Vol. 10 | No. 2 | July - September 2022

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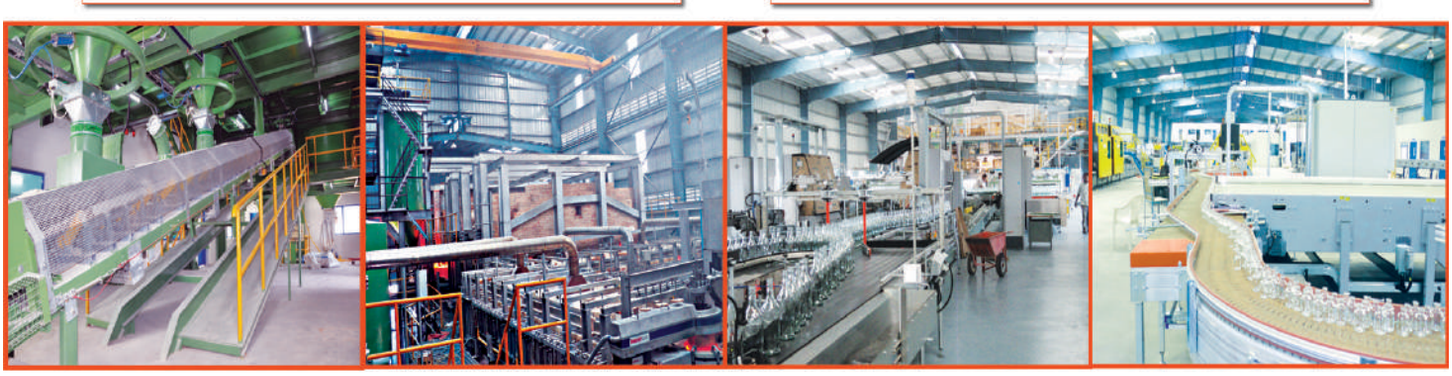

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T: +91 11 2331 6507 E: info@aigmf.com

Editor MOHAN LALVANI

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Quarterly Journal of **THE ALL INDIA GLASS MANUFACTURERS' FEDERATION**

Vol. 10 | No. 2 | July-September 2022

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APNA DESH
APNA GLASS

From President's Desk

AIGMF and Glass Worldwide once again shared the joint stands (13A42 & 13A44) at glasstec 2022 from Sept 20-23 at Dusseldorf, GERMANY. We were able to meet many AIGMF Members and stakeholders at Dusseldorf and discussed future activities including publications.

As part of the celebrations for the International Year of Glass (IYoG 2022) The All India Glass Manufacturers' Federation (AIGMF) organised its annual contest for Youth: 1st Poem / Essay Writing Contest on 'Green as Glass' or काँच और पर्यावरण coinciding with the International Youth Day.

Online entries were invited from the age group between 7-24 wherein over 2,000 entries were received from educational institutes and youth across India. 1st Prize (Rs. 25,000) was given to Akshita Tejwani aged 14 years, 10th class student of Maharani Gayatri Devi Girls School, Jaipur. 2nd Prize (Rs. 15,000) was given to R. Shruthi aged 15 years, 10th class student of Jawahar Vidyalaya Senior Secondary School, Chennai. 3rd Prize (Rs. 10,000) was given to Kanishk Sharma aged 16 years, 11th class student of Ajanta Public School, Gurugram (Haryana). Winning entries can be viewed at www.aigmf.com

An Industry meet was organised on Sept 3, parallel to AIGMF's Annual General Meeting at Hotel Lemon Tree, Aerocity, Delhi where NTPC's Mr. DMR Panda, Head of Hydrogen Group and Planning Head of Renewable Business gave a presentation on Green Hydrogen Economy: Options for Indian Glass Manufacturers.

Former President Mr. Sanjay Somany gave the prestigious annual 'CK Somany Award for Innovation and Technology' to Mr. Eric L'Heureux- Managing Director, Schott Poonawalla Pvt. Ltd. The 'Balkrishna Gupta Award for Exports' was bestowed to M/s Schott Poonawalla Pvt. Ltd., by the Former President, Mr. Pradeep Gupta. Both awards were supported by Glass Worldwide, preferred international journal of the AIGMF in association with Kanch.

These events were attended by approx. 80 industry members.

The jury for Industry awards comprised of Dr. K. Annapurna, Chief Scientist, Glass Division, CSIR- Central Glass & Ceramic Research Institute (CSIR-CGCRI); Mr. Dave Fordham, Publisher, Glass Worldwide, London (UK); Mr. Sanjay Somany, Former President AIGMF and CMD HNG Industries Ltd.; Mr. P K Kheruka, Former President AIGMF and Chairman Borosil Ltd.; and Mr. Vinit Kapur, Secretary AIGMF.

The next Executive Committee meeting is slated to be held at Guwahati on Dec 10 where in addition to the technical presentations, investment opportunities in the state of Assam will be discussed with local government authorities. All Members are invited to be a part of these discussions and to celebrate 80 years of AIGMF ■

Sanjay Agarwal
President AIGMF and
Director, Kwality Glass Works, Firozabad

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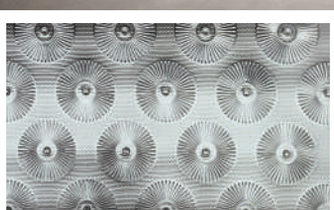
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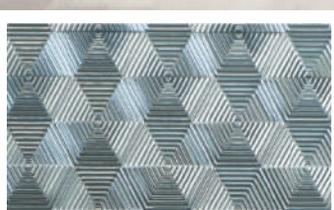
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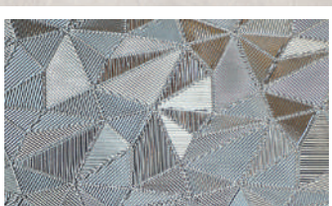
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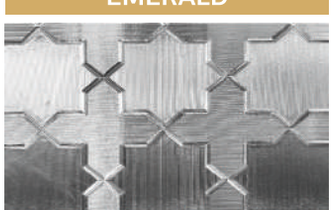
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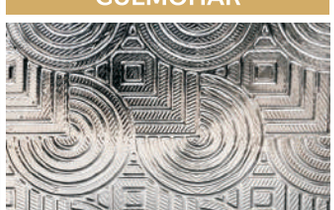
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GLASS News

DR. ARUN K. VARSHNEYA ELECTED AS PRESIDENT OF THE SOCIETY OF GLASS TECHNOLOGY

On Sept 6, 2022, the Council of the Society of Glass Technology (UK) unanimously elected Dr. Arun K. Varshneya as its 58th President - a role which is a first for an overseas domiciled individual and for an Indian by birth.

Dr. Varshneya received his early education at St. John's College Agra (Agra University), standing first in order of merit in the 1962 B.Sc. (pure sciences) exams of the university. By chance, his father, the late Mr. Nathi Lal Varshneya, knew Dr. Atma Ram (former Director of the CGCRI) and Mr. Harish Chandra Varshnei (proprietor of Saraikela Glass Works, Kandra WB) who both urged Mr. Varshneya to ask Dr. Arun to join Sheffield University's Dept of Glass Technology for the B.Sc. Tech. with honours program. Mr. Varshneya himself was a dealer of scientific glass products, chemicals and instruments such as the microscope. It didn't take a second thought. And so began the teenager's journey to the west in the quest of higher education in glass technology, an unheard-of educational discipline those days. Dr. Arun received the best of education under the chairship of Prof. R. W. Douglas. In the Dept library, he made acquaintance with the Society of Glass Technology abstracting staff. From mere acquaintance with staff to becoming the president of the Society sixty years later is coming of a full circle for him.

In the final year, while at Sheffield, he was advised for his thesis research by the late Prof. Alfred R. Cooper. They hit it off. Dr. Arun crossed the Atlantic on a ship in August 1965 to join Case Institute of Technology, Cleveland OH as their first graduate student of ceramics, all thanks to Prof. Cooper, who later proved to be the most powerful influence in the development of Dr. Varshneya as a thinker in glass topics.

After securing his MS and PhD from Case, he joined Ford Scientific Laboratories, Dearborn MI and GE Lighting Business Group in Cleveland. In 1982 Alfred University invited him to join the faculty ranks as a Professor of glass science and engineering. As a teacher, he taught nearly all of the required glass engineering science courses both at the undergraduate and the graduate levels and the much-needed business basics as the engineering capstone course. He always drove his students to excel. Students admired him for his use of clear enunciations and simple language during lectures using math, physics and chemistry to drive the toughest of glass topics home. He is most known worldwide for his textbook, "Fundamentals of Inorganic Glasses", now in its third edition. He is the invited author of the 13-page article on "Industrial Glass" in Encyclopaedia Britannica, and author or co-author of roughly 170 publications and 12 patents. Many of his publications, particularly those on strength of glass with "Lessons Learned and Yet to be Learned" as title ending clause have been some of the most downloaded articles in the International Journal of Applied Glass Science.

He co-founded his entrepreneurship company "Saxon Glass Technologies, Inc." in 1996 two blocks away from Alfred University to assist with the economic growth of the western NY region, and continues to be its CEO. The company delivers glass chemical strengthening service. Their most known product is the Ionex® chemically strengthened Type 1 borosilicate glass cartridge in the EpiPen autoinjector used to combat life-threatening anaphylaxis shock as a result of severe allergic reaction to beestings, peanuts, and shell foods. Prior to chemical strengthening, the probability of glass fracture was as high as 10% during the device administration leading to death. This fracture probability was reduced to virtually non-existent after the chemical strengthening process. As a result, the device market increased roughly 20 folds over the 25 years. It is estimated that several thousands of human lives are saved each year because of this glass product.

Dr. Varshneya is a 2018 Honorary FSGT, a 2014 Distinguished Life Member of the American Ceramic Society and 2007 President's Award of the International Commission on Glass recipient. In December 2011,

at the platinum jubilee session of the Indian Ceramic Society in Agra, he organized "Cera Ga Ma Pa" at the Taj mound to sing Hindi songs to the delight of the conference participants. The local news media cited him as one of the 25 crowning stars of Agra. Also in 2011, his wife Mrs. Darshana and he endowed a pair of lecture awards entitled, "Frontiers of Glass" in their name within the American Ceramic Society. Most recently, he endowed the Cooper, Varshneya and Smialek scholarship at Case Western Reserve University.

Dr. Varshneya has been taking active role in the organization of the 2022 International Year of Glass activities around the globe *(including being a judge for the **AIGMF** photo contest "Glass in our lives" for the youth)*. He is the lead editor of the "National Day of Glass: Commemorative Edition" book discussing what glass products have achieved and highlighting the many North American individuals whose tireless work has brought to where we are and where are we heading.

As President of the Society of Glass Technology, Dr. Varshneya is looking forward to increasing ties with the Indian Ceramic Society, AIGMF, and the CGCRI. Dr. Arun and Mrs. Darshana, his wife lives in Vienna VA and warmly welcome friends and relatives with open arms.

NEW OFFICE BEARERS ELECTED

Following were elected as Office Bearers of the AIGMF for the Year 2022-23 at the Annual General Body Meeting held on Sept 3, 2022 at New Delhi.

President -Mr. Sanjay Agarwal, Kwality Glass Works, Firozabad

Sr. Vice President- Mr. Rajesh Khosla, AGI glaspac, Hyderabad

Vice President – Mr. Hargun C Bhambhani, Sunrise Glass Ind. Pvt. Ltd., Gujarat

Hon. General Secretary – Mr. Mukesh K Bansal, Sri Sitaram Glass Works, Firozabad

Hon. Treasurer – Mr. Purvish M Shah, Gopal Glass Works Ltd., Ahmedabad

On the recommendations of Zonal Associations following were nominated as members of the Executive Committee for the year 2022-23:

Eastern India Glass Manufacturers' Association (EIGMA)

1. Mr. Vinay Saran - HNG & Inds. Ltd., Kolkata

Northern India Glass Manufacturers' Association (NIGMA)

1. Mr. N N Goyal- U. P. Twiga Fiberglass Ltd., Delhi
2. Mr. Shailendra Kumar Misra - HNG & Inds. Ltd., Bahadurgarh

South India Glass Manufacturers' Association (SIGMA)

1. Mr. Sardar Akshay Singh - SGD Pharma Ltd., Hyderabad

U.P. Glass Manufacturers' Syndicate (UPGMS)

1. Mr. Manish Bansal - G.M. Glass Works No. 2, Firozabad
2. Mr. Ritesh Mittal - Meera Glass Industries, Firozabad
3. Mr. Anurag Mittal - Geeta Glass Works, Firozabad
4. Mr. Anurag Gupta - Om Glass Works (P) Ltd, Firozabad
5. Mr. Nitesh Goyal - Goyal Glassware P. Ltd., Firozabad
6. Mr. Devansh Gupta - Tigersons Glass Inds. P. Ltd., Firozabad

Western India Glass Manufacturers' Association (WIGMA)

1. Mr. G.K. Sarda - Empire Ind. Ltd., Vitrum Glass, Mumbai
2. Mr. Ashok Jain - Borosil Ltd, Mumbai
3. Mr. Hemal Thakor - PGP Glass (P) Ltd., Mumbai
4. Mr. Purvish M Shah - Gopal Glass Works Ltd., Ahmedabad
5. Mr. Pawan Kumar Shukla - Schott Glass India Pvt. Ltd., Bharuch

The following are co-opted members of the Executive Committee for the year 2022-23:

1. Mr. Sanjay Somany - HNG & Ind. Ltd., Bahadurgarh
2. Mr. Pradeep Kumar Gupta - Om Glass Works Pvt. Ltd. Firozabad
3. Mr. P.K. Kheruka - Borosil Ltd. Mumbai
4. Mr. Mukul Somany - HNG & Ind. Ltd., Bahadurgarh
5. Mr. SC Bansal - Adarsh Kanch Udyog, Firozabad
6. Mr. S K Jhunjhunwala - La Opala RG Ltd., Kolkata
7. Mr. Sanjay Ganjoo - Asahi India Glass, Mumbai
8. Mr. Raj Kumar Mittal, Mittal Group of Glass Industries, Firozabad
9. Mr. Bharat Somany, Vice President, HNG & Ind. Ltd., Bahadurgarh

EU CONTAINER GLASS INDUSTRY RECORDS HIGHEST EVER GROWTH IN PRODUCTION

New industry data released points to strong growth in container glass production in Europe and demonstrates that the sector continues its recovery from a 2020 decline. Industry production volume of glass packaging for the food and beverage sector increased strongly by 5% compared to 2020 figures, to reach its highest level ever recorded.

According to newly-available data released by FEVE – the European Container Glass Federation, more than 23.4 million tonnes, or 83.3 billion bottles and jars, were produced for the European and global markets in 2021. Since 2012, container glass production has grown by 18.6%, at an average growth rate of 1.7% per year.

Likewise, production of glass flacons for the perfumery, cosmetics and pharmaceutical segments delivered a strong growth of 2.2% to reach 13.6 billion units by the end of 2021■

(News Source: AIGMF Research Team / World Wide Web)

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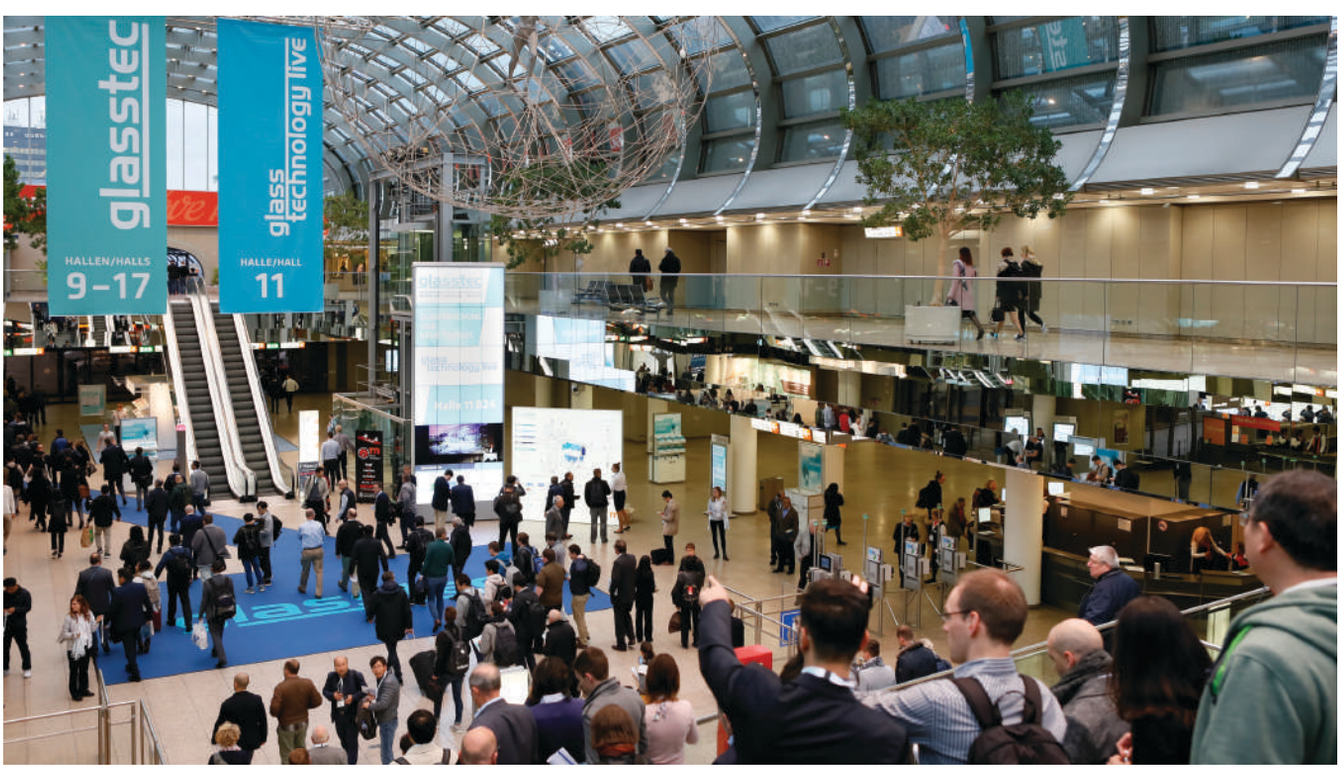
World's Leading Trade Fair underlines its Relevance in the "International Year of Glass"

(Sept 20-23, Dusseldorf)

glasstec has clearly underscored its relevance for the global glass industry with its restart as a face-to-face trade fair after the pandemic induced break.

In the "International Year of Glass", the 936 exhibitors from 47 countries impressively demonstrated to 30,000 visitors from 119 countries the operational excellence of the sector.

In focus were the global trend topics Climate, Resource Efficiency, Urbanisation, Value and Well-Being but also current challenges such as high energy costs, supply chain bottlenecks or skilled labour shortage. Held concurrently over three days, the decarbXpo trade fair with its ranges revolving around the decarbonisation of industries was also perceived as a meaningful addition in this context.



The All India Glass Manufacturers' Federation (AIGMF) and Glass Worldwide once again shared joint stands (13A42 & 13A44) at glasstec 2022 from Sept 20-23 at Dusseldorf, GERMANY.

"AIGMF in partnership with Glass Worldwide, its Honorary Member and preferred international journal in association with Kanch (Glass) was able to organize a wide range of International Year of Glass (IYoG) activities involving Youth and Industry Members in 2021 and 2022. The support of the International Commission on Glass and Worldwide Glass Associations were also commendable."

"We were able to meet many AIGMF Members and stakeholders at Dusseldorf and discussed future activities including publications.", said Secretary AIGMF Mr. Vinit Kapur

Over 75% of the trade visitors travelled to Düsseldorf from abroad. This means the share of international guests continues at a very high level, confirming the leading global position of glasstec for the industry in the "International Year of Glass". This was declared by the United Nations for 2022 to create visibility for the scientific, economic and cultural importance of the material that is glass as well as its vital role in future-

focused topics like climate protection and CO_2-reduction.

At 75%, the equally high percentage of executives who are involved in investment decisions underlines the high quality of the trade fair. Visitors were highly satisfied with the ranges on display at glasstec. Well over 90% stated they had achieved their objectives set for the visit. For the majority, seeking new suppliers as well as innovations and trends was the main goal.

Not only the broad-based ranges displayed by exhibitors make glasstec so attractive for decision-makers but also the high-calibre accompanying programme of Special Shows and conferences. This way glasstec provides a comprehensive platform for knowledge transfer and presents all target groups – from the skilled trades to architects' offices, from glass processors to producers and from upstream suppliers to the industry and technology vendors – with innovations and solutions for their respective demands.

The programme of the glasstec conference combined the industry know-how from theory and practice in the context of the five global trend topics Climate Protection, Resource Efficiency, Urbanisation, Value and

spectacular exhibits to reflect the latest trends and results of scientific research thereby providing insights and outlooks on the performance of the sector. The Innovation Show was organised by the network of the four technical universities Darmstadt, Delft, Dortmund and Dresden.

The Special Area Craft LIVE in Hall 10 again showed the top innovations for skilled craftsmen in the glazing trade in hands-on demonstrations this year. At the WorldSkills Germany@glasstec young glaziers from throughout Germany competed with each other to secure a place for participation in the EuroSkills 2023 in Poland. Maximilian Kröger from Dieburg is the winner of the WorldSkills Germany@glasstec.

With a live demonstration on the fire resistance of fire-resistant glass, ift Rosenheim showed how glass can ensure safe containment in the event of a fire. The supporting programme was rounded off by the Special Show "glass art", which showed art objects made of glass.

The glasstec "START-UP ZONE" offered a total of 11 young and innovative companies an excellent platform for networking and professional exchange with top decision-makers from the glass industry. Visitors benefited from Well-Being. Every day, the glasstec visitors were informed about current developments and trends in lectures on glass production, glass processing and finishing as well as glass products and applications. In addition, the Conference was streamed on the glasstec website.

Also forming a traditional part of the line-up of side events is the International Architecture Congress. Eight representatives from renowned architects' and engineering offices, who are pioneers in planning and building with glass, presented their exciting projects to the approx. 100 participants. Discussions also revolved around the contribution that glass facades can make to moving away from fossil fuel dependence, improving human well-being in increasingly warmer climates and highlighted the technical and design potential glass holds for architecture today.

The Innovation Show glass technology live was centre stage in the line-up of side events and under the heading "NEXT IN GLASS" presented

new and innovative applications and solutions.

