ENERGY STAR®
INDUSTRIALINSIGHTS™

Container Glass Manufacturing

US Container Glass Plants

NAICS 327213

- 44 Container Glass Plants[1]
- 8 Companies[1]
- 22 States & Territories with Plants[1]
- 8 ENERGY STAR Plants

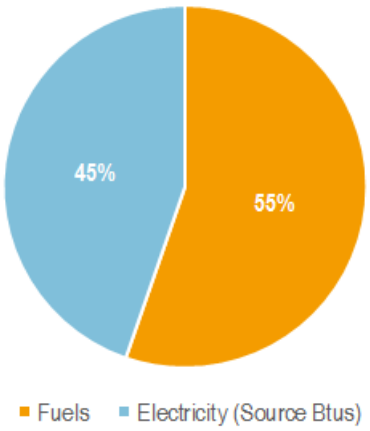
Container glass manufacturing plants process sand, soda ash, and other raw materials into jars, bottles, vials, etc. for a wide range of uses. It is the largest segment of the glass industry in the United States (based on production) and is one of the most energy-intensive industrial processes. Additionally, it is a sector where energy costs represent a major percentage of operating costs.

The US Environmental Protection Agency's ENERGY STAR partnership has worked with the glass industry since 2006 to promote energy efficiency and energy management best practices within the sector through the ENERGY STAR Industrial Focus initiative.

Energy Use Profile

Natural gas and electricity are the dominant energy sources used in container glass manufacturing.[2]

Energy Use Distribution



Electricity and natural gas use vary by plant size and product mix. The table below provides an estimate of total energy use for each plant size category.[3]

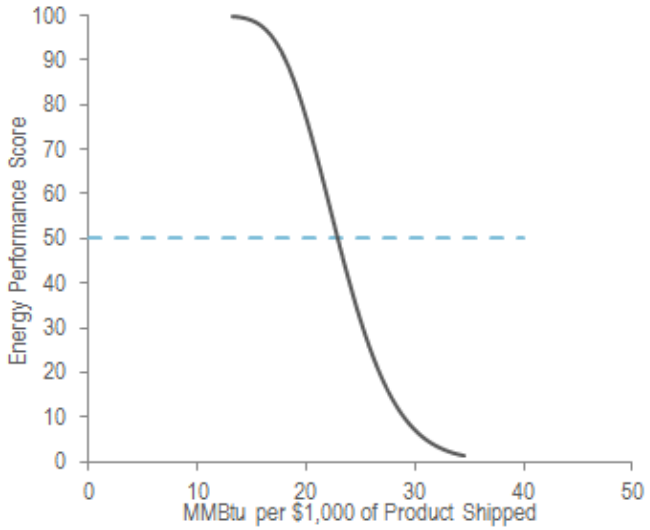
Plant Energy Use	Total Energy (MMBtu)
Small	~384,250
Medium	~1,505,000
Large	~3,562,500

Electricity and fuel (natural gas) costs are roughly equivalent, as shown below. In 2013, the container glass industry spent over $220 million on fuels and over $225 million on electricity.[4]

Electric Costs (51%)	Fuel Costs (49)

Distribution of Energy Performance

EPA, through the ENERGY STAR Glass Manufacturing Industrial Focus, has benchmarked the energy performance of container glass plants. The curve below, generated from the ENERGY STAR Container Glass Plant Energy Performance Indicator (EPI) benchmarking tool, shows the normalized distribution of energy performance for a representative plant. A dashed line corresponding to the performance of an average plant is provided for reference. An Energy Performance Score (EPS) of 75 or higher is defined by EPA as the threshold for efficient plants.



The steepness of this curve shows a fairly narrow range of energy performance between plants in the sector. This suggests that most plants have optimized their furnaces, the sector's largest energy user. Smaller gains in energy performance may be achieved by making improvements in other process areas. Increasing the use of recycled glass (cullet) can also improve energy efficiency in container glass plants.

Major Energy Uses

Container glass manufacturing is an energy-intensive process that involves melting raw materials at extreme heat followed by forming and multiple finishing processes. The table below outlines major energy using processes.[5]

Use / Process	Share of Energy
Batch (raw material) preparation	7%
Melting and refining furnaces	78%
Forming	5%
Finishing (tempering, coating, etc.)	9%

Furnaces used to melt and refine raw materials into glass are designed to operate continuously for 10 to 15 years before stopping for major maintenance and rebuilding. Consequently, significant efficiency improvements to furnaces usually occur only during rebuilds. Increasing the use of cullet (recycled glass), which requires much less energy to melt than other raw materials, will improve efficiency. In furnaces, smaller efficiency gains can be made by optimizing oxygen levels, upgrading burners, and increasing insulation. Compressed air is used extensively in the forming and finishing phases, making it a focus area for energy management.

