’ Confederation represents the interests of all sectors of the glass industry in the UK. Its main activity is in representing the industry at European, national and local level on a wide range of topical legislative issues. It also conducts independent research into all aspects of glass production and technology.
Flat glass for buildings and thermal glazing and the automotive industry, glass containers for food and drink, tableware, glass fiber for reinforcement and for insulation, special glass for TVs and electronic applications and lighting, medical applications, etc. are just some of the applications of glass that affect all areas of our lives. All these diverse products are facing a worldwide competition as well as being confronted with different challenges in various markets.

Glass can be recycled easily and almost indefinitely. In fact, more than 50 per cent of the container glass production is made from recycled glass. Air emissions and energy consumption are the major environmental challenges for the glass industry.

In order to ensure that the glass industry, essentially a commodity industry, remains competitive, many ways of adding value to high volume products have been developed. The glass industry is dominated by large international groups as well as being capital intensive. Most of these groups are worldwide European leaders, who already use the most efficient techniques to remain competitive and to reduce their energy consumption. Since furnace life is usually from 8 to 12 years, these investments are generally long-term. Energy costs for the glass industry represent from 7 to 20 per cent of the total production costs, with over 80 per cent of the energy used coming from fossil fuels whose combustion leads to CO2 emissions. (Electricity accounts for the remaining 20 per cent).

<table>
<thead>
<tr>
<th>Country</th>
<th>Total residential CO2 emissions (Mt)¹</th>
<th>Savings (Mt)²</th>
<th>Savings compared to emissions (%)</th>
</tr>
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<tbody>
<tr>
<td>Austria</td>
<td>15.720</td>
<td>0.81</td>
<td>5.2</td>
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<td>Belgium</td>
<td>21.793</td>
<td>3.15</td>
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<td>EU15</td>
<td>477.712</td>
<td>87.15</td>
<td>18.2</td>
</tr>
</tbody>
</table>

Sources:
1) CO2 inventory EC 2000 - direct CO2 emissions
2) Low-E glass in buildings - impact on the environment and on energy savings – GEPVP publication 2001
Approximately 20 per cent of the total CO2 emissions are represented by process emissions, due to the decomposition of carbonaceous raw materials.

Glass products can help to reduce energy consumption and, thereby, emissions of CO2. In many applications e.g. in buildings by the use of insulation glass fiber or low-emissivity glazing (with one pane having a special coating that reduces the thermal losses through the window). For instance, should all single/double glazing in the EU be replaced by low-emissivity double glazing, this could avoid annual emissions of 82 millions tonnes of CO2. Fiber glass used to reinforce plastics in wind turbines and in materials in the automotive industry are other typical indirect applications resulting in CO2 emissions reduction.

Key Figures for the Glass Industry

Total European production per year is approximately 30,000,000 tonnes, and total energy consumption is about 300 PJ. Total CO2 emissions per year are about 20,000,000 tonnes (to be compared with potential savings due to low-emissivity double glazing: 82 Mt). Figure 3 gives an idea of the specific energy consumption and specific CO2 emissions reduction in the glass industry since 1960 (based on French Glass Industry Federation and CPIV data).

The potential for further energy reduction is very small. Figure 2 shows us an example of the operating conditions of a typical container furnace giving the specific energy consumption and the specific pull on an asymptotic trend.

Competitive Aspects

The increase of electricity prices caused by the Emission Trading Scheme could represent an extra cost of about EUR 60,000,000 per year for the glass industry (based on an extra cost of EUR 7/MWh). The possibility of reducing CO2 emissions by changing from heavy fuel oil or coal to natural gas will, in some countries, increase gas demand, as well as leading to higher prices on the market. Because of worldwide competition, the glass industry cannot simply pass the extra cost of ET on to its customers.

The are also other significant indirect costs linked with emission trading which will impact on the competitiveness of the glass industry. These will mostly regard small companies who will experience difficulties with high fixed costs: emissions monitoring and reporting, external verification, the complex administrative burden (electronic registry, new accounting rules, etc.)

Conclusions

Additional production costs linked with the emission trading scheme will be just one of the problems that glassmakers will have to face. Member States will, thanks to very ambitious targets set up by the Kyoto Protocol, be forced to set unrealistic and insufficient allowances for industry.

Glassmakers will have to buy allowances on the market or relocate production to countries that have no CO2 reduction obligation, which may result in negative economic and social consequences for Europe.

Glass products have essential roles in ensuring food safety and providing thermal insulation and lighting, which must be recognized and safeguarded by the EU.