The first international trade fair for industrial and commercial decarbonisation, decarbXpo, came to a successful close. Around 100 exhibitors from 15 countries presented their technologies and solutions in Hall 9 of Düsseldorf's exhibition centre. Together with three concurrent conferences, the trade fair demonstrated both investors' and industrial users' need for an intensive exchange of information on new technologies and cooperation for climate protection. Held concurrently with glasstec, provided additional attention: production companies from the glass industry visited decarbXpo to discuss reducing energy costs and CO_2 emissions as well as energy storage.

"glasstec 2022 came at precisely the right point in time to provide the glass industry with orientation again after the pandemic-induced changes and in a difficult economic climate. The participants' feedback has been unambiguous here: as a face-to-face trade fair glasstec allows in-depth exchange of experience and knowledge transfer on a global level in a uniquely concentrated form as well as offering an unparalleled, packed line-up of innovations and solutions," sums up Mr. Erhard Wienkamp, Managing Director at Messe Düsseldorf GmbH.

This impression is also shared by Mr. Egbert Wenninger, CCO and board member at Grenzebach Maschinenbau GmbH, Chairman of VDMA's Glass Technology Forum as well as Chairman of the Exhibitors' Advisory Board at glasstec: *"We are very happy with the way the fair went! It was absolutely the right decision to participate in glasstec. We notice the positive mood in the teams, among customers and new contacts. Personal meetings and the opportunity to see innovations on the machines on site as an essential experience that was simply missing in the last few years. Now you really realise the importance of a trade fair like glasstec, and we are already looking forward to the next event in two years."*

The next glasstec will be held in line with its two-year cycle from October 22-25, 2024 in Düsseldorf ■

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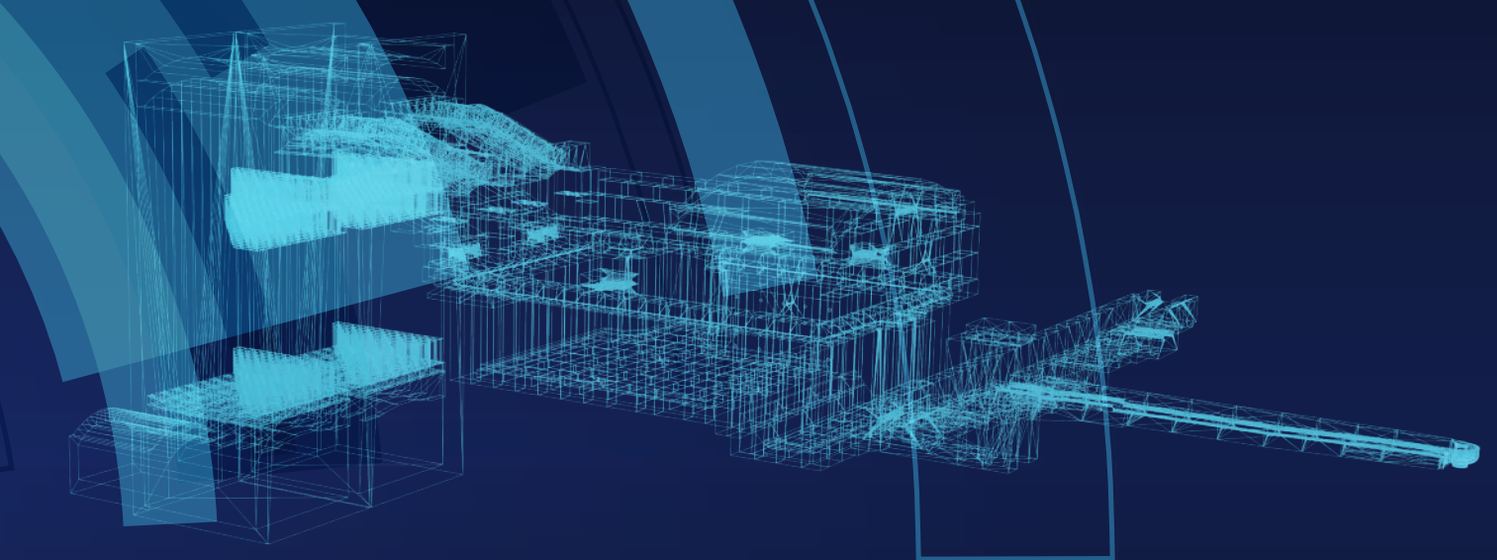

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Youth and Industry get-together to celebrate International Year of Glass 2022

Awards given to Students and Glass Manufacturers

(Sept 3, Delhi)

As part of the celebrations for the International Year of Glass (IYoG 2022) an Industry meet was organised at its Annual General Meeting at Hotel

Lemon Tree, Aerocity, Delhi where NTPC's Mr. DMR Panda, Head of Hydrogen Group and Planning Head of Renewable Business gave a presentation on Green Hydrogen Economy: Options for Indian Glass Manufacturers.

Mr. Panda highlighted *that "the Indian glass manufacturing industry can position itself as a low-cost, zero-carbon green hydrogen manufacturing hub which can help to achieve India's Net Zero target. As always, the Indian glass manufacturing industry lead by examples, it can be one of the early movers in the green hydrogen space and set an example for all MSMEs/hard-to-abate sectors."*

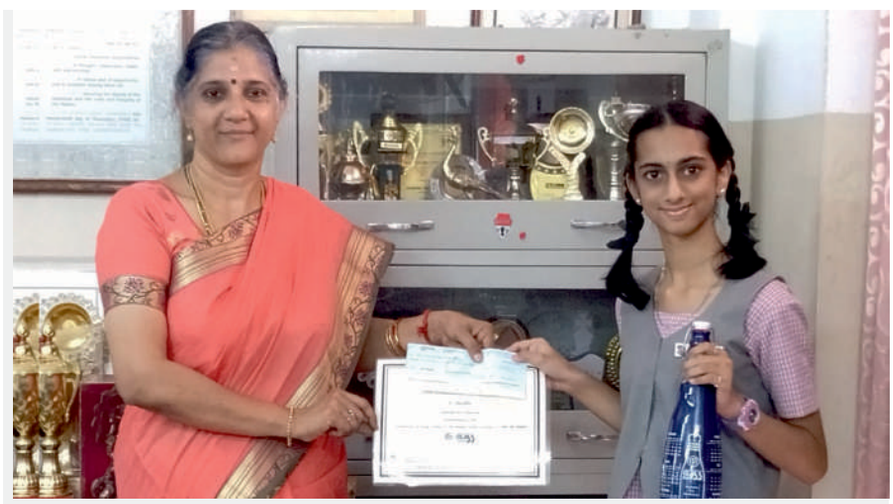
The program provided an excellent opportunity for The All India Glass Manufacturers Federation (AIGMF) to honour Youth of the country who participated from schools and colleges across India in its annual contest for Youth: 1st Poem / Essay Writing Contest on 'Green as Glass' or काँच और पर्यावरण coinciding with the International Youth Day on August 12, 2022. Online entries were invited from the age group between 7-24

wherein over 2,000 entries were received from educational institutes and youth across India.

Former Presidents- Mr. Sanjay Somany & CMD Hindustan National Glass & Industries Ltd.; and Mr. S C Bansal, CMD Adarsh Kanch Udyog Pvt. Ltd., were jury members who judged top 3 entries:

- 1st Prize (Rs. 25,000) was given to Akshita Tejwani aged 14 years, 10th class student of Maharani Gayatri Devi Girls School, Jaipur
- 2nd Prize (Rs. 15,000) was given to R. Shruthi aged 15 years, 10th class student of Jawahar Vidyalaya Senior Secondary School, Chennai
- 3rd Prize (Rs. 10,000) was given to Kanishk Sharma aged 16 years, 11th class student of Ajanta Public School, Gurugram (Haryana)

Winning entries may be viewed at: www.aigmf.com



Mrs. Chitra Srinivasan, Principal, Jawahar Vidyalaya Sr. Sec. School, presented Certificate of Excellence, Award money and IYoG Calendar Glass Bottle to R. Shruti on Sept 2 at their school as Shruti was unable to travel to Delhi for the awards ceremony.

Former President Mr. Sanjay Somany gave the prestigious annual **'CK Somany Award for Innovation and Technology'** to Mr. Eric L'Heureux- Managing Director, Schott Poonawalla Pvt. Ltd. The **'Balkrishna Gupta Award for Exports'** was bestowed to M/s Schott Poonawalla Pvt. Ltd., by the Former President, Mr. Pradeep Gupta. Both awards are supported by Glass Worldwide, preferred international journal of the AIGMF in association with Kanch.

Mr. Eric L'Heureux, who joined Schott as a QA Manager at Schott Belgium in 1992, went on to become the Technical Director at Schott Indonesia in 1998, and was

appointed the President Director of Schott Indonesia in 2001. He also served as the Managing Director of Schott Hungary and was responsible for operations of 2 plants in France from 2006 until 2009. In 2009, he was appointed as Vice President Asia operations.

Mr. L'Heureux's main contributions towards expansion of operations within the glass pharmaceutical packaging at Schott Poonawalla in India since 2011 are: Started operations at the state-of-the-art plant at Jambusar (Gujarat) with 20 ampoule lines and 16 vial lines having a total output of more than 3 million pcs per day; Completed first upgrade of forming and inspection technology at Jambusar plant; Roll-out of cosmetiQ inspection system (100% camera inspection system for cosmetic parameters) in Jambusar plant; Expansion of module 2 and 3 at Jambusar plant thereby enhancing capacities to over 3 billion containers per annum. He has been instrumental

in starting and stabilizing the operations at the Greenfield plant at Umarsadi (Gujarat) for pre-fillable syringes, cartridges and sterile RTF products.

Under Mr. L'Heureux's guidance, Schott Poonawalla today has 4 state-of-the-art manufacturing units in Daman, Jambusar, Umarsadi and Baddi in India that produce an entire range of products including, bulk vials and ampoules, specialty vials and ampoules, siliconized vials, siliconized cartridges and Ready-to-Fill (RTF) vials and cartridges, siliconized pre-crimped RTF nested cartridges, sterile nested vials and an entire range of pre-fillable syringes.

As the world health safety concerns soared during the COVID-19 pandemic, Schott Poonawalla has been the supplier of vials for COVID-19 vaccines, not only for India but also supported the global vaccination drive by exporting substantial quantum of vials across the globe including Europe, USA, Russia and South Africa. The company successfully contributed towards 4.3 billion doses of COVID-19 vaccines globally, through supply of vials, out of which 3 billion doses were provided for India and 1.3 billion doses were provided for the global market.

The jury for Industry awards comprised of Dr. K. Annapurna, Chief Scientist, Glass Division, CSIR-Central Glass & Ceramic Research Institute (CSIR-CGCRI); Mr. Dave Fordham, Publisher, Glass Worldwide, London (UK); Mr. Sanjay Somany, Former President AIGMF and CMD HNG Industries Ltd.; Mr. P K Kheruka, Former President AIGMF and Chairman Borosil Ltd. and Mr. Vinit Kapur, Secretary AIGMF.

"At the outset, I am honoured to be part of Jury for AIGMF glass awards 2022. I heartily congratulate Mr. Eric

L'Heureux, MD, Schott Poonawalla Pvt. Ltd. for winning the prestigious C. K. Somany Award for innovation and technology with his splendid contribution in innovative technology implementations at Schott Poonawalla Pvt. Ltd. such that to meet the demand for glass packaging for pharmaceuticals at the need of the hour like COVID-19 pandemic. For this reason, again, M/s Schott Poonawalla Pvt. Ltd. had proved itself suitable to be bestowed with the Balakrishna Award for its exceptional exports in the last year. Kudos to M/s Schott Poonawalla Pvt. Ltd." said Dr. K. Annapurna, Chief Scientist, CSIR-Central Glass & Ceramics Research Institute, Kolkata.

"It is very fitting that Mr. Eric L'Heureux should receive recognition on the 30th anniversary of him joining Schott because his vast experience across many of the company's global operations led to the recent success story at Schott Poonawalla. Mr L'Heureux's achievements in overseeing the remarkable growth and accomplishments of the Indian operations over the last decade make him a very worthy winner of the prestigious C K Somany Award and Glass Worldwide sends sincere congratulations. Having been a front runner in the fight against the COVID-19 pandemic by providing pharmaceutical glass for primary packaging to fill so many vaccines worldwide also fully justify Schott as the recipient of this year's sister award, the Balkrishna Gupta Award for Exports. It is an honour to be part of the judging process and we look forward to publishing an exclusive interview about Eric L'Heureux and Schott-Poonawalla in a future issue of Glass Worldwide and Kanch." said Mr. Dave Fordham, Publisher, Glass Worldwide, London (UK).

Thanking AIGMF and the jury for industry awards, Mr. L'Heureux said, *''2022 being the International Year of*

Select photos of the event can be downloaded from: https://aigmf.com/past-events.php

Glass, it is a huge honour to receive the prestigious C. K. Somany Award for innovation and technology and the Balkrishna Gupta Award during this particular year. At Schott Poonawalla, we continuously invest in innovation and cutting-edge technology, not just to meet the needs of our customers, but better them. It is the collective effort and genius of all my teams that drive us forward to meet industry demands, even during challenging times like COVID-19 pandemic. I look forward to everything we can accomplish together in the years ahead."

As a token of appreciation, top 250 entries of Poem/Essay contest will get a specially designed 2022 Calendar Glass Bottle made out of recycled glass (specially manufactured by AGI GLASPAC, official main partner for IYoG 2022 Indian activities) carrying logos of International Year of Glass 2022 ■

As the National Apex Body of the Glass Industry, the AIGMF undertakes socially responsible steps as a voluntary service to society, thereby bringing increased awareness of Glass being a safe and 100% recyclable building and packaging material.

Haldyn® Glass Limited

CIN: L51909GJ1991PLC015522

Registered Office & Works
Village Gavasad, Taluka Padra, District Vadodara - 391430, Gujarat
Telephone : +91 2662 242339/42 | Fax : +91 2662 245081
E-mail : baroda@haldynglass.com
Website : www.haldynglass.com

Youth says Adopt Green as 'Glass'

(August 12, Delhi)

As part of the celebrations for the International Year of Glass (IYoG 2022) The All India Glass Manufacturers Federation (AIGMF) organised its annual contest for Youth: 1st Poem / Essay Writing Contest on 'Green as Glass' or कांच और पर्यावरण coinciding with the International Youth Day

Online entries were invited from the age group between 7-24 wherein over 2,000 entries were received from educational institutes and youth across India.

1st Prize

AIGMF 1st Poem / Essay Writing Contest - 'Green as Glass' or कांच और पर्यावरण (2022)
1st Prize: Akshita Tejwani (14 years)
10th class student of Maharani Gayatri Devi Girls School, Jaipur

Former Presidents, Mr. Sanjay Somany and Mr. S C Bansal were jury members who judged top 3 entries received from all over India.

- 1st Prize (Rs. 25,000) was given to Akshita Tejwani aged 14 years, 10th class student of Maharani Gayatri Devi Girls School, Jaipur

- 2nd Prize (Rs. 15,000) was given to R. Shruti aged 15 years, 10th class student of Jawahar Vidyalaya Senior Secondary School, Chennai

- 3rd Prize (Rs. 10,000) was given to Kanishk Sharma aged 16 years, 11th class student of Ajanta Public School, Gurugram (Haryana)

Mr. Sanjay Somany said, *"The mindset of the youth looks focused on glass and making our surroundings clean. It is encouraging to see how young people think".*

Mr. S C Bansal said, *"Good to see some excellent work and impressive thoughts by*

2nd Prize

When it comes to glass, it is one of the most gifted materials that man has ever received.

Even though most of them believe that glass is a man-made material, it can be naturally occurring, as well. For instance, the striking of lightning on the sands of desert and beach and the volcanic activities result in a material which is similar to a man-made glass.

The usage of glass in the form of beads, bowls, vases and bottles dates back to around 2500-3500 BC. This shows that glass is a material which is consistently used since our ancient times.

Glass, as a transparent and solid material, has a widespread role to play in our daily lives.

Right from helping us to see the world through the help of eyeglasses to being a prime component in architecture it is indeed a one which is impossible to live in its absence. In scientific laboratories, glasses acquire a foremost role in the manufacture of experimental apparatus due to its salient features of withstanding extreme temperatures, being non-reactive as well as transparent in order to observe the reaction taking place.

Glass also acts as a décor piece, as a tableware which helps in setting up a beautiful and vibrant indoor as well as an outdoor space. Another use is that the glass being inert, less reactive to water and sustainable helps in packaging and storing foods and beverages.

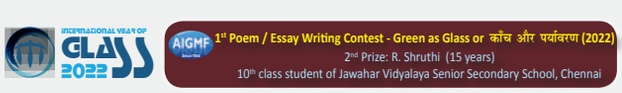
In this new world filled with technology, glass updates itself and has an important role in fiber optics, which is a primary component for long-distance and high-performance data networking.

Glass is also beneficial in regulating temperatures. For instance, plants are grown in glass houses because of its ability to trap heat or solar energy and create a warm surrounding than the one which is outside the house.

We have seen how glass is used in our daily life, and its importance in the world of science and technology. Glass is advantageous only because of its salient features such as transparency, sustainability, being fully inert, protection to viruses, and its benefit in communication.

But a question arises as to what will happen to the glass that is used. Everyday numerous used glass bottles tend to fall in trash. It cannot be thrown away just like that, as it can take thousands of years to decompose and can harm the environment. Here comes the main point- **Among the most significant feature of glass is its ability to be recycled.** As we recycle more and more, the amount of garbage that ends up in landfills gets reduced. This in turn aids in keeping the environment pollution-free. Not all materials can be recycled due to which recyclable materials are hard to find. **This proves that glass is eco-friendly and a green material. Henceforth, it can be concluded that it is difficult to find a material as "GREEN AS GLASS".**

'R. Shruthi'



the youngsters showcasing their love and protection for the environment".

Secretary AIGMF, Mr. Vinit Kapur commented *it is very encouraging to see participation from Pan India schools and colleges*. Mr. Kapur highlighted *that Glass is the only packaging medium which is 100% recyclable and contributes*

3rd Prize

काँच और पर्यावरण, देखा जाए तो इन दोनों में बहुत समानतायें हैं। यदि आप काँच को स्वच्छ एवं सुन्दर रखेंगे तो वह पारदर्शी सिद्ध होता है अन्यथा काँच यदि दूषित रहता है, तो वह भी पारदर्शी ही कहलायेगा परन्तु उसमें से दिखने वाला हर दृश्य धुंधला मालूम होगा। उसके पश्चात उस काँच में से देखने वाला हर दृश्य चाहे फिर वह सत्य हो या फिर असत्य हो वह एक ही समान दिखेगा। कुछ इसी प्रकार है हमारा पर्यावरण, इसे भी यदि हम स्वच्छ रखेंगे तो यह भी हमें रोगों से मुक्त रखेगा अर्थात पर्यावरण यदि दूषित हुआ, तो अनेक रोग हमारे वायुमंडल में विचरण करेंगे, जिसके पश्चात समस्त जीव-जंतु भिन्न-भिन्न प्रकार के रोगों से पीड़ित हो जाएंगे। कहने का तात्पर्य यह है कि काँच और पर्यावरण, दोनों के लिए स्वच्छता का बहुत महत्व है।

दुनिया का हर शौक पाला नहीं जाता, काँच के खिलौनों को उछाला नहीं जाता। पर्यावरण स्वच्छ रखने से हर रोग होता है दूर, क्योंकि हर कार्य भगवान पर टाला नहीं जाता।

काँच और पर्यावरण के संदर्भ में एक और समानता दिखाई पड़ती है। प्राकृतिक काँच का निर्माण यानी ज्वालामुखीय काँच का निर्माण उसके पिघले हुए रूप के तेज़ी से ठंडा होते ही बनता है। ऐसे ही मेघ में अत्याधिक जल एकत्रित होने के पश्चात जब वह शीतल पड़ने लगता है तो मेघ वर्षा करने लगते है, जिसके कारण वह वर्षा कि बूंदे धरा पर पड़ती हैं और वृक्षों की जड़ों से होते हुए प्रत्येक वृक्ष के प्रत्येक भाग को जल प्रदान करती हैं। जिसके कारण समस्त वृक्ष खिले-खिले रहते है अथवा काँच की ही भाँति वातावरण को शीतल रखते हैं।

काँच एक ऐसी वस्तु है जो शत प्रतिशत **पुनः प्रयोजित** अथवा **पारदर्शी** है। काँच को किसी भी आकार में परिवर्तित कर उसे घरों की सज्जा में भी उपयोग में लाया जा सकता है। काँच आंतरिक सज्जा में बनावट और परिष्कार जोड़ता है। आंतरिक सज्जा के लिए उपयोग किये जाने पर यह विभिन्न आवश्यकताओं को पूर्ण करने के लिए जाना जाता है।

काँच की अत्यधिक उपयोगिता ही उसका श्रेष्ठ होना सिद्ध करता है।

काँच को अपना प्रतिबिम्ब देखने के लिए भी उपयोग में लाया जाता है। **काँच के इसी रूप को दर्पण कहते है।** दर्पण का उपयोग अत्यधिक समय सजने संवरने के लिए होता है। दर्पण छवि की दिशा को एक समान लेकिन विपरीत कोण में उलट देता है जिससे प्रकाश उस पर चमकता है।

काँच का प्रयोग वाहनों में भी होता है जिसके कारण कोई भी वाहन चलाते समय उस काँच या दर्पण से अपने पीछे की ओर के दृश्यों के प्रतिबिम्ब को भी देख सकता है। इसी प्रकार वाहन चालक वाहन चलाते समय सावधानी भी बरत सकता है। काँच और पर्यावरण दोनों को ही समान रूप से देखा जा सकता है। काँच हमारे अस्तित्व की छवि प्रस्तुत करता है, वहीं पर्यावरण मानव जाति के अस्तित्व को उजागर करता है।

एक काँच लोगों को बहुत चुभता है लेकिन जब वह काँच आइना बन जाता है तब उसे पूरी दुनिया देखती है।

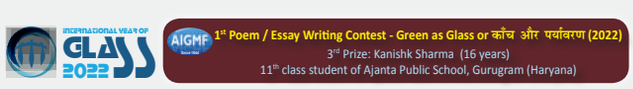
काँच के समक्ष खड़े होकर हम अपने सुख-दुख या पीड़ा की बातें कर स्वयं के मन को शांत अथवा पीड़ा मुक्त कर सकते हैं। ठीक इसके समान ही पर्यावरण है, यदि पर्यावरण में चारों ओर हरियाली छाई होती है अथवा चारों ओर मौन होता है तो वहाँ पर भी हम स्वयं तनाव की जिन्दगी से मुँह मोड़कर कुछ समय आराम एवम् एकांत में व्यतीत कर सकते हैं।

काँच को कई रंगों में बनाया जा सकता है। काँच एक स्थायी, पूर्ण प्रकार से पुनर्चक्रित करने योग्य सामग्री है जो जलवायु परिवर्तित करने अथवा कीमती प्राकृतिक संसाधनों को बचाने में योगदान देने जैसे महान पर्यावरणीय लाभ प्रदान करती है। काँच और पर्यावरण एक दूसरे के पर्याय है। दोनों को समान रूप से देखा जा सकता है।

जहाँ काँच साफ़ सुथरा रहकर सम्पूर्ण जाति की छवि स्पष्ट करने में सक्षम है वहीं प्रकृति भी साफ़-सुथरा रहकर संपूर्ण जीव-जंतु की छवि को प्रदर्शित करती है। प्राकृतिक सौंदर्य उसके रखरखाव पर निर्भर है। **प्राकृतिक सम्पदा में सर्वोत्तम है काँच।**

अंततः काँच के विषय में यह कहा जा सकता है कि, काँच और पर्यावरण मनुष्य के जीवन में बहुत महत्वपूर्ण हैं एवं **पृथ्वी के यह दो तत्व मानव जाति के जीवन में सर्वोत्तम स्थान पर होने चाहिए।**

'कनिष्क शर्मा'



significantly for a clean environment.