ENERGY STAR Resources

The ENERGY STAR Glass Manufacturing Focus, a collaborative effort between EPA and the industry, has developed the following materials for energy efficiency in container glass plants:

- **Energy Performance Indicator** (EPI): Benchmarks and rates plant energy performance.
- **Energy Guide**: Technical guidance on energy saving opportunities.

ENERGY STAR Certified Plants

EPA's ENERGY STAR program certifies plants that demonstrate energy performance in the top quartile nationally. Since 2010, **8 plants** have earned ENERGY STAR certification by scoring 75 or higher using the Container Glass Plant EPI.

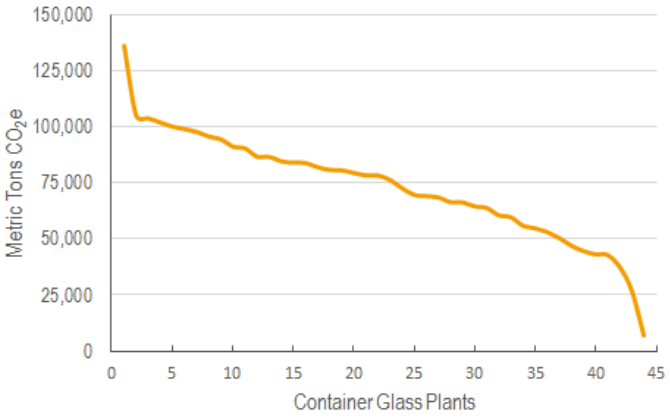
References:
1. Plant, company, and state counts from the EPA FLIGHT Database (ghgdata.epa.gov).
2. Fuels from 2013 EPA FLIGHT Database (ghgdata.epa.gov). Electric from 2013 Annual Survey of Manufacturers.
3. 2010 Manufacturers Economic Census Survey, Table 6.3.
4. 2013 Annual Survey of Manufacturers.
5. ENERGY STAR Energy Efficiency Improvement and Cost Saving Opportunities for the Glass Industry.
6. EPA Greenhouse Gas Reporting Program Database (ghgdata.epa.gov).
7. Estimate calculated from purchased electricity reported in the 2013 Annual Survey of Manufacturers.
8. Estimate calculated by combining direct emissions from the EPA Greenhouse Gas Reporting program with estimates from the 2013 Annual Survey of Manufacturers.

* Emissions from this plant reflect that plant was not fully operational in 2013.

Greenhouse Gas (GHG) Emissions

Direct GHG emissions from container glass plants are produced by fuel use and the chemical reactions in the glass making process. Forty-four plants reported direct emissions to EPA's Greenhouse Gas reporting program in 2013, totaling over 3.2 million metric tons of CO_2e ($MMTCO_2e$).[6] As shown below, emissions ranged from 136,256 to 6,639* metric tons of CO_2e ($mtCO_2e$) and averaged around 73,146 $mtCO_2e$.[6]

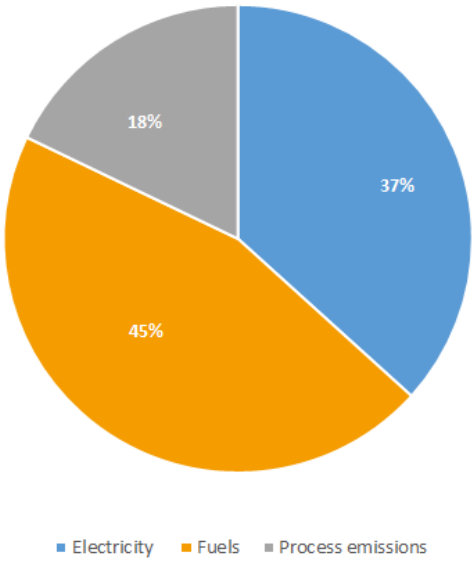
Direct Emissions Distribution



Indirect emissions from electricity purchases were approximately 1.8 $MMTCO_2e$ in 2013.[7]

Total GHG emissions from container glass plants were approximately 5 $MMTCO_2e$ in 2013.[7,8] Direct emissions from fuel use (natural gas) is the largest source, as shown in the graphic below.

GHG Emissions by Source



EPA United States Environmental Protection Agency