

Life Cycle Assessment of Glass as a Construction Material

James Cullen p15151

Abstract

This research poster relates to an investigation undertaken into the whole life cycle of glass and its use in the construction industry. The purpose of the poster is to highlight the processes, outputs and inputs associated with each stage of the life cycle. The investigation was based purely upon existing information available into the subject but did raise several interesting findings. These include that it appears far more recycling and re-use of glass could be carried out. This is further emphasized by the fact that the possibilities for re-use are wide ranging. In conclusion, in order to instigate this, more government intervention could be helpful.

Introduction

Glass has been recognised by humankind for Millennia as very useful material. Only relatively recently however has it found use in the construction industry, although traditionally its use was confined to glazing. Further innovation has resulted in it being implemented as a “statically and dynamically loaded civil engineering structural component” (Karmazinova, Date Unknown) as well for staircases, partitions, cladding and canopies. Glass has many desirable properties for architects and developers including strength, workability and transparency which has contributed to the global construction glass market being “valued at \$76,036 million in 2015 and is expected to reach \$121,877 million by 2022” (Sukhija, 2017).

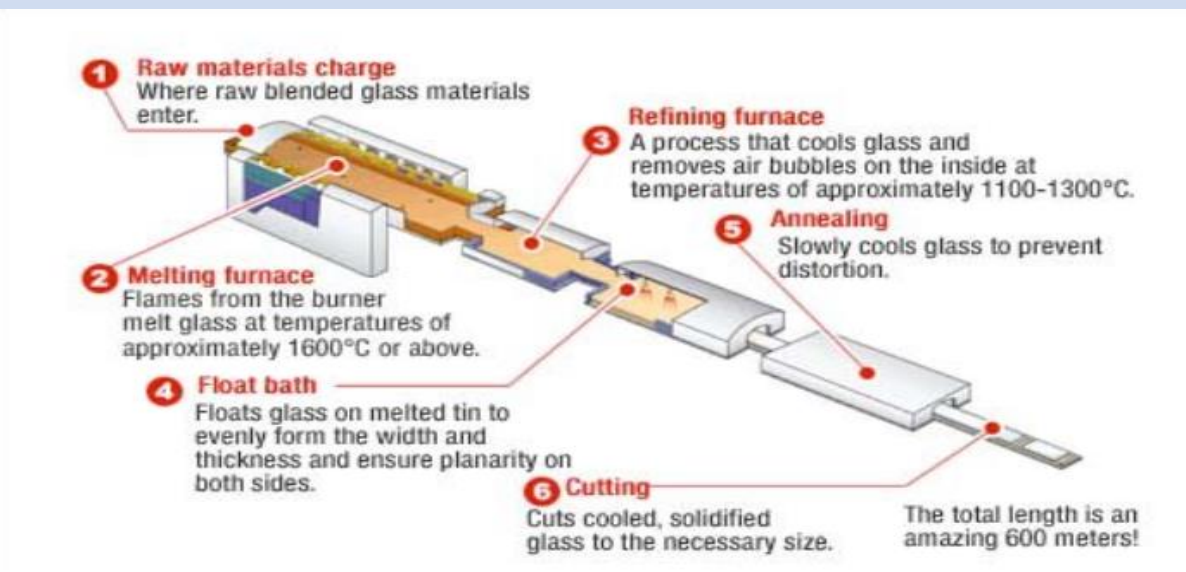
This research poster will profile the life cycle assessment as glass as a building resource, describing the processes in conjunction with CEN/TC 350 construction standards. The major inputs and outputs throughout the timeline will also be profiled. There is wide variety of glass types available depending on what it is required for and consequently, the inputs in the process also differ significantly. As an indicative research poster, this investigation will be restricted to glass in its simplest form.

A - Product Stage

The main raw materials required to produce glass are:

- Sand – Required for its high silica content and is globally extracted in large volumes in Australia and South East Asia. “Some sand is from Britain and Ireland and most of the glass factories in the U.K. use this sand” (Bryson Energy, 2020). UK output in 2018 was roughly 5million tonnes in 2018 (British Geological Survey, 2020).
- Soda Ash – Acts to lower the temperature required for the sand to melt in the furnace. It is mined throughout the world with “53% of the 60 million tonnes of soda ash produced in the last year” (Morris, 2019) being used in the glass making industry.
- Limestone - Widely available, limestone increases the durability of the finished product.