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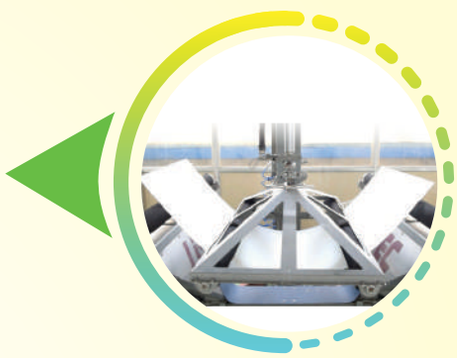
Winning entries can be viewed at https://aigmf.com/past-events.php

BOROSIL renewables

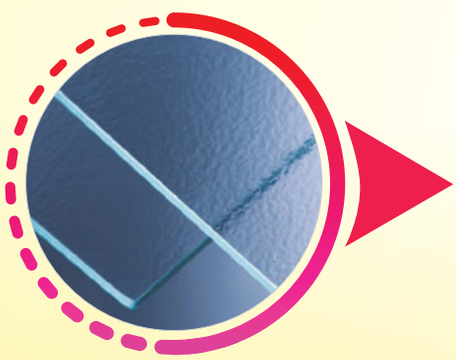
Proudly making solar glass in India since 2010

WORLD'S 1st



NoSbEra: Antimony-free solar glass

2 MM fully tempered solar glass



Our recent Innovations

Shakti: High-efficiency solar glass in the matt-matt finish

Selene: Anti-glare solar glass for PV installations near airports

Glass for Future Solar Technologies

Large size modules

Anti-reflective and Anti-soiling Coating

Meeting customer expectations with continuous innovation

W: www.borosilrenewables.com • E: sales.lig@borosil.com

Borosil Renewables' Bharuch facility in Gujarat is currently the focus of significant investment.

On the Spot... Shreevar Kheruka

Managing Director Shreevar Kheruka outlines Borosil's expansion plans to cater for increased demand across its diverse solar glass, consumer productions and life sciences divisions in an exclusive interview with *Glass Worldwide,* preferred international journal of the All India Glass Manufacturers' Federation (AIGMF).

GW: Following the sad passing last December of Borosil's Executive Chairman Mr B L Kheruka, what legacy did he leave behind within the company and the wider glass industry?

"Leave every place you visit in a better condition than it was when you entered." This seemingly simple learning played a large part in all aspects of my grandfather's existence. As he departed this life on 12 December 2021, he leaves behind a family that has strived to create a positive impact through all its members and two companies that have added tremendous value to all their stakeholders. He also leaves behind a shining path of values such as integrity, discipline, hard work and giving back, for all of us to follow. Finally, he leaves behind his love and passion in all of us.

Mr B L Kheruka, Borosil's Executive Chairman, passed away last December.

GW: What is the progress of the new brownfield solar glass plant being constructed at Borosil Renewables' Bharuch facility in Gujarat?

The construction of the third furnace is in full swing and it is expected to get commissioned by July 2022. Our project team, the equipment suppliers, and associates working on project construction have done a commendable job to stay on the project schedule despite supply chain disruptions and various restrictions being faced in view of the ongoing Covid-19 pandemic. We hope there are no further challenges to the schedule!

GW: Following the doubling of Borosil Renewables' capacity in 2016 and a further successful upgrade and expansion project in 2019, what is the motivation for the latest significant increase?

We more than doubled the capacity to 450tpd in 2019 from the earlier 180tpd in view of the increasing demand for solar glass in India and abroad. Due to a very positive outlook from governments across the world, the demand for solar power is increasing substantially. Moreover, the political and regulatory support for the creation of a robust domestic supply chain has created a conducive environment for domestic players like us. We firmly believe that domestic solar manufacturing industries in geographies like India, Europe, the Americas, Turkey, MENA, etc. are on the cusp of significant growth, and demand for solar glass in these geographies is expected to increase substantially. Since we have been catering to these markets and have long-term relationships with the customers, we were motivated to expand our capacity.

GW: What are the highlights of this investment?

This is a 550tpd integrated (from raw materials to tempered coated solar glass) solar glass manufacturing capacity being built with state-of-the-art technology from the best-in-class equipment suppliers. We have added several types of equipment in this expansion that will be compatible with changes that are expected to take in the solar industry in near future in terms of sizes, thicknesses, coatings, etc. This is a brownfield expansion and the available land, utilities and permits are already available. The team of professionals, contractors and equipment suppliers are largely the same that worked on our last expansion in 2019, and hence we are confident that we shall be able to complete the project within the

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Solar glass production at the Borosil Renewables factory.

estimated costs and timelines.

GW: Is it still your policy to adopt state-of-the-art technology from renowned international suppliers? Which partners were selected for the latest expansion?

We have been using state-of-the-art technology since the inception of our factory in 1994 when we successfully used the Pittsburgh process. We are now going for a 550tpd furnace and the design for the same has been sourced from a leading supplier of large furnaces. This furnace design uses a cross-fired technology for charging the fuel for glass melting and is expected to be very efficient and user-friendly. Moreover, such furnaces are expected to have a longer running life before they become due for a rebuild. The other equipment used for glass manufacturing and processing is also from very reputed global suppliers.

GW: And you were also recognised last year for the commercialisation of indigenous technology with an award from the Department of Science and Technology at the Government of India?

Last year, the Department of Science and Technology, Government of India honoured us with the National Award for 2021 for the development and commercialisation of indigenous technology. This is a very prestigious award and we are very proud of our team for this achievement. Innovation and continuous improvement in the areas of products and processes are the values ingrained in the DNA of the Borosil group and these are the main reasons for our survival and success as well as growth.

In Borosil Renewables Ltd. we have successfully been able to commercially develop the world's first antimony-free solar glass. We are also the first company to develop the commercial capability to fully temper solar glass in 2mm thickness. Other recent product developments include the high efficiency 'Shakti' solar glass and 'Selene' Anti-glare solar glass.

This award is great recognition from the government of India and is a testimony to our efforts in developing new technologies and products. It is important to note the previous awardees for this recognition are very reputed industry names such as Reliance Industries, Larson and Toubro, Nuclear Power Corporation, etc. and it is our honour to join this prestigious league.

GW: What are the current and future prospects for the solar market in India and following the brownfield expansion, how well equipped will Borosil be to meet this sector's needs?

The solar market is one of the fastest-growing markets across the world in terms of solar installations as well as manufacturing activity. With a very strong political will and regulatory support for domestic manufacturing, the solar module and component manufacturing in India is expected to grow manifold in near future. The installed manufacturing base of around 15GW per year of solar module capacity is expected to cross 50GW per year within the next three years. Borosil Renewables is very well placed to meet this demand as we have a strong relationship with the customers, a high-quality product, the global certifications for our glass, and our customers' modules certified with our glass. Being a domestic supplier, we are able to offer certain unique benefits to our customers such as shorter delivery time, flexibility in terms of changes in glass sizes, ease of doing business, etc. With the upcoming expansion and the next set of expansions in the near future, we are very well equipped to meet the future demand.

GW: What is the strategy for future investment at Borosil Renewables?

We expect to complete the ongoing expansion by July 2022, taking the installed capacity to 1000tpd. We have obtained enabling approvals from our board for the installation of our 4th and 5th furnace at the same location with 550tpd, which are expected to get commissioned by Q4 of CY2023 and Q4 and CY2024, taking the installed manufacturing capacities to 2,100tpd which should be able to cater to solar module requirement of ~12GW per annum.

Examples of calibrated laboratory glassware.

Performing a bending test on 2mm solar glass.

GW: How is the company structured to best serve the different sectors?

The board of Borosil Ltd. has approved the restructuring of the business of the Company into two separate listed entities by a composite scheme of arrangement. As you are aware, Borosil Ltd. operates two distinct businesses viz. consumer products and scientific products. The consumer business comprises glassware, non-glassware and Opalware product ranges for usage in the kitchen and for serveware, while the scientific business is made up of laboratory glassware, laboratory instrumentation and primary pharmaceutical packaging. Both the businesses have been functioning as separate profit centres with separate business heads and largely independent teams. Each is responsible for delivering on their own profit & loss and this has been the case for quite a few years now. Going forward, each of these businesses has distinct capital and operating requirements. The growth path and organic and inorganic growth potential is different, which entails different capital-raising requirements. Consequently, the scientific business will be demerged from the Borosil Ltd business. Pursuant to this demerger, Borosil Ltd will house the consumer products division of the company and the demerged scientific division will be housed in a separate company that is proposed to be named as Borosil Scientific Ltd. This company too will be listed on the National Stock Exchange as well as the Bombay Stock Exchange upon completion of this scheme. We expect that this scheme will further create value for all stakeholders of our company.

GW: How is Borosil Ltd, the household and laboratory glassware production business, performing?

Borosil Ltd houses our consumer products, scientific & industrial products, and pharmaceutical packaging businesses. Consolidated revenues for this business YTD Q3 2022 saw a very healthy growth of 54% compared to YTD Q3 2021. The EBITDA [earnings before interest, taxes, depreciation and amortisation] of the business grew to $16.61 million in YTD Q3 2022 from $8.88 million in YTD Q3 2021. These represent a strong operating result even with the harsh second wave of Covid that hit India very hard between April – June 2021.

Our consumer division (including glassware and non-glassware products) has seen a good bounce back in sales across all our key product lines. In fact, in each of our main categories, the sales during the nine-month period ended December 2021 exceed the sales for the entire 12 months of FY21.

Net sales of Scientific and Industrial products during the nine-month period ended December '21 registered a growth of 35.5% over the same period last year. We have embarked upon a strategy to add new avenues of growth to supplement its domestic lab glassware by foraying into the export markets for lab glassware and introducing a range of lab instrumentation in India. Both these initiatives are beginning to contribute towards the healthier top-line growth of the scientific business.

Borosil's vials and ampoules brand of pharma packaging products, Klasspack registered a sales growth of 61.7% over a nine-month period of the previous financial year.

Ashok Jain of Borosil Renewables with the AIGMF's prestigious 2021 Balkrishna Gupta Award for Exports.

GW: How would you describe prevailing market conditions in the sectors served by this business?

Despite a few variants of Covid emerging and there being a substantial rise in the number of cases, the impact has not been as severe as earlier waves, partly on account of the vaccination coverage. After a decline of maybe 8% in FY21, GDP growth for the country is estimated at 11% during this financial year. This bodes well for a recovery in demand.

Our consumer business has significant tailwinds for a few reasons. It is obvious that the larger theme of people upgrading their lifestyles from steel and melamine has continued towards the more contemporary glass. Secondly, with Covid lots of get-togethers have been at home over going to restaurants and that has definitely led to people improving their lifestyles at home. Thirdly, in general, people are increasingly aware of the environmental and health impact of many plastics and are therefore looking for substitutes. Glass is becoming an increasingly preferred alternative here. Finally, we have clearly seen a reduction in imports from China and that is due to high levels of freight. So, owing to all these factors, we certainly see domestic demand has become stronger.

The growth in the scientific and industrial products business was despite schools and colleges still remaining broadly closed and even government institutes having limited funding. However, on the flip side, pharmaceutical companies have been growing substantially and our presence in this segment has boosted our revenues from all three of our product categories viz. lab glassware, lab instrumentation as well as pharmaceutical packaging. There

Borosil's Classic Delite ware.

Borosil's Vision glasses range.

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In recognition of his achievements, the late Mr B L Kheruka was the 2019 recipient of the AIGMF's C K Somany Award for Innovation and Technology.

has also been a jump in our export sales of laboratory products owing to our world-standard manufacturing capabilities and I am happy to say that the number of countries we export to has increased exponentially.

GW: What have been the highlights of investment into Borosil Ltd's manufacturing facilities since we last spoke in 2019?

We have already announced expansion projects for the consumer and scientific business during the first two quarters. Firstly, the project towards capacity expansion for Opalware production in Jaipur would take the capacity of our plant from 42tpd to 84tpd. Secondly, we are starting up the production of pressed borosilicate ware in India with an initial capacity of 25tpd, also at our Jaipur plant. We expect production of Opalware from the expanded capacity to commence sometime in the Q3 of CY22 and production for borosilicate glass press products to commence in Q2 of CY23. Finally, we have also announced an upstream project for the manufacture of glass tubing (due to uncertainty in the global supply chain as well as increased cost) with a capacity of 24tpd in Bharuch, which is likely to be commissioned by Q3 of CY23. The expansion of our production capacity for vials (close to double the existing capacity) and ampoules has also started and all orders to this extent have already been placed.

GW: In general across all Borosil's operations, is investing in digital platforms still a priority to enhance manufacturing operations?

We have identified the potential of digital platforms and data for the businesses of Borosil Ltd and Borosil Renewables Ltd. We have either implemented or are in the process of implementing various digital solutions in the area of automation of the manufacturing process, improvement of the quality assurance process, the relevant CRM solutions and data analysis to make informed [investments]. We still have some ways to go to entirely achieve Industry 4.0; however, our team is committed to the same and we have been taking various steps in this direction.

Shreevar Kheruka addresses staff at the Borosil glassworks.

GW: With Borosil having been recognised externally for its efforts in recent times, what importance is the company placing on sustainability?

The sustainability aspect has been at the very core of operations for Borosil. To give a few examples, the energy consumption of our solar glass manufacturing process is about 1100kCal/kg compared to ~1600kCal/kg that global leaders in solar glass are able to maintain as per our estimate. In addition, according to a life cycle assessment analysis carried out by a very reputed French institute, the carbon footprint of our operations is 22% lower compared to the default score of the glass industry. Moreover, other steps such as developing a toxin-free solar glass and employing reusable packing help make us more environmentally friendly.

As we all know, people are the key to any business. Our efforts on sustainability go beyond products and operations and we also focus on the well-being of all our stakeholders. We have been actively working on various initiatives in the area of water conservation, improvement of health outcomes for low-income citizens, female education, sports, etc. With the help of a very reputed organisation, we have been able to contribute towards a manifold increase to the income of farmers in the severe drought-affected Beed district of Maharashtra. Further, our employee policy that we announced during the Covid-19 pandemic to support the families of any deceased Borosil employees was considered an industry benchmark and was subsequently adopted by several leading Indian corporates.

To take these credentials to a next level, we are working on the development of the ESG [environmental, social and governance] roadmap and have identified critical areas where our teams would be working on to achieve the global benchmarks on various parameters of ESG.

GW: Following Mr B L Kheruka being awarded the prestigious C K Somany Award in 2019, what did it mean to Borosil to be the recipient last year of the AIGMF's sister award, the Balkrishna Gupta Award for Exports?

We are truly thankful to AIGMF for honouring Borosil Renewables with the prestigious Balakrishna Gupta award for Exports. It is pertinent to note that when we started the business of manufacturing solar glass, it was primarily from the view of catering to the export market. Back in 2010, the Indian solar manufacturing industry was in its nascency. Even today, we export nearly 20–25% of our products to customers spread across various geographies such as Western Europe, the Americas, Russia, Turkey, MENA countries, etc. The sale in export markets helps keep us updated on various areas like emerging technology trends, quality requirements and also provides us with a risk diversification. We have been consistently meeting the requirements of our customers worldwide and have a long-standing relationship with them. Solar module manufacturing across the globe is expected to increase as the need of local supply chains is being felt in most of the geographies. With our existing presence in these geographies, exports are expected to grow significantly in the near future. ●

Further information:
Borosil Ltd, Mumbai, India
tel: +91 22 6740 6300
email: borosil@borosil.com
web: www.borosil.com

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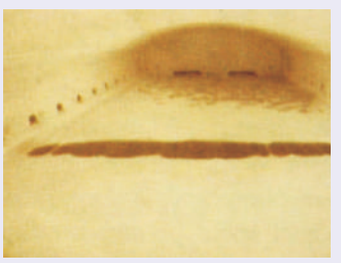







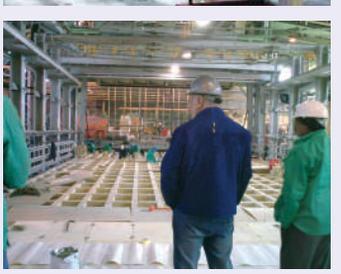

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Hydrogen blends for glass melting

Ashwin Vinod, Michael J. Gallagher and Junxiao Wu from Air Products discuss the use of advanced combustion technology to enable a transition from natural gas to H_2 blended gas in glass furnaces as a step towards decarbonisation (originally published in *Glass Worldwide,* preferred international journal of AIGMF).

Climate change, and the threat it poses to the environment and population, has moved decarbonisation into the focus of many players in the glass industry.[1,2] One approach that has gained notable consideration in this regard is transitioning from natural gas to hydrogen (H_2) as the primary fuel for melting in glass furnaces. This approach, however, has its challenges. The combustion characteristics of methane (CH_4), the primary constituent in natural gas, and H_2 are substantially different (see Table 1.)

Essentially, H_2 is a significantly more reactive fuel, which when incorporated into existing burner systems, could yield shorter flames due to rapid combustion kinetics. Shorter flames, in turn, may have two major implications, (1) altered heat release profiles with the bulk of the reaction occurring closer to the burner risking breast wall overheating, and (2) increased nitrogen oxide (NOx) generation due to higher flame temperatures. Additionally, the absence of carbon in the fuel noticeably lowers the flame luminosity and thereby further affects the radiative heat transfer efficiency to the glass melt.

In view of the key differences between the two fuel types, a complete transition to H_2 would necessitate modifications to burner designs to ensure optimal fuel and oxygen velocities, and maximum operational flexibility and efficiency. Adopting natural gas-H_2 blended fuels in existing burner systems is an important first step to kickstarting decarbonisation efforts, and glass manufacturers stand to gain practical experience and understanding of the implications of H_2 combustion on glass melting efficiency and the furnace itself. This article discusses the combustion performance and functionality of the Air Products Cleanfire HR_x burner in efficiently handling a natural gas-H_2 blend that incorporates 30% H_2 by volume. Operational parameters such as flame length, luminosity, NOx, breast wall temperatures and melting efficiencies are discussed via results obtained from laboratory tests and computational modelling.

Cleanfire HR_x Burner

Air Products has a three-decade-long history of producing innovative combustion technologies to meet the evolving needs of the glass manufacturing industry. The Cleanfire HR_x burner is a flat flame oxy-fuel burner designed for the glass industry. The state-of-the-art burner incorporates key features such as extreme oxygen ▸

Property	Natural Gas/Methane (CH_4)	H_2	Relevance
Heating Value (Btu/scf)	900–1100	325	Fuel flow rate, nozzle flow velocity
Ignition Energy in Air (mJ)	.29	.02	Ignition in the event of a leak
Wobbe Index (kcal/Nm^3)	11,597	9714	Flow controls, piping sizes
Required Oxygen (lb O_2/MMBtu fuel)	164	128	Oxygen flow rate, blower/oxygen plant size
Flammability Range (mol%)	5–15 (Air)	4–75 (Air)	Adjustability of combustion conditions
	5–61 (Oxy)	4–94 (Oxy)	
Laminar Flame Speed (cm/s)	35 (Air)	270 (Air)	Reaction rates/flame stability
	330 (Oxy)	890 (Oxy)	
Flame Temperature (deg C)	1875 (Air)	2045 (Air)	Radiation heat transfer, NO_x
	2780 (Oxy)	2805 (Oxy)	

Table 1: Key properties pertaining to combustion of natural gas and H_2.

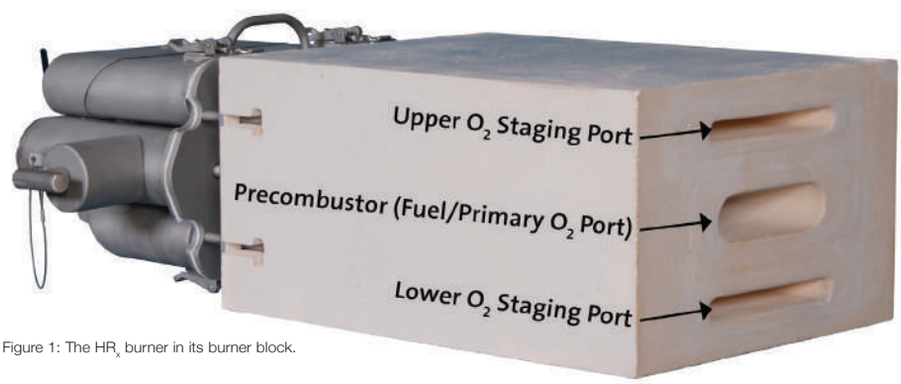

Figure 1: The HR_x burner in its burner block.

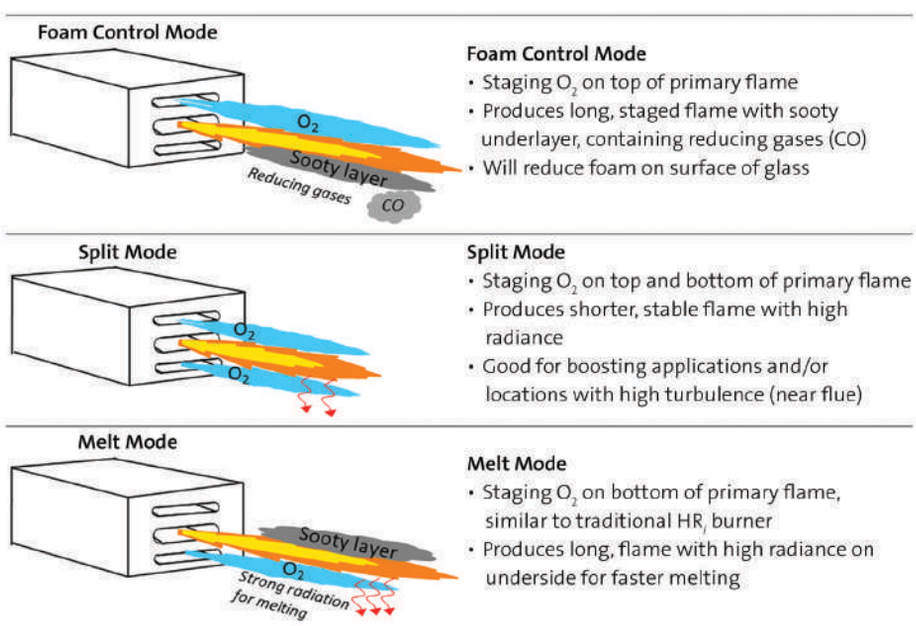

Figure 2: Staging modes of the HR_x burner.

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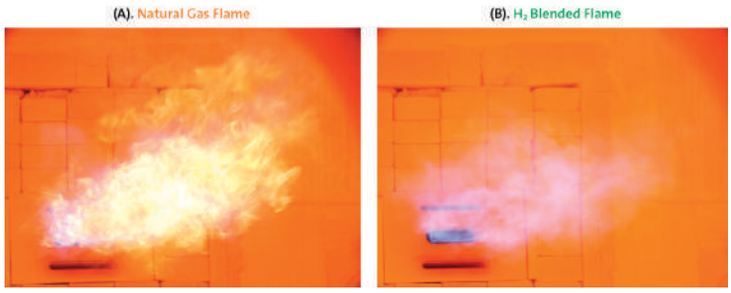

Figure 3: Images of (A). natural gas flame and (B). H_2 blended gas flame produced by the HR_x burner.

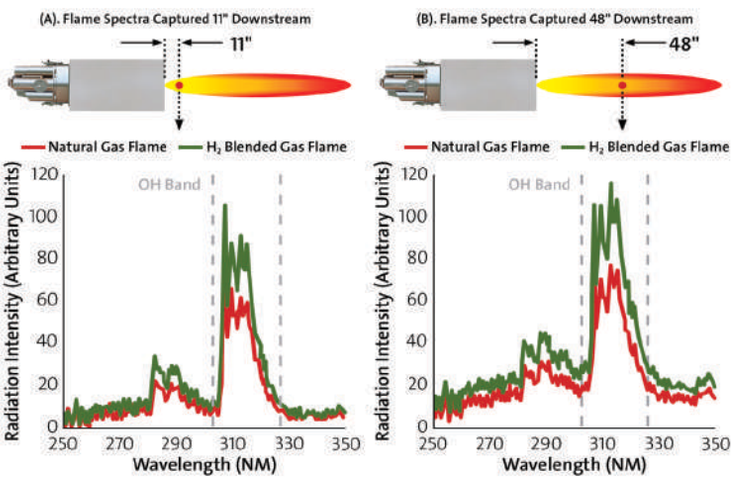

Figure 4: Flame spectra captured at downstream distances of (A) 11 inches and (B) 48 inches from the burner block, with 25% staging O_2.

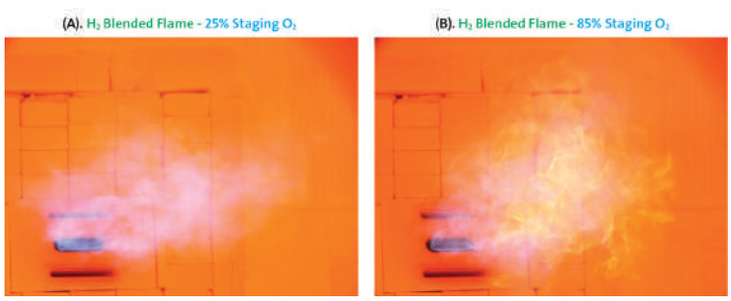

Figure 5: Images of the H_2 blended gas flame produced by the HR_x burner with (A) 25% staging O_2 and (B) 85% staging O_2.

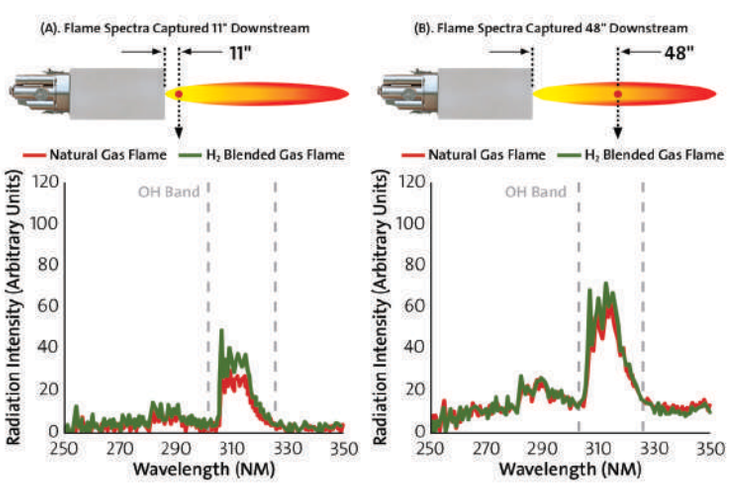

Figure 6: Flame spectra captured at downstream distances of (A) 11 inches and (B) 48 inches from the burner block, with 85% staging O_2.

(O_2) staging up to 95%, low NOx emissions, foam reduction mode to destabilise surface foam,[3] and optional sensors for remote performance monitoring.[4] Figure 1 shows the HR_x burner in its burner block. The burner block includes three ports: a central precombustor port for initiating the combustion reaction via a stable and rooted flame, and upper and lower ports for staging O_2.

The HR_x burner can be operated in any of the three distinct O_2 staging modes, each having its own operational benefits depending on the location of the burner within a glass furnace. Figure 2 depicts the various staging modes of the HR_x burner and their respective functionalities. In Split Mode, the staging O_2 is evenly split between the upper and lower staging ports resulting in a high momentum flame ideally suited for the more turbulent locations within a furnace. In Melt Mode, all of the staging O_2 is directed to the lower staging port located below the flame. In this state, the flame develops a bright bottom surface due to the reaction between the fuel and staged O_2, resulting in increased radiation directed towards the molten glass below, thereby speeding the melting process. In Foam Control Mode, the entire volume of staging O_2 is directed to the upper staging port located above the flame. As a result, the flame develops a sooty bottom layer composed of reducing gases such as carbon monoxide (CO), in concentrations of several percent, that effectively destabilise surface foam and thereby minimise inefficiencies in the melting process.

The HR_x burner is also equipped with an O_2 staging control valve that essentially controls the split of combustion O_2 into primary O_2 and staging O_2. When 100% open, about 75% of the combustion O_2 flows through the primary port, speeding up the mixing of O_2 and gas, thereby producing a high momentum flame. This setting also significantly lowers the O_2 backpressure and enhances cooling of the burner tip due to the volume flow of O_2 around it. Conversely, when the O_2 staging valve is completely closed, only 5% of the O_2 flows through the primary port and the remaining 95% is directed to the staging ports. High levels of O_2 staging delay the mixing between the fuel and O_2 thereby lengthening the flame. This delay, in turn yields two benefits; firstly, it impedes NOx production due to the lower flame temperature of the long flame, and secondly, it augments flame luminosity due to the burning of soot formed by fuel pyrolysis.

Performance with H_2-blended natural gas

The performance of the HR_x burner with a fuel blend that constitutes (by volume) 70% natural gas and 30% H_2 was evaluated thoroughly in the test furnace at the Air Products Research and Development (R&D) facility in Allentown, Pennsylvania, USA. Burner level operational parameters relevant to H_2 combustion, such as flame length, luminosity, ▸

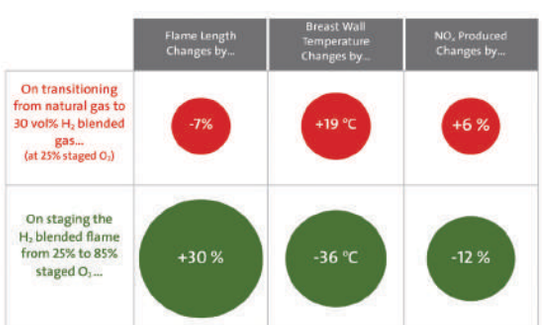

Figure 7: Effect of fuel transition and O_2 staging on flame length, breast wall temperature and NOx.

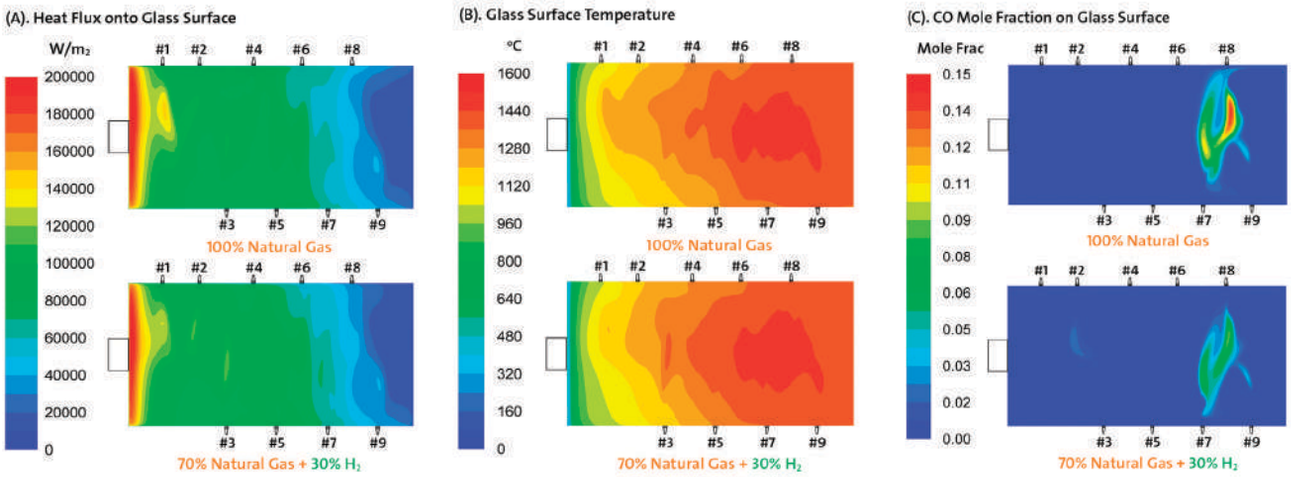

Figure 8. Effect of transitioning from natural gas to H_2 blended gas on (A). Heat flux onto glass surface, (B). Glass surface temperature, and (C). CO mole fraction on glass surface

breast wall temperatures and NOx were benchmarked against the burner's performance with 100% natural gas as the fuel. Figure 3 shows images of the flames (at 25% staging O_2) with (a) 100% natural gas (hereafter simply referred to as 'natural gas') and (b) 70% natural gas – 30% H_2 (hereafter referred to as 'H_2 blended gas'). The images clearly depict the reduced flame luminosity and length resulting from the presence of H_2 in the fuel.

The reactivity effect of the two fuels was further examined using flame spectroscopy. Figure 4 depicts the flame spectra (in the UV range) captured at downstream distances of 11 inches and 48 inches from the hot face of the burner block. The hydroxyl radical spectral emission peaks (OH bands) are visible in the spectra and are indicative of the presence/strength of the flame front. The OH bands provide a better sense of the rate of progression of the combustion reaction with the two fuels. The spectra of the H_2 blended gas flame exhibits stronger OH peaks at the two probed locations, clearly signalling the higher reactivity of the H_2 blended fuel. The higher concentration of radicals due to the presence of H_2 facilitates faster breakup of the first C-H bond,[5] thereby accelerating the reaction and consequent heat release closer to the burner block via a shorter flame.

The previously described oxygen staging feature of the HR_x burner was tested for its ability to delay the reaction with the H_2 blended gas. Figure 5 shows the photographs of the H_2 blended gas flame with (a) 25% staging O_2 (b) 85% staging O_2. The longer, more luminous staged flame depicted in the figure demonstrates the effectiveness of the HR_x burner's O_2 staging control. Delayed introduction of O_2 into the flame permits more abundant nucleation and growth of soot particles, which are responsible for the bright yellow appearance of the flame. Once again, the UV range flame spectra is utilised to better assess the downstream progression of the combustion reaction (see Figure 6.). The OH band intensities seen in the spectra of Figure 6 further confirm that the enhanced oxygen staging feature of the HR_x burner effectively counters the higher reactivity of the H_2 blended fuel while still providing control of the flame length and luminosity to a level comparable to that of the natural gas flame.

The specific impact on flame length, breast wall temperatures and NOx, of transitioning from natural gas to H_2 blended gas (at 25% O_2 staging) and staging the H_2 blended flame (25% to 85%) was also evaluated and is summarised in Figure 7. As is evident from the data presented, H_2 blended flames without oxygen staging are shorter and hotter, which leads to increased NOx and breast wall temperatures. But when the oxygen staging feature of the HR_x burner is employed, the results show that it is possible to neutralise these challenging effects, thereby reducing NOx and breast wall temperatures and maintaining control of flame length and luminosity. Such results firmly endorse the HR_x burner's readiness to handle hydrogen blends in its current form with very few required modifications.

Impact on furnace performance/operation

To better forecast the operational effects of transitioning from natural gas to H_2 blended gas in a glass melting furnace, a commercial scale furnace equipped with HR_x burners was modelled in ANSYS Fluent, and CFD [computational fluid dynamics] simulations were performed using both natural gas and H_2 blended natural gas as the energy source. The burners were configured to operate primarily with high O_2 staging to maximise flame length and heat transfer within the simulation. Additionally, a combination of Split/Melt/Foam mode operation was incorporated to ensure maximum melting efficiency (see Table 2 for details of burner configurations). Figure 8 illustrates the impact of H_2 blended fuel compared to natural gas fuel on the following parameters: (a) heat flux into the glass surface, (b) temperature on the glass surface, and (c) CO mole fraction on the glass surface.

Burner Port #	% Furnace Power	Staging %	Staging Mode
1	9%	25%	Split
2	10%	50%	Melt
3	11%	75%	Melt
4	11%	75%	Melt
5	14%	75%	Melt
6	13%	75%	Melt
7	13%	75%	Foam
8	12%	75%	Foam
9	6%	50%	Foam

Table 2: HR_x burner settings utilised in the glass furnace simulations.

The contours of simulation results shown in Figure 8 positively suggest that the impact of transitioning from natural gas to 30% H_2 blended gas is likely to be minimal from a furnace standpoint. The heat flux into the glass surface, and glass surface temperatures were observed to be very similar in the two test cases, suggesting comparable melt mode efficiency of the HR_x burner with the two fuel types. The higher CO mole fraction on the glass surface seen down tank is a reflection of the foam mode setting of burners #7, #8 and #9. While a difference in CO concentrations is evident between the two test cases, the CO surface concentrations with the H_2 blended gas (~8%) and natural gas (~14%) are of the same order of magnitude. Such high CO concentrations in close proximity to the glass surface has been proven to be sufficient to destabilise the secondary foam layer, thus eliminating the negative effects of surface foam on glass melting efficiency and the refractory life.[6] This observation shows that the HR_x burner's Foam Control Mode can still be very effective despite the reduced carbon content in the fuel.

Summary

The Air Products Cleanfire HR_x burner is a widely deployed, high-performance oxy-fuel burner in the glass industry. The burner and furnace level performance presented and discussed in this article demonstrates that the HR_x burner is well equipped to handle combustion of natural gas-H_2 blends, offering its users an immediate path to reducing their carbon footprint without causing higher breast wall temperatures, elevated NOx emissions, or glass melting inefficiencies. The state-of-the-art capabilities of the HR_x burner enable the flexibility to handle the key differences in chemical kinetics of H_2 blends, without compromising the widely appreciated operational efficiency and functionalities of the burner. The burner technology continues to evolve and the next generation under development will be tuned to maximise performance with higher H_2 blends (50–100%).

We are confident that the HR_x burner platform will remain a leading technology as the glass industry navigates towards zero carbon emissions via increasing H_2 adoption. The HR_x system is slated for a commercial trial with H_2 blends ranging from 0–100% in the latter half of 2022. As a global leader in H_2 production, Air Products is well-positioned to deliver step-by-step support beyond the supply of molecules. This includes critical safety analysis and state-of-the-art combustion technologies, as well as consulting services for laboratory testing, burner assessment, combustion and process modelling. Kickstarting the H_2 transition with smaller volumes, gaining the operational experience with H_2, and thereby optimising the tools, technologies, and procedures to adopt 100% H_2 fuel safely, efficiently and economically could very well be the most promising path towards decarbonising the glass industry.

Cleanfire is a registered trademark of Air Products

1 O-I Receives Approval for Science-Based Emissions Reduction Targets. https://www.o-i.com/news/contributing-to-a-healthier-world/

2 SAINT-GOBAIN NET-ZERO CARBON BY 2050, 9/24/2019. https://www.saint-gobain.com/en/news/saint-gobain-net-zero-carbon-2050

3 M. D'Agostini, W. Horan, "Optimisation of Energy Efficiency, Glass Quality, and NOx Emissions in Oxy-Fuel Glass Furnaces Through Advanced Oxygen Staging"; 79th Conference on Glass Problems (GPC), 2018.

4 Hendershot, Reed. "First smart burner for the glass industry." Glass Worldwide, March/April 2016.

5 Di Iorio, S., Sementa, P., & Vaglieco, B. M. (2014). Experimental investigation on the combustion process in a spark ignition optically accessible engine fuelled with methane/hydrogen blends. International journal of hydrogen energy, 39(18), 9809-9823.

6 Laimbock, P. R. "Foaming of glass melts.", Ph.D. Dissertation, Technical University of Eindhoven, (1998). ISBN 90-386-0518-8.

About the authors:
Ashwin Vinod, Ph.D. is a Senior Research Engineer, Combustion Technology – Glass; Michael J. Gallagher, Ph.D. is Lead Engineer, Combustion Technology – Glass; and Junxiao Wu, Ph.D. is an Engineering Associate – Computational Technology at Air Products & Chemicals

Further information:
Air Products & Chemicals, Inc., Pennsylvania, USA
tel: +1 610 481 8148 / 610 481 3618 / 610 481 4532
email: vinoda1@airproducts.com / gallagmj@airproducts.com / wuj16@airproducts.com
web: www.airproducts.com/glass

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Phone : +91 (0)124 4544 510
Mobile +91 9654393213
BohraV@md-india.com

GLASS BULLETIN
LAKHAN SINGH
Editor & Publisher
Mobile : +91 9310562488
editor@glassbulletin.com

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New furnace brings speciality glass opportunities

Investment in a 154tpd clear glass furnace and five production lines at AGI glaspac's Bhongir manufacturing facility will enable the company to export to countries such as the USA, Australia and to Europe, as well as India. *Glass Worldwide,* preferred international journal of the All India Manufacturers' Federation (AIGMF), spoke exclusively to Rajesh Khosla, AGI's President & CEO about the company's entry into the speciality glass sector.

Rajesh Khosla, President & CEO of AGI glaspac.

The new set-up means the Bhongir plant can produce 154tpd of premium flint and other different colours.

AGI glaspac's recent INR 400 crore ($52.2 million) investment at its Bhongir facility will provide substantial opportunities for the Indian glass manufacturer. Not only will it expand the company's capacity to produce speciality clear glass but it will also enhance its opportunities to produce glass for export, according to the company's President and CEO Rajesh Khosla.

"AGI glaspac's entry in the new segment of manufacturing speciality glass is a strategic decision. It will allow us to cater to the much-expected rise in the global demand after the pandemic subsides," he explained.

The facility has been set up in line with the company's 'Make in India' and 'Aatmanirbhar Bharat' (self-reliant India) vision. It will help reduce dependency on imports, as well as promote sustainability by encouraging various industries to opt for glass products over plastic. The company foresees top line growth of not less than 15–18% by 2022–23.

Furnace

AGI glaspac's Bhongir facility operates alongside the company's 600tpd[1] glass plant in Hyderabad. The company has served its clients in the liquor, wine, food, chemicals and pharma industries worldwide with commercial and Type-1 glass for more than 40 years.

The Bhongir furnace has a capacity of 154tpd, or the equivalent of 2 million (20 lakh) containers and bottles per day. From its five manufacturing lines spread across 15 acres, the facility will make high end glass bottles, vials and containers to cater to the requirements of sectors such as cosmetics and perfumery, pharmaceuticals, premium spirits, food and beverages as well as water bottles and candle jars. Construction of the unit has meant the company can not only focus on the domestic market, but also export to countries such as the USA, Australia and to Europe.

Pandemic

Like the rest of the world, AGI glaspac had to grapple with the problems caused by Covid-19, particularly as the impact of the pandemic coincided with the construction of the Bhongir facility. Mr Khosla says the impact of the pandemic caused many businesses to struggle with new ways of life and to grasp what it would mean for their operations. It was an issue particularly pertinent to construction projects and capital expenditure programmes due to their many components.

"There were delays, loss of efficiencies and cost impacts because of Covid-19 and related regulatory responses, and there was little to no precedent to help companies understand what the potential future impacts of Covid-19 on the capital project and construction

AGI glaspac been designing and manufacturing glass bottles and jars for over 49 years.