These along with some other components require extraction, preparation and processing prior to transportation to the local glass making plant where differing quantities of each are mixed and heated in a furnace. To produce glass for use in construction, the ‘float glass’ method is employed:



During the production process various emissions are produced such as sulphur dioxide, carbon dioxide, and nitrous oxide. These are further exacerbated by the various emissions associated with transport. This is true for transporting the constituent raw materials, as well as the finished product to the construction site.

B - Use Stage

Once implemented in a construction project the glass will require little maintenance throughout its lifetime which can last for many years based on its use. This can demand on the building use or factors such as style or use changes to the property. Little or no inputs or outputs at this stage.



C – End of life stage

In a cradle to grave system, this where glass used in a construction will come to an end and be transported to a landfill site following the building demolition. Estimates suggest that of Construction waste produced yearly across the EU totalling between 510 and 970 millions tonnes, around 0.66% constitutes glass (Glass for Europe, 2013).



D – After life stage

Alternatively, the glass can be reused elsewhere or recycled, where it is re-melted in a furnace and reformed. This option obviously possesses implications for emissions, although less raw materials are required. Re-use also necessitates some preparation such as cleaning and vigorous sorting, while both will methods will be subject to the undesirable outputs associated with transportation.

A further option involves ‘down-grading’, whereby glass can be exploited for a totally different use such as acting as a fill for patio laying “and as a fluxing agent in the manufacture of bricks and ceramics” (PBC Today, 2019).

Conclusion

Since the industrial revolution humans have intensively exploited raw materials and subsequently burnt them to produce products and energy. Recent research has focused upon the results of this finite resource depletion as well the ever increasingly prominent effects of climate change. Recycling and re-use of products are of paramount importance to prevent the situation worsening. Opportunities for this to occur in relation to glass used in the construction industry are vast. Land is another finite resource, indicating that to facilitate development in future years, building demolition will be widespread and therefore so will be construction waste. This in turn will produce a large quantity of glass, which as has been shown by this poster can affectively be recycled, re-used or down graded into a vast array of useful products. As the possibilities are easily accessible, perhaps it is time for policy to reflect this and introduce legislation focused on glass waste in isolation as opposed to the overall construction waste targets in existence already.

Reference List

British Geological Survey (2020), *Mineral Planning Factsheet – Silica Sand*,
Glass for Europe (2013), *Recycling of end-of-life building glass*, <https://glassforeurope.com/recycling-of-end-of-life-building-glass/>, accessed 09/02/20, Belgium
Karmazinová (Date unknown), *Glass – structural material of buildings*, Energy, Environment and Material Science, pp 23-33, UK
Kuenen (2013), *Glass Production*, www.tfeip-secretariat.org, Netherlands
Morris (2019), *Glass consumes more than half of soda ash production*, <https://www.glass-international.com/news/glass-consumes-more-than-half-of-soda-ash-production>, UK
PBC Today (2019), *Making the most of recycled construction waste*, <https://www.pbctoday.co.uk/news/planning-construction-news/recycled-construction-waste/54769/>, UK
Sukhija (2017), *Construction Glass Market Outlook*, <https://www.alliedmarketresearch.com/construction-glass-market>, UK
Understand Building Construction (2020), *Glass*, <http://www.understandconstruction.com/glass.html#>, accessed 09/02/20, UK
Image List
Bluck et al (2017), *Float Glass Production Process*, Intevac, Inc, USA
Paving Expert (2020), *View of Operative screeding a floor made up of recycled glass*, <http://www.pavingexpert.com/news219.htm>, accessed 11/02/20
Schwartz (201&), *View of a Glass Floor*, <https://www.bdcnetwork.com/fire-resistive-glass-floors-make-dramatic-statement-nashville%E2%80%99s-historic-neighborhood>, accessed 11/02/20