Originally published in Glass Worldwide, preferred international journal of AIGMF

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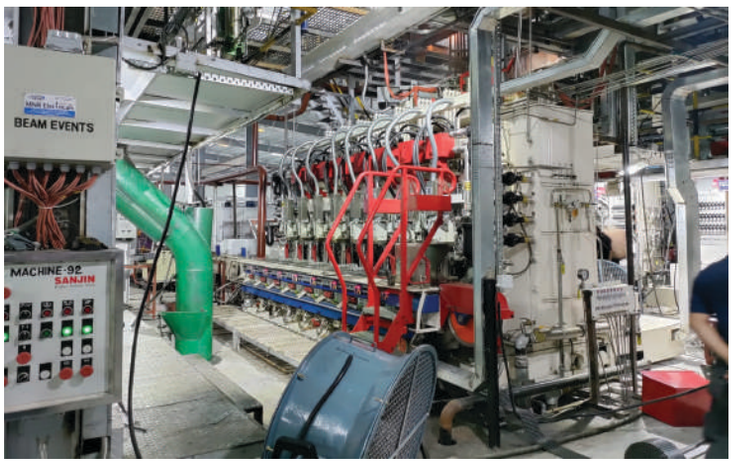

Approximately INR16 billion has been invested by AGI into its facilities in Telangana.

programmes may be, or when restrictions may end," he explains. "Even if project planning, design, and management did not stop altogether, work was likely to be more costly and to take more time."

The support of the local Telangana state government was instrumental in the success of the project. It not only provided state relief, but was also one of the first states to allow industries to continue their production from May 2020 onwards, even while restrictions continued elsewhere in the country.

Currently AGI has invested approximately INR16 billion (US $208.8 million) in its facilities in Telangana and is keen to invest further, driven by the ecosystem enabled by the state government. One disappointing impact of the pandemic was that the company has had to put its plans for a 700 crore ($91.3 million) expansion in the east of India on hold.

Bhongir facility

According to AGI, the commissioning of its new furnace has seen the Bhongir campus emerge as one of the largest, single location glass facilities in the world. The glassworks will now have a combined capacity to process 1,154 metric tonnes of glass per day and produce about 7 million (70 lakh) bottles and containers per day.

"We are looking at the new facility adding revenues of Rs 250–300 crore ($32.6million) and targeting capturing a 10–15% share of the speciality glass segment in India," says Mr Khosla.

Growth opportunities

AGI is confident that its flint glass furnace will open opportunities and enable the company to reach new customers in a post-pandemic business environment. The pandemic has resulted in geopolitical disengagement with certain countries and will leave the glass industry with a huge void and a shortfall of suppliers or importers in the future, predicts Mr Khosla.

"We believe that it is a huge opportunity for Indian manufacturers and start-ups from various industries to increase exports and reduce imports," he expounds. "It is a golden opportunity to raise the bar in the international markets for 'Made-in-India' products."


AGI glaspac's glass plant in Hyderabad has a capacity of 600tpd.

AGI already has plans to invest in both greenfield and brownfield expansion in future years.

Another potential growth opportunity is via acquisition of other Indian glassmakers. Mr Khosla does not rule out any such acquisitions, providing they give value to AGI's customers.

"Definitely, it makes a lot of synergy for [our] existing glassmaking business because it gives us an ample opportunity to grow but at the same time we are also evaluating various other opportunities, so that we can further enhance the sales."

Skilled workforce

The entry into the speciality glass segment means the company will engage more than 4,600 people, including direct and indirect employees. The total strength of the team is 14,700, which should grow to 19,300 by the end 2022.

It is testament to the perseverance of AGI glaspac staff that, despite the challenges posed by the pandemic during the construction period, the furnace was fired on time, on 24 January.

"Developing and sustaining a skilled technical workforce is a high-priority goal for AGI," states Mr Khosla. "We are making substantial investments in achieving a broad range of education and training goals."

In a talent-based economy the workforce itself is arguably the most important tangible asset of most organisations, he states. Yet despite its importance, it is often not carefully planned, measured, or optimised, which creates challenges in terms of a gap between intent and execution. Consistent objectives regarding the outputs of workforce planning, and a consistent process of conducting workforce planning and predictive modelling can bridge this


Rajesh Khosla believes adopting the latest technology from renowned suppliers is critical to the company's success.


AGI exports to the US, Australia and a few markets in Europe.

With Hyderabad and Bhongir facilities combined, AGI melts 1600 tonnes of glass per day.

AGI manufactures high-quality glass containers for sectors including food, pharmaceuticals, soft drinks, spirits, beer and wine.

gap, states Mr Khosla. Such is the company's commitment to its staff, it has modified its workforce development practices to include options that potentially accommodate the diverse needs of its employees.

Supplier support

While communications with staff are a key component of the company, relationships with technology suppliers are also essential to the success of the company. In the past AGI has partnered with companies including Agr International, Bucher Emhart Glass, Dukhiram, EMS Group (Zecchetti), Furnotherm, Heye International, HORN Glass Industries, IRIS Inspection machines, Lubitech, Pennekamp, Shamvik, Sheppee International, Sonicam, SORG, Strutz International and ZIPPE.

Mr Khosla is quick to recognise the contribution these companies have made to AGI glaspac's growth.

"Suppliers are critical to the success of any company. They drive new growth within your industry and ensure you are able to achieve revenue and profit goals. They are at the heart of any organisation's processes and activities.

"However, you might not consider how important it is to effectively manage your relationships with them," he stresses. "In the past, procurement was simply the department that bought goods and services. Nothing more, nothing less.

"But now, procurement should be considered a part of your overall business strategy. To get the best value for your money, you should be taking a strategic approach to efficiently manage your suppliers. Doing so will have myriad beneficial effects."

During these unprecedented times, the AIGMF was pivotal in keeping its members updated about the latest market dynamics, notes Mr Khosla. "The best part was peer learning that we get through the platform, which enabled […] better decision making."

As the world emerges from the pandemic and restrictions begin to ease, Mr Khosla is looking forward to meeting equipment suppliers and other members of the glass industry again at glasspex INDIA and the parallel 13th International Conference of the AIGMF in Mumbai in September next year. ●

1 Source: AGI glaspac website

AGI glaspac has a stringent eco-friendly policy in place as well as a policy to always maintain ethical and transparent business practices.

Further information:
AGI glaspac, Hyderabad, India
web: www.agi-glaspac.com

Developing and sustaining a skilled technical workforce is a high-priority goal for AGI.

Rajesh Khosla is confident that glasspex INDIA 2023 and the parallel 13th International Conference of the AIGMF will be a grand success. As preferred partners, AIGMF and *Glass Worldwide* share an exhibition area.

Originally published in Glass Worldwide, preferred international journal of AIGMF

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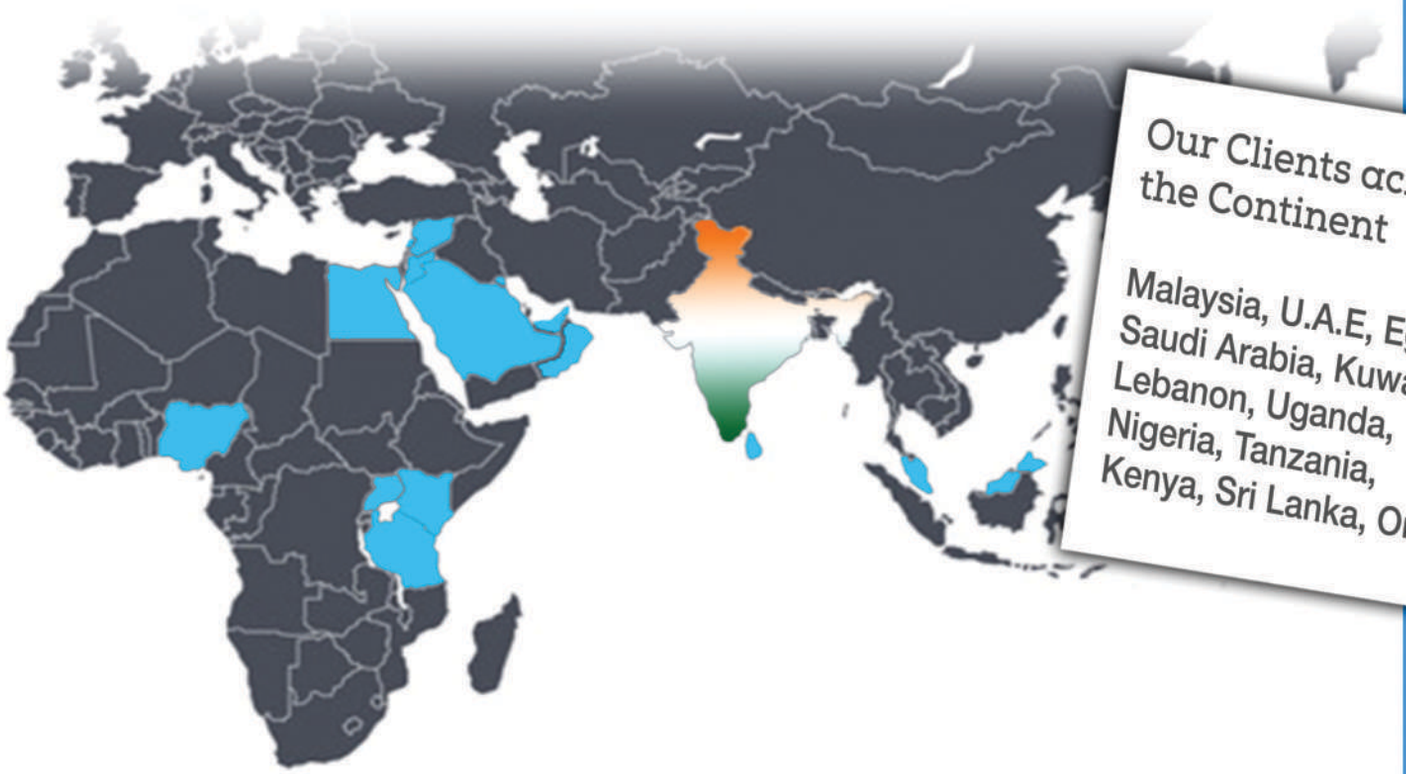

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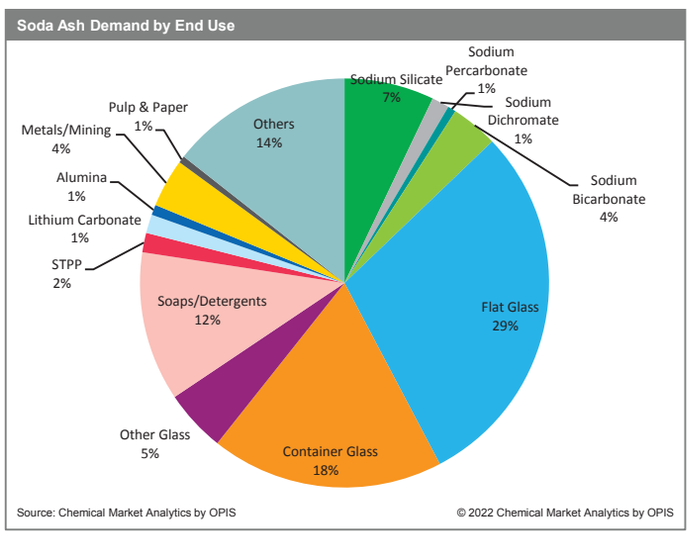
INTRODUCTION

The COVID-19 pandemic has been a defining event that has had massive repercussions both on our personal lives and from a commercial perspective. But just as many countries around the world were tentatively emerging from COVID-19 restrictions, a war broke out after Russia invaded Ukraine. After February 24th, a lot has changed in the World in the midst of escalating sanctions against the Russian state. The impact of yet another major event on the soda ash industry and many other industries has been significant.

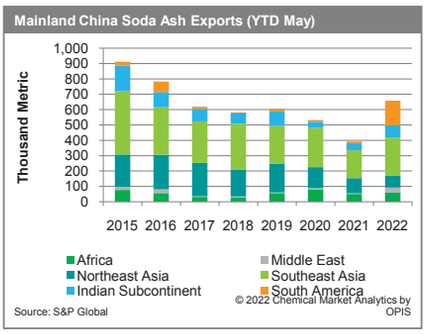
Events in 2020 set the stage for where the soda ash industry is today. Soda ash is used as a raw material in the production of a number of basic goods such as architectural and automotive glass, glass packaging, sodium silicates and soaps and detergents, as well as a number of other smaller applications. As such, the temporary closure of large sections of many economies, in a bid to tame the spread of COVID-19 across the world, had a significant negative impact on demand. Despite some end use sectors faring better than others, overall demand for soda ash fell by about 5.5%, year-on-year, or a loss of 3.4 million mt. This was though followed by a strong recovery in 2021 with growth of about 8.2%, or 4.9 million mt. As such, demand in 2021 exceeded pre-COVID levels. Our expectation for 2022 was that growth would continue but we were aware that soda ash capacity was in decline with the total world capacity this year about 1.0 million mt less than the total in 2020. As such, we were anticipating tight market conditions this year. This has proved to be the case, but in fact, conditions are even tighter than anticipated following Russia's invasion of Ukraine.

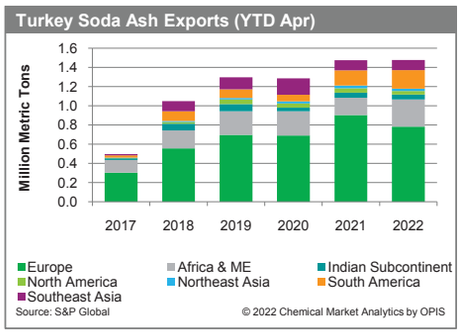


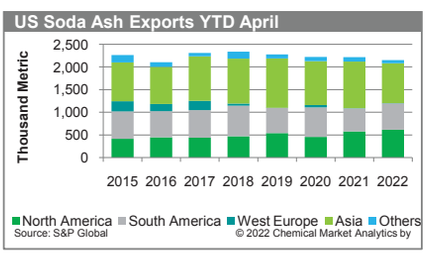
Contextually, Russia is not a significant player in the world soda ash market, even less so Ukraine. Russia accounted for 4.3% of world soda ash demand in 2021 and Ukraine just 0.4%. The Russia/CIS region is traditionally quite self-contained and while Russia is a fairly significant exporter of soda ash, with volumes in the past three years averaging 720,000 mt, exports are primarily to countries within the CIS region. In 2021, 84% of Russian soda ash exports were delivered within the CIS, and 68% in 2020. However, in today's market, when soda ash is extremely tight, diminishing exports from Russia places additional pressure on markets like the Indian Subcontinent and Africa, which traditionally purchase regular small spot volumes from Russia. None-the-less, while there has been some impact from the conflict on soda ash trade the main influence of the war in Ukraine is on energy prices and at times energy availability.

TRADE

Trade is very important for the soda ash industry given that about a quarter of soda ash produced is shipped to another part of the world to be consumed. The US is by far the world's biggest exporter accounting for about 40% of world trade, followed by Turkey in 2nd place with about 27%. China and Bulgaria vie for 3rd place due to the fact that Chinese export volumes can swing significantly from year to year. Chinese exports can switch from over two million in a year to under one million mt, as was the case last year. The Black Sea, is an important trade route for soda ash. Exports from Bulgaria via the Black Sea are at risk due to the Russia/Ukraine conflict, as well as imports







from Turkey to Central Europe via the same route.

The trade patterns so far this year also help explain the global market tightness. To date exports from key sources are up by just 5% or 243,000 mt which is mainly due to increased availability from China. Exports from the US, to date are down by 3% or 66,000 mt, year-on-year, and exports from Turkey are flat, year-on-year. Another interesting observation in terms of trade is that for China the biggest increase in exports has been to South America, which is not a traditional destination for Chinese product. China's exports to the region to date have totalled 123,000 mt, while in January-May last year the total to South America was just 7,000 mt. A lack of spot availability in South America has encouraged this shift in trade from China.

ENERGY/RAW MATERIALS

The Russia/Ukraine conflict is having a major impact on energy prices, especially in Europe. Energy availability can also be an issue. In Europe, soda ash plants typically use either coal or natural gas as energy sources. In addition, for the synthetic Solvay soda ash process, either anthracite and/or coke are used to provide an energy source for limestone decomposition, as well as generating additional CO_2 required for the production process. We understand that typically more anthracite is used in Europe rather than coke because it tends to be cheaper.

Russia accounts for about 40% of West/Central Europe's natural gas supply. In addition, Russia is responsible for about 81% of global anthracite exports, 13% of global coke exports and about 16% of global seaborne thermal coal exports.

Soda ash production in West/Central Europe has been impacted indirectly by the conflict because of energy related issues which has at times forced producers to declare force majeure. The European Union, has a ban in place on coal imports from Russia which becomes fully effective from the 2nd week in August. As a consequence a number of plants are expected to switch from anthracite to coke. In addition, the availability of coal/coke/anthracite, on top of likely continued high prices, will maintain pressure on the region.

In addition to energy related operational issues the industry has also been plagued by plant problems and not just in Europe. Two US producers have had to declare force majeure while there have also been plant issues in Argentina and Botswana. In addition, the largest soda ash plant in Iran has recently suffered from a fatal accident.

PRICES

Chinese export prices fell considerably in 2020, this put pressure on other exporters to lower prices especially when annual 2021 contracts come up for renewal. This year we see very different market dynamics with record high prices being recorded worldwide. Tracking China's export prices provides a good barometer of the trend in global pricing. In August 2020, in the midst of the COVID-19 pandemic, China's export price average $161 per mt FOB while in May this year export prices from China averaged $405 per mt FOB.

CAPACITY PLANS

In the second half of 2019, a number of capacity expansions were announced, as soda ash demand in the medium term was expected to steadily increase. Much of that extra capacity was planned for the US and scheduled over the 2021-2022 time period, with further expansions due to come on stream in 2025.

However, since then, as mentioned, the soda ash market saw a major impact from COVID-19 with a drop in both demand and prices. In response, soda ash producers were also forced to rethink their future plans. The US producer Genesis Alkali idled its trona based plant, located in Granger Wyoming, in April 2020. Meanwhile, the expansions announced in late 2019 were pushed back. These included a 600,000 mt expansion by Solvay scheduled for the end of 2021, a 1.0 million mt expansion by Ciner (now Sisecam Wyoming) planned for 2023 and a 680,000 mt expansion by Genesis Alkali, planned for Q2 2022. These expansions were also due to be followed in 2025 by the opening of two new plants in the US by Ciner/ Sisecam (now majority owned by Sisecam), each with a capacity of 2.5

million mt. Genesis is now the first set to bring on stream additional capacity, which is scheduled for early/mid next year and includes the restart of Granger. All other projects have been delayed to the 2024/2025 time period, or even later.

Soda ash capacity in China has been in decline since 2021. None-the-less, there are ambitious expansion plans for China. These plans though are dominated by one single project, a huge natural soda ash plant in Inner Mongolia. Phase I of the Inner Mongolia project is set to have an annual capacity of around 5.0 million mt. This was to come on stream by mid this year but was delayed until July 2023. However, the exact scope of phase I of the project, including its timing and initial size are being widely debated, even locally in China. Meanwhile, there's little capacity scheduled to be added outside the US and China.

DEMAND DRIVERS

A prolonged Russia/Ukraine conflict, is likely to lower soda ash demand growth over the medium term as a result of slow down in global economic growth and demand destruction in the conflict region. However, with the exception of the CIS region, any significant demand erosion has not been noticed yet. Glass plants across the world, including in West/Central Europe appear to be operating at full capacity with demand said to be robust. There is though concern about very high stocks of flat glass in China. Meanwhile, one demand category which may be less influenced by economic factors, and thus cushion the blow from slower economic growth, is the environmental category. These sectors of demand include lithium carbonate, solar glass, and sodium bicarbonate which were each immune to the negative impacts of the COVID-19 pandemic.

Solar glass has the potential to provide significant new demand for soda ash. In the wake of the war in Ukraine, the shift to green energy is no longer just about environmentalism, it is also now about energy security. This global trend will accelerate the use of solar power in the coming years and hence, it will create additional demand for solar glass. China is dominating the PV (photo voltaic) and solar glass space. Chinese solar glass capacities under planning would alone consume something like an additional 20 million mt per year of new soda ash demand if approved. Such glass proposals do seem excessive, and much more than the PV industry appears to require, nonetheless, it indicates the opportunities and also the lack of transparency in terms of what this ultimate demand opportunity may be. India also has ambitious expansion plans for solar glass and thus soda ash.

Lithium carbonate, a key component in some batteries, is also supporting growth in soda ash demand, especially in South America. Sodium bicarbonate also has a growing environmental application, which is for flue gas desulphurisation.

CONCLUSION

It is clear that the soda ash market has seen extreme volatility in the recent past and that it faces both opportunities and also likely some challenges ahead as well.

To get further insight into the outlook for soda ash please join us at our forthcoming conference. Chemical Market Analytics by OPIS, a Dow Jones Company (formerly IHS Markit), is hosting its **annual World Soda Ash Conference on the 11th to the 13th of October**. This year's conference will be held in person in Sorrento, Italy, and will include speeches from some of the industry's leading companies, as well as experts from Chemical Market Analytics ■

For more information, contact:
Marguerite Morrin
Executive Director
Global Soda Ash Services
Chemical Market Analytics by OPIS, a Dow Jones Company
Marguerite.morrin@chemicalmarketanalytics.com

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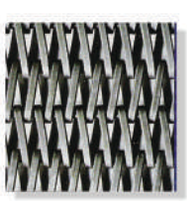
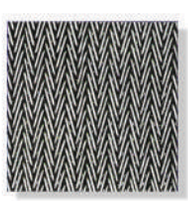
Mr. M.D. Farooq, the founder of Umda Enginering, brings to the table more than 35 years of expertise in the manufacturing industry. Starting from humble beginnings, today more than 350 of Mr. Farooq's Lehr machines are successfully installed around the world.

Mr. Farooq is best recognised as one of the co-founders of TNF Engineering, a company known across the industry as not only the leading manufacturers of Metallic Wire Conveyor and Lehr belts but also of Glass Plant Equipment. This mantle of superior performance and expertise has now been passed on to Umda Enginering.

Belts





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Sustainable Glass Production with Carbon Reduction

Eng. Erik Muijsenberg

SUSTAINABLE GLASS RECYCLING (UN GOAL 11)

Glass plays an important role in our society. Its usage in housing, transportation, communication, food storage, etc. is crucial to enjoying a high quality of life. To produce glass, we need raw materials and energy. We can reduce the need for materials by recycling more. Indeed a significant advantage of glass is that it can be endlessly recycled without loss in quality or purity although glass waste needs to be purified, cleaned, and color separated before use [1] [2].

Using more cullet for melting means not only considerable savings in raw materials costs and energy usage, but CO_2 emissions are also lower. Clean cullet needs to be reheated and homogenized; but melting reaction energy is not required and every 10% cullet addition reduces the energy consumption of glass melting by 2-3%. To melt soda lime glass from raw materials requires a theoretical energy of about 2.6 MJ/kg. As pure cullet, this is reduced to 1.9 MJ/kg. More importantly, re-melting cullet avoids CO_2 emissions from soda ash (Na_2CO_3) and lime ($CaCO_3$) in the batch. Every metric ton of waste glass recycling saves about 315 kg of CO_2 that would be released manufacturing a new glass product [3]. However, the most common, efficient, end-fired container glass furnaces, melting with an average of 50% cullet, consume about 3.5 MJ/kg, due to additional heat losses through the furnace structure.

SUSTAINABLE RESPONSIBLE GLASS PRODUCTION & CLIMATE ACTION (UN GOAL 12 & 13)

Melting glass requires considerable energy to reach the necessary high temperatures (>1500°C). Glass production used to take place in "glass houses" where people had local resources —sand and wood ash as raw materials and wood from the forest for energy. Old glass houses can still be found in forested areas. As much as 150-200 kg of wood was needed then to melt a kg of glass [4]. Assuming wood burning generates about 19 MJ/kg, this equates to >2850 MJ for a kg of glass. Today's result of 3.5 MJ/kg is astonishingly 800 times more efficient.

Over the last century, the main energy source has shifted to fossil fuels such as oil and natural gas. Modern glass melting uses about 1% of all industrial energy [5] much less than for example steel production. Nevertheless, it is energy intensive and massive improvements have been made over the years. Asahi Glass Company have plotted these downward trends, and the reduction in pollutants such as NO_x, SO_x and dust emissions for flat glass production (Figure 1).

Figure 1 also shows that since 2000 the relative specific energy line has flattened, suggesting little improvement in recent furnace designs. Furnace efficiency had increased because new refractories allowed higher combustion and crown temperatures, and increased melting temperatures. Furnaces became larger, producing more glass per m^2 of heat loss surface. Some flat glass furnaces now produce a remarkable 1200-1500 tons/day while container glass furnaces can melt a high 800 tons/ day. But furnace size is limited by the maximum crown span (width), the size of equipment, flame length, and other factors. Larger regenerators have increased heat regeneration from 50% to 70%, close to the theoretical maximum of 75%. This maximum arises from the difference in heat flow in the waste gas (greater mass and specific heat) than the air being preheated.

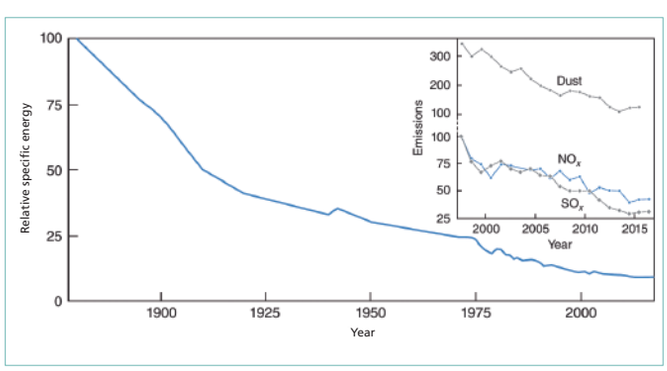

Figure 1. Energy efficiency gains over 150 years and NO_x, SO_x and dust emissions for the last quarter century

Source: http://www.agc-glass.eu/sustainability/environmental-achievements/air

Figure 2 shows the design of the most common U flame (end-fired) container glass melting furnace, producing about 350-380 TPD (tonnes/day). Cold air enters the base of the regenerator at the right and is preheated to 1200-1300°C, before leaving at the top and entering the combustion chamber. Gas (or oil) is injected into the hot air at the base of the port. This example has four injectors. The iso-temperature surfaces indicate the flame shape that develops. The hot gases radiate heat to the glass melt surface, the furnace walls and the crown, the latter two re-radiating energy to the glass. The waste gases then circulate round the furnace and exit via the left exhaust port, entering the opposite regenerator, and preheating it until the process is reversed after 20-30 minutes. Raw materials enter into the melting basin from two sides. First the batch under the flames is melted. Some designs have a barrier wall (0.8 m high) on the bottom of the furnace to bring the glass from a typical depth of about 1.3 m to the melt surface to aid the removal of small bubbles, the so-called fining process. The glass then dives down into the sunken throat to be delivered into the distributor which connects to the forehearth which takes the glass to the forming machines. The small rods protruding from the bottom of the glass basin are molybdenum electrodes that assist in melting the glass by electrical Joule heating, often called electric boosting. Such a melter is typically about 15 m long by 6 m wide.

The second most common glass melter is the cross-fired regenerative float glass furnace. Flat glass is formed after leaving the melter by floating the melt on a molten tin bath. This glass is mainly used for window glass or automotive windshields also solar panels or sometimes LCD products can be produced. The furnaces can be 35-40 m long and 10-12 m wide. The most typical pull rate is 600-800 TPD, but some furnaces produce 1200 or even 1500 TPD. These cross-fired regenerative furnaces alternate firing from opposite sides. They have five to nine burner ports on each side and the preheated air comes from brick regenerators on each side. Injectors introduce gas into preheated air to create flames crossing the glass melt surface, the hot waste gases exiting to the opposite regenerators. This process is reversed about every 30 minutes.

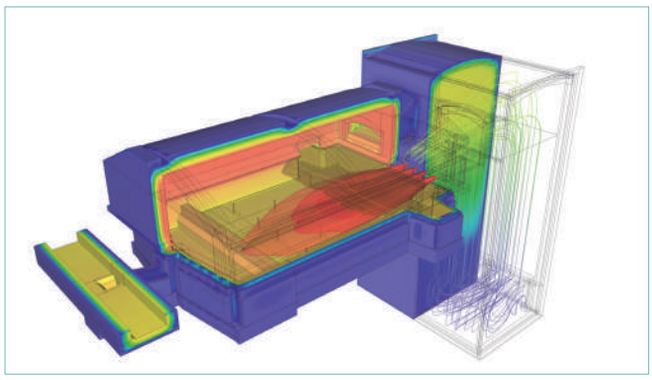

Figure 2. A 350 TPD container glass melter
Source: Courtesy of Glass Service a.s. (www.gsl.cz)

Figure 3 shows a 600 TPD float furnace with 5 ports with 2 gas injectors on each side. Raw materials are introduced by batch chargers. After melting, the glass is cooled in the working end and leaves by the canal onto the molten tin, where it spreads out to form a flat sheet.

OTHER FURNACE DESIGNS

Other technologies include the recuperative and the oxy-gas furnace. Oxy-gas furnaces use pure oxygen, extracted from air and may seem more energy efficient than the best regenerative furnaces. A correct analysis though requires the energy and cost of separating the oxygen be considered and usually favors a regenerative furnace. However, oxy-gas furnaces can bring other benefits - NO_x reductions and a smaller footprint. Recently, two industrial gas suppliers have reduced energy consumption by preheating the fuel and oxygen.

Linde (Praxair) developed the OptiMeltTM technology to save another 20% of energy by preheating the natural gas with waste gas from the oxymelter to create a syngas ($CO + H_2$) formed by cracking CH_4 with CO_2 in the waste gas [6]. An interesting side benefit is that CO tends to reduce foam on the glass surface, increasing heat transfer and lowering seed counts.

Air Liquide designed HeatOx technology with heat exchanging recuperators using furnace waste heat to preheat the natural gas and

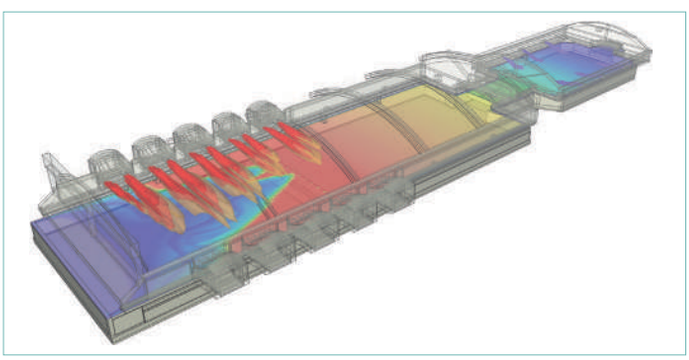

Figure 3. A cross-fired regenerative 600 TPD float glass melting furnace
Source: Courtesy of Glass Service a.s. (www.gsl.cz)

oxygen indirectly to 400-500°C, giving 9-10% additional energy savings [7-9]. Should this technology be installed in a conventional regenerative float furnace converted to oxy-gas firing, a total of 20-25% energy savings may be achieved. A side effect would be a major NO_x reduction.

Finally an oxy-gas furnace is apparently converted to burn hydrogen more easily than an air-fired furnace. Burning hydrogen with air gives higher lame temperatures typically equating to higher NO_x emissions. Oxy-gas furnaces may therefore be more attractive when hydrogen is affordable.

ELECTRIC MELTING

The first continuous regenerative glass melting furnace was invented by Charles William Siemens of Westminster England between 1872 and 1880 and modern regenerative furnaces have changed little since.

Many do not realize though that continuous all electric melting (AEM) is almost as old as gas-fired regenerative melting. The first electric furnace was built in 1905 following French Sauvageon's design and was for window production. The specific energy consumption was even then only 0.73 kWh/kg. Many designs have been implemented since but recently electric melting has fallen in popularity due to its high cost compared to widely available fossil fuels.

Global warming and pressure on carbon footprints, has rekindled interest in full or partial (hybrid) electric melting. Alternative energy sources for electricity have helped to lower costs and production is essentially CO_2 free; for example in Germany, 40% of electricity is generated using renewable resources such as wind, solar, hydro, and bio. The question for the future is not if more electricity will be used for glass melting but what will be the balance between fully electric and hybrid furnaces (substituting bio fuel for fossil fuel).

Glass is important in generating green renewable energy, or "green electricity". Most wind turbine blades are composed of reinforced glass fiber. And most solar panels use large quantities of flat glass. In the future photovoltaics will probably be widely integrated into windows. These applications mean that glass is not only a consumer of renewable energy but also has an important role in generating it.

For larger furnaces with higher pull rates, the higher volumes and lower wall losses make recuperators or regenerators sensible. Gas-fired furnaces can be cheaper than the efficient electric melter. This was historically so in most countries because electricity was generated from fossil fuels, and typically 2.5 to 3x more costly per kWh than the fuel alone.

Even small electric furnaces are 70-85% thermally efficient. While a fuel fired furnace without a recuperator at a low pull is only 10% efficient, adding a regenerator improves efficiency to 45% and an oxy-gas fired furnace, can achieve 50% efficiency.

Most common all-electric melters produced 10-30 TPD, sometimes up to 80 TPD. They were round or hexagonal to avoid heat losses via the furnace walls and to allow more easily distributed batch charging and electric connections. Figure 4 shows a larger rectangular melter at 80 TPD. These cold top electric melters used the batch cover as a heat insulating blanket, conserving heat inside the melt. They were called vertical melters, as the glass melts on the surface near the batch, refines at lower levels and flows out via a bottom throat into a working end/distributor. To maintain batch coverage and hence an insulating blanket, the cullet content was usually below 50%. Electric melters were mostly used for high quality clear glasses and crystal (lead) glasses, as the redox (color) control is best managed with this process.

During the 1970 global oil crisis, some glass producers, especially in the United States converted their regenerative furnaces to all electric melters. They retained the infrastructure and horizontal configuration because other shapes were difficult to incorporate into their existing space; sidewall losses are less important at higher pull rates.

THE FUTURE OF CARBON FREE MELTING—ELECTRIC, HYDROGEN OR HYBRID?

Currently, 95% of all glass melting uses fossil fuels, mostly natural gas or heavy oil; but industries are now strongly encouraged to follow the Paris Climate Agreement guidelines and are seeking to minimize CO_2 emissions. Many but not all countries are enforcing rules, with penalties for carbon emissions and benefits for reductions. Either way, the glass industry knows its consumers expect low-carbon or carbon-free production, so are working to achieve this while remaining competitive amongst themselves and with other packaging materials.

Four key technologies for carbon reduction exist, in addition to those already discussed. They are:

- Cold top all electric vertical melting (AEM)
- Hydrogen combustion (replacing

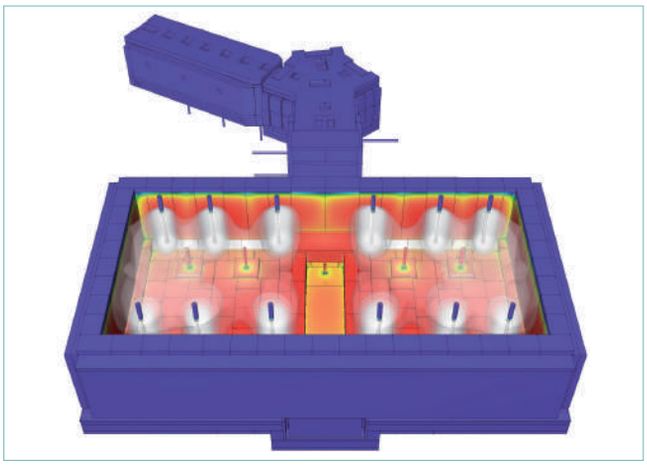

Figure 4. An 80 TPD cold top rectangular all electric melter using top, side and bottom molybdenum electrodes
Source: Courtesy of IWG Wagenbauer and Glass Service

natural gas in regenerative or oxy-gas furnaces)

- Horizontal hot top electric melting (H^2EM) also referred to as hybrid melting
- Horizontal hot top hydrogen electric melting (H^3EM)

The question is: What is the best solution —not just now— but for 2030? 2050? After 2050?

Hydrogen

Currently, truly green hydrogen produced by electrolysis using renewable electric energy is the first choice, but it is insufficiently available. Even with low electric pricing, hydrogen at 6€/kg is three times too costly to compete with natural gas. So, in most regions it would be uneconomic, without state subsidy. More research on hydrogen combustion is needed, specifically the effect on the molten glass and refractories of water concentrations approaching 100% in the combustion atmosphere. Certainly concentrations near 50% in the combustion atmosphere of oxy-gas furnaces created problems. Using electricity to break water into H_2 and O_2 by electrolysis is expensive and is only now reaching 70% efficiency levels. However, expectations are that investment costs should decline while efficiency continues to increase so that, as more renewable electricity becomes available, hydrogen will become affordable.

But why consider hydrogen? If electricity is used directly, the furnace melting efficiency is much higher than via the hydrogen route. An advantage of hydrogen is the possibility of storage for long periods, allowing long-distance transportation and creation of a buffer against supply hiccoughs. Storing electricity for similar times is simply not efficient. Unused batteries slowly lose power while storing sufficient energy would require huge batteries. Different storage options are shown in Figure 5; some, such as hydro power have been created but are not universally applicable, mountains and water reservoirs, as in Norway or Austria being necessary. Energy storage today is facilitated by methane which can be stored for millennia in caves with appropriate geology [10].

All-electric melting

Electric melting has been a proven technology for over a century so why not convert all furnaces to all-electric melting? Mainly because electricity typically costs three times that for natural gas /kWh. While electric melters are twice as thermally efficiency, they are more expensive to operate. Another obstacle remains. Most electric melters are producing less than 80 TPD. Only a handful in the entire world melt more than 100 TPD; and only two have produced 200 TPD —both were stopped due to production issues. All-electric melters greater than 200 TPD, have diameters so large that maintaining a well distributed insulating batch blanket across the melt surface is difficult although a key requirement for keeping the furnace operational. Should the batch cover disappear, the furnace loses heat from the top, the glass cools, melt quality and pull rate fall and production deteriorates. There is also limited long-term experience at that size of producing reduced colored glasses or melting with high cullet levels.

Hybrid melting

Hybrid melting entered the glass dictionary in 2017 being mentioned by companies such as Glass Service & FIC-UK, Fives, TECO, Horn and Sorg. Previously discussion was limited, though hybrid melting simply means more than one heat source and has a long history. It is analogous to hybrid cars where the engine is the main power source, while the battery-driven electric motors can move the car short distances and add extra power during acceleration. Previously, electric boosting in glass production was often for 15-30% of the total energy input. Combustion is also used in hybrid melters (H^2EM) but 50% or more energy comes from electric heating. The thermal efficiency of the electricity is 85-90%, while combustion is about 50%.

A smaller all-electric furnace (<4 TPD/m^2) has the following advantages:

- No emissions (NO_x, SO_x) or particulate dust, so no filter or cleaning costs for waste gas
- No chimney stack and therefore fewer complaints from neighbors
- Lower investment: no crown, regenerator or flue gas channels

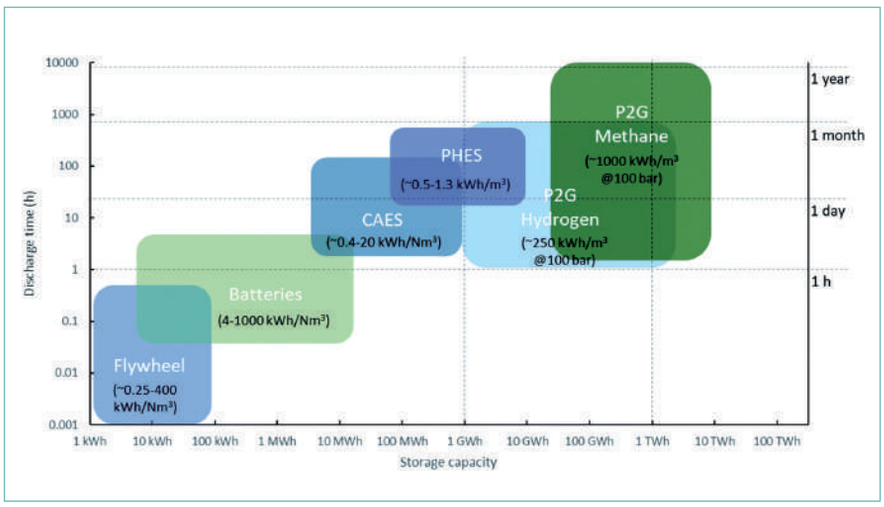

Figure 5. Showing the capacity and discharge times for different storage technologies
Source: RMIT

- No regenerators to clean
- Lower raw materials costs, because volatilization reduced
- Lower repair costs and shorter repair times
- Efficiency is less impacted by furnace size and capacity

Hybrid melting restores the following advantages relative to electric melting:

- Pull flexibility
- Reasonable furnace lifetime (10-12 years)
- Experience of operators (behaves more like a standard furnace)
- Less dependent on electrical power availability (net stability). Switch to more combustion.
- Cullet can be up to 90% of batch
- Unchanged furnace size and aspect ratio, to match existing hall

The 'Furnace for the Future' (F4F) project organized by a consortium of glass makers [11] is expected to adopt a flexible design independent of energy source, melting at times with 80% fossil fuel/H_2 and 20% electric boost (at 3 MJ/kg), or conversely 80% boost and 20% combustion (at 2.5 MJ/kg). This should reduce the risks of adopting a new technology. Figure 6 shows the concept design of such a horizontal hybrid electric melter.

Hybrid electric melting and oxy-gas furnace such as this can break the magic energy barrier undercutting a specific energy consumption of 3 GJ/ton of glass (with 70-80% cullet).

Table 1 shows that using electric energy directly in the glass melt is much more efficient than hydrogen whether by combustion or via the fuel cell. Direct efficiency is estimated to be 79%, whereas hydrogen reduces efficiency below 30%.

DARK FACTORY WITH SMART GLASS FURNACES OR INDUSTRY 4.0 (UN GOAL 9)

Since 2020, new technologies such as neural networks have generated opportunities for automation that were impossible before. As consumers we see it first-hand in self-driving vehicles. If automation is pursued for furnaces, forehearths, and perhaps the complete production it becomes possible to switch lighting off and create so called "dark factories".

Without doubt, the term Industry 4.0 created during a Hannover Messe in 2011 has awakened modern industry to the coming revolution. The last decade has seen the glass industry work diligently to optimize systems, but more is required. Realistically, production in 2030 will need far less human intervention than now.

Industry 4.0, often referred to as Big Data or the Internet of Things, refers to high levels of automation of individual parts of production and intimate communication between them. For example, if defect levels increase, then the system itself decides how to react. It might increase or reduce the furnace temperature, whichever is appropriate. Such decisions currently depend on human interpretation and experience. We review next the automation already used in the glass industry and investigate new technologies such as artificial intelligence (AI), neural networks, machine learning, deep learning and how they will impact production.

Leading engineering firms and glass producers around the world use furnace modeling known as computation fluid dynamics (CFD). While in 1990 accuracy was debated, today the technology is considered

Renewable source	Electricity	Hydrogen electric	Hydrogen combustion
Renewable source	100%	100%	100%
Electrolyzer		70%	70%
Compressor		92%	92%
Transportation	92%	98%	98%
Transformer/fuel cell	95%	52%	
Heat losses effect (electrode holders, fluegas)	90%	90%	45%
Total	**79%**	**30%**	**28%**

Table 1. Comparison of electric melting efficiency versus hydrogen route

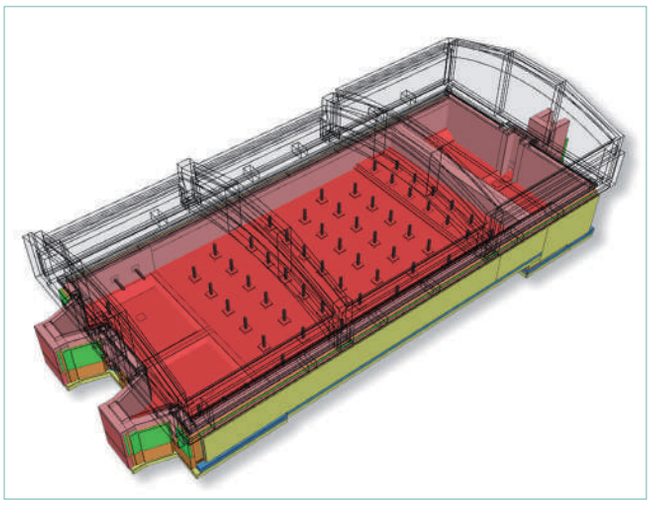

Figure 6. 3D view of the combustion space and glass melt in a Horizontal Hybrid Electric Melter at 80% electric mode and 20% firing mode
Source: Courtesy of Glass Service a.s. (www.gsl.cz) and FIC UK (www.fic-uk.com)

reliable and valuable. It has become state of the art for designing or rebuilding furnaces. Furnace and forehearth model predictive control (MPC) systems of today, one of which is the Expert System III™, have evolved beyond CFD. Initially sceptics had little belief that it was possible to control a furnace using MPC. Today over 300 furnaces worldwide have it installed, with over 20% of their forehearths.

Since 2010 interest in Industry 4.0 has skyrocketed, as new equipment has been installed, such as furnace cameras to monitor batch flow. The question is what next? A review of Industry 4.0 uncovers many different technologies to use and bundle together to optimize factory operation. Robots, augmented reality, the Internet of Things and Big Data, where useful information is harvested using powerful computers, all can contribute to efficient operation.

A proportional-integral-derivative (three-term) controller (PID) employs a control loop using feedback. They have been widely used in applications requiring continuously modulated control but often offer limited success because: (1) round the clock PID control by a single operator was demanding and unreliable; (2) furnace temperatures were slow to react; and (3) responses to change were subject to long dead times. MPC strategies using dynamic algorithms offer an alternative. They capture process behavior with minimal intervention while maintaining optimum quality, lowest emissions and minimal operational costs.

MPC typically works with furnace inputs such as gas, crown and bottom temperatures (Figure 7A-C).

Mathematical models are created using software such as *Expert System III™* and this historical data. These linear models predict the future response of a furnace.

The next step requires more complex inter-relationships to be understood. One is how temperatures relate to glass quality. Should furnace temperature be increased for better glass quality, or lowered as would be the case for re-boil or refractory reactions? Such questions showcase

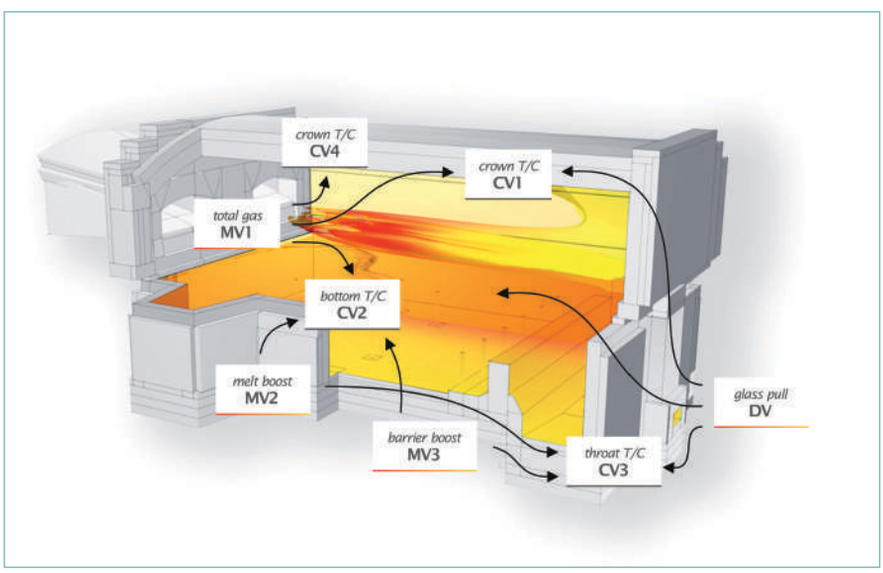

Figure 7A. Advanced model based predictive control model relations [12]
Source: Glass Service, a.s

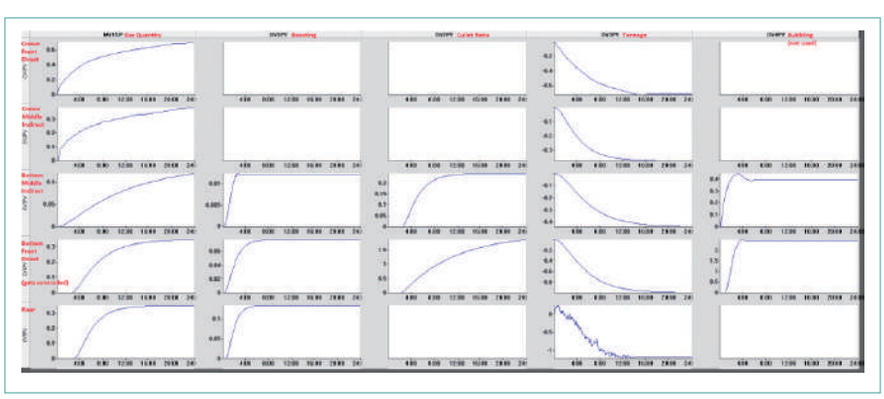

Figure 7B. Example of model relations after process identification using historical data
Source: Glass Service, a.s

Figure 7C. ESIII PC taking over with MPC furnace control from the operator
Source: Glass Service, a.s

areas where artificial intelligence offers more than straightforward linear models.

Much more data is available than in the past. But, how to handle it? Near Infrared (NIR) furnace cameras can act as virtual thermocouples and see the temperature trends within the furnace over time (Figure 8). Indeed even temperature profiles can be explored. In the following, the capabilities of such cameras are considered first and the question of data accuracy later.

First though we consider what artificial intelligence (AI) and its neural networks are? How can they help the glass industry? Most glass operators are familiar with DCS, a digital control system for a process or plant usually with many control loops and MPC. Before AI, irregular issues evaded their operators creating inefficiencies and low-quality glass production. AI anticipates and performs the tasks that could not previously be resolved by hands-on techniques. It allows the computer to mimic human intelligence to solve a problem, using neural network decision trees trained by machine learning.

Deep learning may appear magical, but is simply a multi-layered deep neural network that handles vast amounts of information. Actually, a daily search for something on Google uses the same technology. Google suggests an answer to what you are really searching for. So, this is already AI.

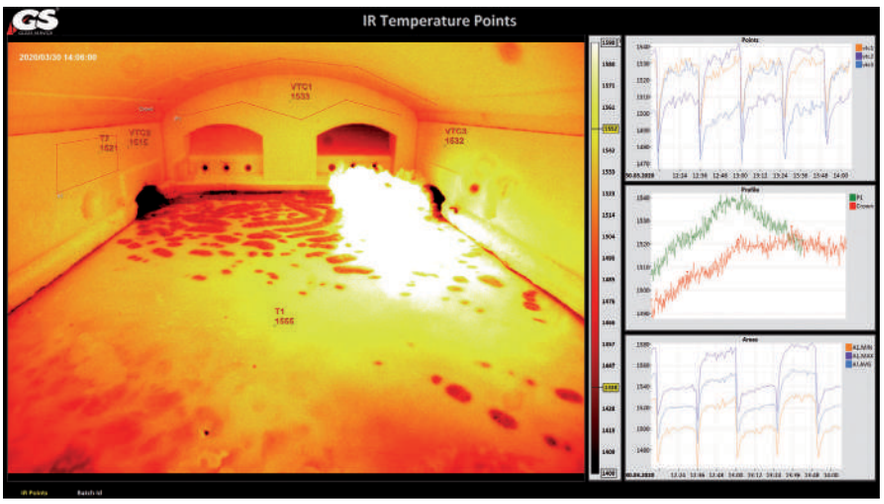

Figure 8. Furnace image using near IR camera
Source: Glass Service, a.s

What is a neural network? It was probably named after neurons in the human body which have similar characteristics. A data set needs first to be analyzed, and after analysis, the result is the outer layer which is its meaning. So first this data was born into the inner layer of the analysis, to be formalized and then inserted into the neural network. We then teach this neural network to fill certain highs and constants inside different neurons, to learn (with lots of data on the input side) to predict what is produced as output —and to recognize it automatically. The key thing is that we don't fully understand these neurons, and we don't *have* to understand them. They are simply filled out by giving sufficient data and sufficient output for the neurons that are going to be filled with the mechanism that they recognize best. Figure 9 shows the data input, the data analysis and the process output.

To illustrate these concepts, let's look at an imaging technique which we use with an NIR furnace camera. The camera software is trained to recognise the images it sees, and after time can differentiate between batch, flame, glass surface, refractory, and camera build-up. So if buildup around a camera covering a thermocouple occurs, it can no longer be used reliably. Then, input data from this thermocouple should not be applied to deep learning. Deep learning can also detect the flame independently from the batch, determine the flame direction and signal an alarm if the furnace needs attention. With neural network technology, we can learn much more from these images than just temperatures and process them to make intelligent control decisions (Figure 10).

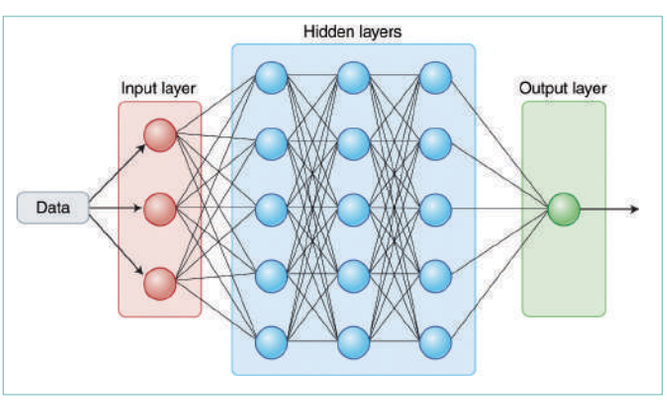

Figure 9. Neural networks, with deeper hidden layers
Source: Glass Service, a.s

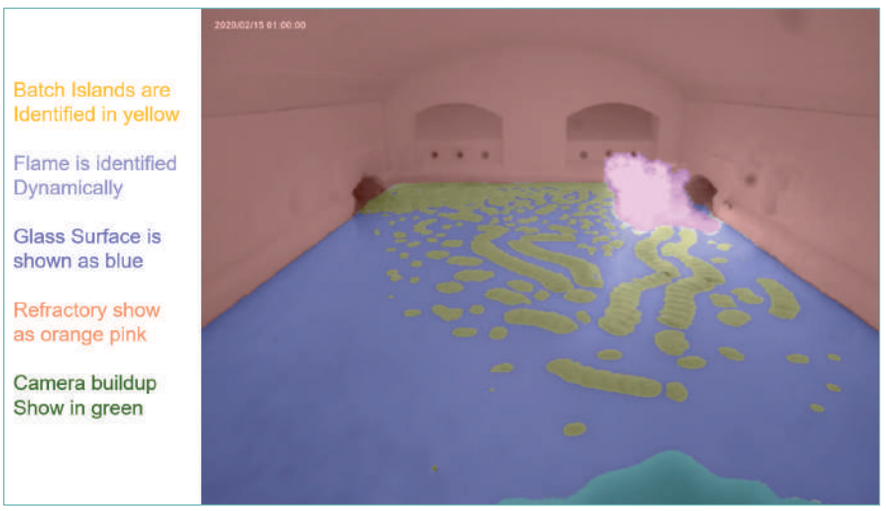

Figure 10. Furnace image from a camera identified by a Neural Network

Source: Glass Service, a.s

The next step is to measure the batch distribution. The image is transformed to eliminate the parallax errors caused because the camera tilts (Figure 11). The yellow areas represent the batch piles. In this furnace there is clearly more batch on the left than the right. Thus, the batch location coverage and movement can be monitored, facilitating corrective actions (Figure 12). For some furnaces, stability is vital, for others less so.

The next question is: Will there still be employed workers if AI technology is used and becomes standard? For this we look for historical data in other areas for comparison.

The great benefit of MPC is that it improves and upgrades furnace operation. There may be disagreements about its installation, caused by concerns about job security. An understanding within the factory is important to convince employees that this will not be so; instead it will assist their work. The goal is to give them new technologies which enhance production processes. Intensive and continuous training of employees is necessary to manage properly the new technology. Different capabilities and skills need to be incorporated to the workforce, a constant factor in Industry 4.0 implementation in every sector and field.

In conclusion, the perspective is to not be afraid. The artificial intelligence revolution that has arrived cannot be avoided. Some suggest that the AI revolution is much larger than any automation revolution seen before. Strong leadership skills and business practices will prepare workers, so that they can understand and accept AI, because it will revolutionize our lives and bridge the gap between what humans are capable of and what is actually possible. AI will penetrate across industries to take over basic tasks from humans, seamlessly

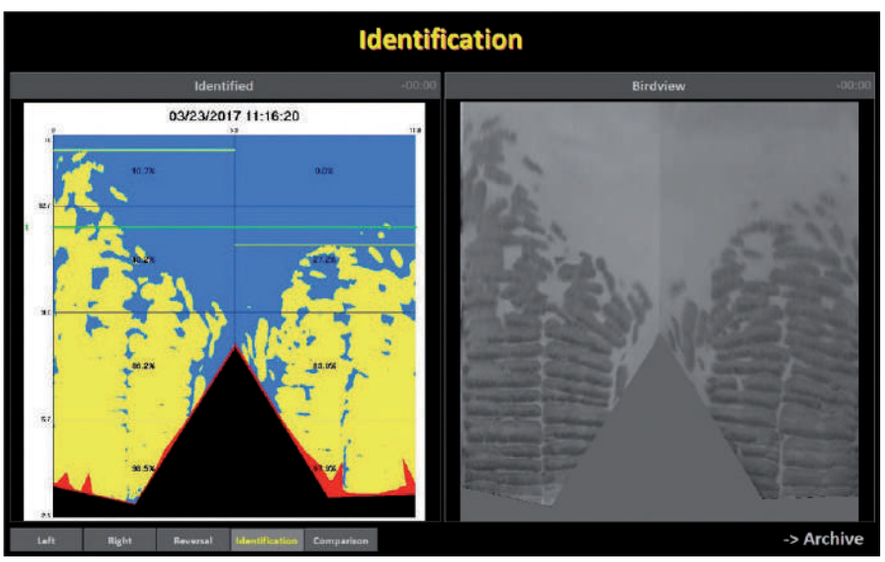

Figure 11. Batch coverage converted into a bird's eye view

Source: Glass Service, a.s

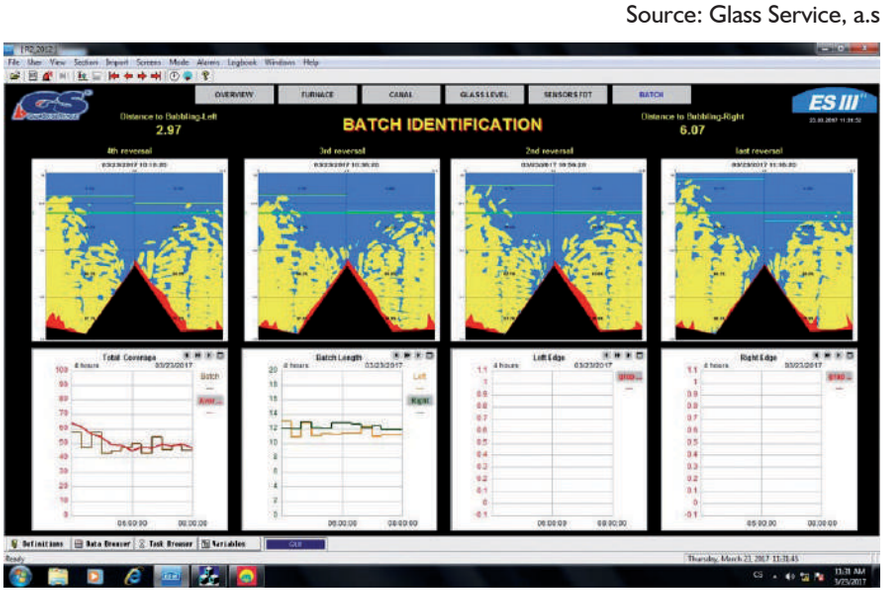

Figure 12. Batch coverage of about 62 m^2 over several reversals

Source: Glass Service, a.s

interacting with our daily lives. As Elon Musk has said, we have already become Cyborgs. "If you forget your phone at home, a simple thing, you will feel helpless. Without your phone you will miss numbers, contacts, your agenda, maps, and no communication anymore, nothing to do while waiting. Who still knows the phone numbers of all the people you know inside your phone?".

SUMMARY AND OUTLOOK

With the acceptance of Industry 4.0 automation, the required 55% reduction of carbon emissions should be possible before 2030 through:

- Improved glass recycling (in both amount and quality)
- Greater use of low-cost green electricity, in hybrid or all electric furnaces
- The use of hydrogen for combustion or electricity generation

Generating hydrogen using green electricity will become important post-2030. The 2050 goal of an 80% CO_2 reduction, will require large amounts of green electricity and a functioning hydrogen economy to replace fossil fuels for glass production, and transportation to and from the factory.

Industry 4.0 automation will continue its forward progression. A dark glass factory may be difficult to imagine by 2030, but not by 2050 when the light from hot gobs falling from the forehearth spout will be all that illuminates the factory hall.

REFERENCES

1. https://www.cambridge.org/core/journals/ contemporary-european-history/article/glass-recycling-container-in-the-netherlands-symbol-in-times-of-scarcity-and-abundance-19391978/D4119AC7A38C4D29486557CCACF3D 4FC
2. https://www.gpi.org/a-circular-future-for-glass
3. https://publications.jrc.ec.europa.eu/repository/ handle/JRC68281
4. https://en.wikipedia.org/wiki/Forest_glass
5. https://www.eia.gov/todayinenergy/detail.php?id=12631
6. https://www.lifeoptimelt.com
7. https://www.oxyfuel-heatrecovery.com/sites/ oxyfuel_heatrecovery/files/2017/03/28/oxygen-natural_gas-preheating-for-oxy-float-glass-air-liquide.pdf
8. https://www.lifecleanox.com/sites/cleanox/ files/2018/05/30/extractpage_glass_worlwide_may-june_2018.pdf
9. https://www.ecoheatox.com
10. https://patents.google.com/patent/US230668A/en
11. https://feve.org/about-glass/furnace-for-the-future
12. Glass Service, a.s. data, with Gob Input Data from Cortex ■

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  - Furnace building, commissioning & maintenance
  - Selection & commissioning of combustion system, instrumentation & allied equipment
  - Selection of raw material
  - Designing of fully automatic batch house and cullet handling system.
  - Selection, installation and commissioning of production machinery and annealing lehrs
  - Installation and commissioning of quality control equipment and packing machinery
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Sustainable Glass in a Circular Economy

MSc. Michael Delle Selve

We all strive for a better tomorrow —a world where the planet and people are healthier and happier than they are today. In the face of global warming, public health crisis and economic turbulence, that future has never felt more uncertain. But people are demanding more from businesses, governments and one another to ensure we foster a more sustainable world for the next generation. In such turbulent times, it's reassuring to know that for product protection, one aspect of our future is clear: glass packaging. The timelessness of glass means the packaging people have loved most, yesterday and today is the very best option for tomorrow.

For close to two millennia, glass has been a touch point of celebration, commerce, culture, and science for societies around the world —its footprint shaping local communities stretching from production lines in industrial towns, to the secretive medieval guilds of Venice's Murano, all the way back to the Romans' discovery of craft glassblowing. The simple, inert combination of sand, soda ash and limestone is a formula that's worked its magic for thousands of years, and it's very much here to stay, according to the research *'Glass recycling, an activity that continues for millennia'* [1].

Yet there's another element that goes into the mix, and as society turns its attention to issues of circularity, responsible production and consumption and environmental impact, it's coming to the forefront now more than ever. It's an ingredient that's just as important as any of the natural raw ingredients: recycled glass.

When it comes to ensuring sustainable consumption and production patterns and fostering sustainable cities, glass is in a class of its own. Glass is the only packaging material which is not just reusable and refillable, but also infinitely recyclable in a closed bottle-to-bottle loop. What does that mean in real terms? That bottle of wine you're saving for dinner tonight may have started its life as a six-pack of beer, a jar of jam, or even a pot of face cream. And if you make sure to drop it off at the bottle bank afterwards, it could be back on the shelves living a whole new life in as little as a month.

That's because the same glass material can be indefinitely reused without any loss of quality and recycled again and again into new bottles and jars. Once produced, a glass bottle becomes the main resource needed to produce new bottles —meaning the more recycled content that can be used, the more we can reduce our need for virgin raw materials. And all of this adds up to lowering energy and CO_2 emissions, crucial if we want to keep global temperature rise to well below 2°C in line with commitments to the Paris Agreement and the 2030 Agenda for Sustainable Development.

All of this makes glass unrivalled in its environmental credentials. Join us as we look deeper into the miracles of glass, and what it represents for planet, people, and society, as we work towards a circular economy that works for all.

A CIRCULAR ECONOMY THAT WORKS FOR THE GOOD OF THE PLANET

There's nothing like glass when it comes to packaging that's both reusable and infinitely recyclable. With endless lives, glass can be recycled again and again, in an endless loop, into new bottles and jars. And recycling rates are at a record high: today, 7 in 10 glass bottles are collected for recycling in the EU, which is a global leader in household recycling with collection systems that have been perfected over decades.

Yet it may surprise you to learn that despite its recyclability, the inherent properties of glass do not become corrupted over time. Again and again, glass can be made a new using recycled content along with the natural raw ingredients, and new bottles and jars will be just as high in quality as older products. All of this makes glass a permanent material —ideal to maintain a true circular material loop. Due to the strength of their chemical bonds, permanent materials are not damaged by the recycling process and can stay in the recycling loop indefinitely, as long as they are properly collected, treated and re-melted.

Today, a record 78% of all container glass put on the market in Europe is collected for recycling. For a breakdown by country, see Figure 1

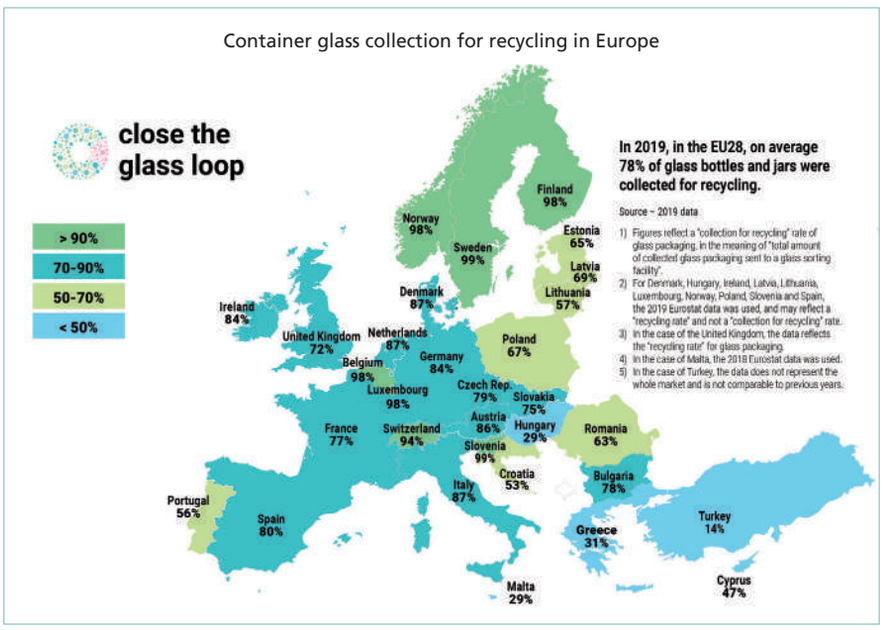

Figure 1. Latest available data on the levels of container glass recycling in Europe
Source: www.closetheglassloop.eu

and through the link with the latest available data [2].

And the industry wants to collect more and better into the bottle-to-bottle production! Close the Glass Loop [3], a multi-stakeholder partnership, brings together the glass packaging value chain with the shared objective of achieving a 90% average EU collection rate of used glass packaging by 2030 and improving the quality of collected glass so that more recycled content can be used in a new production loop.

It is important however to point out that not all kinds of glass materials can be recycled into a closed loop. Soda-lime glass is the composition used for the majority of glass containers put on the market and is perfectly recyclable into new bottles. However, other compositions such as crystal glass must not be collected into bottle banks because it can't be recycled — in fact, this kind of glass can actually contaminate the entire glass recycling process because it may contain lead.

Glass bottles are available in a large range of colors, but only three are mainstream and represent the vast majority of the bottles on the EU market: flint (transparent), green and amber glass. Color choice depends upon several factors, ranging from aesthetics to UV-resistance —yet color separation is an important step in recycling, to ensure that all glass collected can be recycled, depending on local specificities like production versus consumption. This color separation can take place either at source, where different bottle banks are offered to consumers to dispose of their bottles according to their colors, or after collection, through an industrial sorting using selective optical sorting machines which sort by color. Notably, once glass has been sorted by color, there is no limitations in terms of recycling to make new colored bottles: Europe boasts colored bottle production of over 90% of cullet. All green, amber and flint bottles can be infinitely recycled in a closed loop, and as glass is a permanent material, there is no degradation of the physical and chemical properties of glass during the recycling process. Various tints of the two basic colors (amber and green) exist and pose no issue from a recycling point of view. Moreover, these tints are generally standardized (for green bottles, the most common tints are Georgia green, emerald green, champagne green and dead leaf green). Tints outside the standardized specifications are relatively rare and can be easily diluted in the mass of mainstream glass.

The environmental benefits that this continued cycle can bring are exponential. Today, glass producers use more recycled content than virgin materials in our packaging: on average, 52% of the raw materials we use are made up of recycled glass. This is crucial to meeting UN goals on Responsible Production and

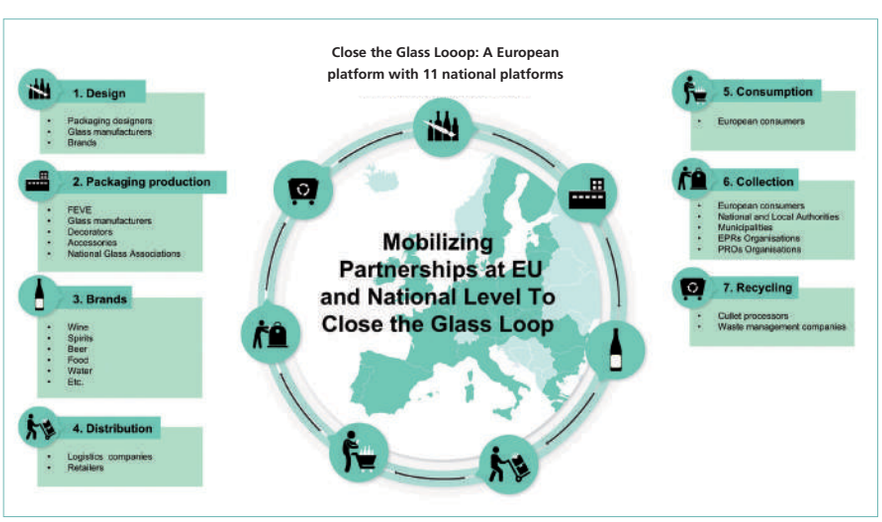

Figure 2. The Close the Glass Loop partnership brings together members of the glass value chain with the objective of more and better-quality recycling in Europe through each stage of the recycling journey

Source: FEVE

Consumption, because compared to producing new glass from raw materials, every ton of recycled glass used in the furnace avoids the extraction of 1.2 tons of virgin raw materials. What's more, every additional 10% of recycled glass in the furnace reduces the CO_2 emissions by 5%, while also cutting back on energy consumption by 3%.

At the center of this endless cycle? A strong commitment to recycling in cities and towns around the world, both by individuals and by industry and the wider glass value chain. Recycling glass is a topical issue in modern societies all over the world, given the continuous increasing consumption and the recyclability of glass, but it's nothing new: glass packaging and its recycling has been an integral component of human lifestyles for millennia. Historical and archaeological evidence demonstrates that even in antiquity, glassworkers were already collecting and reprocessing broken glass into new consumer goods. Looking to the modern era, the current glass collection schemes in Europe have been in place for over fifty years, and today, some 1.5 million bottle banks are available for residents to rely on.

For decades, glass has been successfully collected for recycling via kerbside and bottle bank collection across the EU, under so-called 'Extended Producer Responsibility' (EPR) schemes, backed by a strong European policy framework that lays down key waste management principles (including the waste hierarchy), sets recycling targets for all packaging materials, requires separate collection of packaging waste, and introduces the EPR concept. Centre to this framework is the Packaging and Packaging Waste Directive (PPWD) —currently under legislative review and set to be updated as part of the flagship EU Green Deal and Circular Economy Action Plan that calls for further action on packaging waste prevention, reduction and recycling.

As more and more people move to towns and cities —68% of the world population is projected to live in urban areas by 2050, according to the UN— glass recycling is set to become a model circular economy for sustainable cities to learn from. Europe currently has the world's highest recycling rate at 78%, underpinned by an extensive network of curbside or local collection systems. From that, most of the bottles recycled "close the loop" as they are broken down, refined and made into new glass products —while other waste glass may be used as asphalt in road construction, as insulation in homes, or even as a soil replacement in hydroponic food set-ups. Thanks to these collective efforts, we can prevent some nine million tons of CO_2 from being emitted per year. Whether it's collected from a curbside or dropped off at a neighborhood bottle bank, increasing the number of bottles and jars that are collected is vital for glass manufacturers to cut back on raw materials and drive forward a circular and sustainable economy.

What's more, as well as being infinitely recyclable, glass is the only packaging that's both reusable and refillable. To further close that gap and work towards sustainable cities around the globe, we also depend on returnable (and refillable) packaging, which can be reused dozens of times and still be recycled at the end of its life. This makes glass a permanent material that forms an endless loop. Technically, we could produce more recycled material, but are limited by availability and quality. That's why as an industry, we're strongly committed to working in partnership with our members, policymakers, academics, all parts of the supply chain and other stakeholders to identify powerful and practical solutions to improving our contribution to sustainability.

SUPPORTING CONSUMERS TO MAKE THE SUSTAINABLE CHOICE

Consumers themselves are an important part of the equation. We all have a footprint through the choices we make each and every day. We're expanding our efforts to promote responsible production and consumption through consumer education campaigns, notably with Friends of Glass [4] —a pan-European consumer awareness platform with a footprint in 13 countries, to promote all the reasons why people should opt for products

Figure 3. Friends of Glass brings together consumers around Europe, united by a shared love of glass packaging for its environmental, health and design credentials. To date, Friends of Glass campaigns have reached millions of consumers since launch: in 2020 alone, our content gained over 13 million views on social media

Source: FEVE

in glass packaging. Bringing together a community of self-confessed glass lovers, Friends of Glass campaigns encourage consumers to choose and recycle glass packaging and see it as the first choice for a sustainable everyday packaging material. Our campaigns have featured everything from talking dolphins, to hidden celebrities, from singing influencers to anthropomorphized glass bottles!

We're also set to launch a new packaging symbol —known as the Glass Hallmark [5]— to better engage in sustainability conversations with consumers. Throughout history, hallmarks have been used on valuable metals to visually identify high quality products, and we see no reason why glass should be the exception. Our new hallmark incorporates all the unique features of glass that make it a high-quality, sustainable packaging material. Designed to be printed on labels or directly onto the glass itself, the hallmark highlights environmental and health benefits of glass products at a glance. Our message to the world is simple: glass is caring. Choosing glass protects the health of the environment and more importantly, ourselves.

A NATURAL CIRCULAR MATERIAL THAT WORKS FOR ALL PEOPLE, WHERE PLANET AND HEALTH CREDENTIALS INTERSECT

When we talk of responsible production and consumption, it's impossible to mention the recycling credentials of glass packaging without also touching on its health benefits: namely, that glass is the only food-grade packaging material that can be endlessly recycled into new packaging solutions without ever losing its inherent properties in terms of taste and quality preservation.

That's because glass is an inert material that does not change or leach over time. Made of natural ingredients, there is no risk of harmful chemicals getting into food or drinks that are packed in glass, and products are preserved for longer in glass, even once opened —no additional barriers or additives needed. It's also a single-layer material, which means there is no need for additional internal chemical

Figure 4. The new Glass Hallmark stands as a symbol of what glass brings to people, planet and society. Each element symbolizes the commitment we make when choosing glass: a commitment to use resources wisely, to recycle, to protect and to work towards a more sustainable future.

Source: FEVE

liners such as plastics found on other packaging materials that can interact with food and beverages. For these reasons, it's also recognized as safe by international authorities, being both exempt from EU REACH chemical regulations and the only widely used packaging material considered 'GRAS' ("generally recognized as safe") by the U.S. Food and Drug Administration. And because it's made entirely of raw materials found in nature, glass cannot pollute the environment, now or ever. All of this makes glass the natural choice for preserving not only the quality of the product, but the health of the people who use it.

In short, as an everyday packaging material, glass is natural, sustainable, and safe —crucial at a time when society is facing unprecedented uncertainty, fueled by global health and environmental crisis, and when the health credentials of packaging are becoming more important to people than ever. Wellness and 'zero waste' lifestyle trends are also rapidly changing how we produce, purchase, consume and dispose of our everyday products. People are increasingly in search of a toxin-free circular economy, one that uses safe materials for food contact without losing sight of the need for recycling potential.

Recycling should be part of achieving a circular economy, but never at the expense of health, and this is where glass is ready to shine.

BACKED BY INDUSTRY INITIATIVES FOR A BETTER FUTURE

Glass already has strong environmental credentials in a circular economy and consumers are increasingly recognizing that, but that doesn't mean we're resting on our laurels. The industry is working to make glass production even more sustainable and taking rapid strides to become carbon neutral and maximize our use of recycled content. We're committed to the UN 2030 Sustainable Development Goals (SDGs), and by driving forward the transition to a resource-efficient and low-carbon economy, we'll be able to ensure that glass manufacturing can continue to thrive sustainably in the long run.

Glass is healthy, reusable and infinitely recyclable, "it is the hidden gem in a carbon neutral future", as stated by *Nature* —the international journal of science [6]. By addressing our biggest problem —the CO_2 footprint produced by an energy-intensive industry —the glass industry can offer a future-proof packaging that is healthy, circular and climate-neutral— one that can sustainably meet growing consumer demand. That's the rationale behind the Furnace for the Future (F4F, for short) [7] a pilot furnace project designed to reduce carbon emissions by up to 60%. The Furnace for the Future project underpins the industry's ambition for climate neutrality and offers a clear pathway to decarbonize an energy-intensive process.

At present, 80% of production emissions in the glass industry come from combusting natural gas to melt glass. Our aim with the Furnace for the Future is to cut direct furnace CO_2 emissions by 60%, as gas is replaced with renewable electric alternatives with a low carbon footprint. We already know that electric melting works, but we're currently limited to small-scale furnaces that can only handle clear glass with limited recycled content. Put simply, that's not going to cut it if we want to produce sustainably at scale.

Figure 5. Glass is inert and keeps products safer for longer —making it the natural choice for preserving not only the quality of the product, but the health of the people who use it

Source: FEVE

Enter the Furnace for the Future, set to enable larger furnaces to process all colored glass at the same time as using high amounts of recycled product. Each ton of glass recycled can save 580 kg of CO_2 —both cutting emissions and reducing landfill waste. Europe alone produces an estimated 35.85 million tons of glass each year, so imagine what that could add up to in energy savings over time, if we replace every ageing furnace with a climate neutral alternative? The furnace is the first of its kind in the world and represents the joint efforts of 19 companies (together, representing 90% of production in Europe) who have joined forces to finance the F4F for the benefit of the whole European container glass sector. The first F4F is set to be built in Germany, while the know-how from this initial pilot will be shared across the whole sector —sending a strong signal of the industry's collective commitment to improve society. A more detailed discussion on this furnace is presented in the previous chapter 'Sustainable Glass Production with Carbon Reduction'.

The Furnace for the Future is the pinnacle of the container glass industry's efforts towards climate neutrality, but it's by no means the end of our ambition. As an industry, we're constantly improving our energy efficiency and resource management through sustainable innovation. 610 million Euros is invested each year on decarbonization, energy efficiency and upgrading our 160 EU plants —adding up to 10% of annual operational and maintenance costs. The industry is also investing in other areas of sustainability— from making more lightweight products to decoupling

emissions from production. These efforts are paying off: while glass production continues to grow, energy consumption has been reduced by almost 50% in 40 years; meanwhile CO_2 emissions are down by 70% in 50 years. We've even created the world's lightest beer bottle —a 330 ml container that weighs just 155 grams that performs identically to heftier products.

Our shared circular economy ambitions don't stop at production. Glass is a key resource for achieving a thriving, circular European society, and the industry —a longtime leader in circularity— is convening stakeholders across the entire glass value chain to Close the Glass Loop and make our circular economy work better for sustainable towns and cities.

An action platform for a healthier planet, we want to achieve 90% average EU collection rate of used glass packaging by 2030 (up from the current average of 78%) and unlock better quality of recycled glass, so more recycled content can be used in a new production loop. We aim to do this by collecting more and better glass upfront, involving everyone who interacts with glass, at all parts of the value chain —from the glass producer to brands and consumers, Extended Producer Responsibility and Waste Management Schemes to municipalities. That's why we're bringing them all together with a common goal: to increase the quantity and quality of available recycled glass —so that people don't just recycle but recycle more and better. By recycling more and better, we can progress on new EU 2030 recycling targets and the UN SDGs, achieving sustainable growth opportunities in the Circular Economy.

LOCAL BY NATURE: A MATERIAL THAT GIVES BACK TO SOCIETY

Glass is a key resource for achieving a thriving, circular society. Our industry has long been a leader in circularity, and we're committed to working with our partners throughout the entire ecosystem to meet even tougher targets. We have and will continue to work in partnership with the complete value chain to keep evolving. From energy and raw material suppliers, through waste management stakeholders, to policymakers, NGOs, and civil society at-large, we strive to find any and all approaches to enable and optimize our Circular Economy. The way we see it, a circle isn't just a shape. It is a symbol of continuity —of permanence. Glass is here to stay, and our goal is to ensure that glass continues to be seen as the leading sustainable material for healthy, reusable and infinitely recyclable packaging.

As society moves to a new age of industrialization, the glass industry also remains committed to building on its long standing cultural heritage in cities, towns, and local communities across the world to drive sustainable growth for society as a whole. Glass production is a local industry by nature —in European countries alone, more than 125,000 people work in the glass packaging industry, spread across 162 manufacturing plants in 23 countries alone. That's why glassmaking is adapting and innovating to secure the future of the industry —the jobs that come with it and essential sectors that depend on it— and ensure glass is fit for the circular and climate-neutral economy Europe's 2050 sustainability targets will bring.

In an increasingly unstable global environment, making progress against the SDGs is not merely an option: it's a business and societal imperative for all of us, no matter where we are located. As a result, we are strongly committed to working in partnership with our members, policymakers,

Figure 6. Building on a longstanding cultural heritage of glassmaking dating back thousands of years, the container glass industry is continuously innovating to contribute to thriving local circular economies

Source: FEVE

academics, all parts of the supply chain and other stakeholders across the glass industry, to identify powerful and practical solutions to strengthen our contribution to sustainability, and to continue to foster responsible production and consumption.

As the world continues to strive towards meeting the 2030 Agenda for Sustainable Development, the container glass industry will not rest on its laurels: we will continue to improve on our record in existing areas and continue to innovate to further sustainable practices and the well-being of the world. Glass is a natural choice for helping the world achieve sustainability targets by 2030, 2050 and beyond. It's the future, made clear ■

REFERENCES

1. https://feve.org/wp-content/uploads/2019/07/ FEVE-report-with-illustrations-and-hyperlinks.pdf
2. https://feve.org/glass_recycling_stats_2018
3. https://closetheglassloop.eu
4. http://www.friendsofglass.com
5. http://www.glasshallmark.com
6. https://www.nature.com/articles/d41586-021-02992-8
7. https://feve.org/about-glass/furnace-for-the-future ■

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Block No.1018 At-Berna, Ta- Himatnagar
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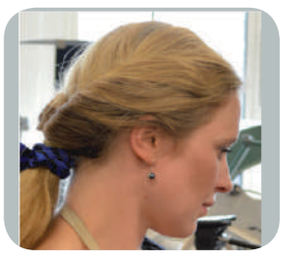
Social, Cultural and Environmental Sustainability within the International Art Glass Movement



Dr. Jessamy Kelly

Since their publication in 2015, the world has reflected upon and used the UN Sustainable Development Goals (UN SDG) as a target to revise our actions and to direct our research drivers with an aim to implement them by 2030. This call to action is a collective, universal wake-up call: to end poverty; to protect the environment; to achieve gender equality; to ensure health and well-being; and to ensure peace and prosperity for all. But what does this mean in terms of Art Glass? The far-reaching effect of these goals when viewed through the lens of the international Art Glass movement is an engaging and exciting space to examine. Understanding how the goals can or have been applied to contemporary art glass practice, education and community is an important enquiry for the sector. As an artist and academic educator within the Art Glass community, the UN SDGs have been an important reference point. This essay will focus on the effect of goals 4, 5, 12 and 13; which can be seen in action as a form of social commentary within the international Art Glass movement.

UN SUSTAINABLE DEVELOPMENT GOAL 12 RESPONSIBLE CONSUMPTION AND PRODUCTION

Global consumption and production have a huge destructive impact on the natural environment and resources of the planet. Over the last 100 years, our environment has been seriously impacted and damaged by social and economic progress, risking our future development and threatening our existence.

UN SUSTAINABLE DEVELOPMENT GOAL 13 CLIMATE ACTION

Climate change is widespread and its affects are apparent worldwide, affecting and disrupting economies and lives. Our weather, climate and environmental conditions are changing fast. Weather patterns and temperatures are mutable, our sea levels are rising, and extreme weather events such as precipitation, drought, or flooding are widespread

Substantiality is gaining considerable ground within the Art Glass community. Glass recycling can be traced back to the first Millennium AD. Today it is viewed as a sustainable material, as it is made from natural materials and if properly cleaned and sorted can be infinitely recycled. Unfortunately, recycling and processing glass is complex. Contamination and sorting are a huge problem, most glass is only considered for single loop recycling, with the majority becoming aggregate within road surfaces. When processed and disposed of in the right way glass can offer a viable alternative to synthetic materials, offering sustainable products that actively reduce our impact on the environment. This recognition of sustainable models of practice alongside discussion of its importance within Art Glass has seen a range of glass artists prioritising sustainability as part of their practice.

In 2021, the Society of Glass Technology invited Colin Brain, Tyra Oseng-Rees, Hannah Gibson, Inge Panneels, Juli Bolaños-Durman and Gregory Alliss to speak on a History and Heritage panel focused on 'Glass Reuse and Recycling through the Ages'. Colin Brain gave a fascinating keynote lecture about the historical perspective of recycling, reminding us that recycling is not a contemporary phenomenon and dates back to early Roman glass making, with evidence that most Roman glass was recycled or reused. The Norwegian glass artist Tyra Oseng-Rees discussed her work, which she creates by upcycling recycled glass bottles into a sustainable material for wall panels and tiles for bespoke interior and architectural projects. Her work has a beautiful marble-like finish as the glass has gone through a crystallisation phase in the firing (Figure 1).

British glass artist Hannah Gibson discussed her figurative casts, which are part of a growing series of work called 'Recycling Narratives - Whispering Sweet Nothings'. She first started working on this series in

Figure 1. Tyra Oseng-Rees, recycled waste glass panel, 2019, 92 x 70 x 1.5 cm

Source: Johan Butenschøn Skre

2015 as a way to start a commentary on recycling and sustainability and to explore where glass comes from and the transformation it can make. 'Shattered Past' (2021) is a set of iconic kiln cast glass figures which are made from recycled car windscreen glass (Figure 2).

Belgian glass artist Inge Panneels was able to introduce her approach, including her artwork *Material Journey* (2018), which is a social commentary on the Anthropocene, a concept which states the major geological impact humans have had on the planet's climate and ecosystems. Her work asks us to explore the impact that we have as makers. Panneels calculated the carbon footprint of her artwork to detail the energy that went into the creation of it (Figure 3).

Figure 2. Hannah Gibson, 'A Shattered Past', 2021, kiln cast recycled glass, 4cm, 9cm, 27cm, 41cm

Source: Alick Cotteril

Costa Rican Glass artist, Juli Bolaños-Durman repurposes found glass objects which she transforms into artefacts; each tell a unique narrative (Figure 4). She is based in Edinburgh and completed her MFA at Edinburgh College of Art in 2013.

Finally, British Glass artist Gregory Alliss shared his working approach and a range of kiln cast sculptures made from recycled cathode ray tube (CRT) television glass (Figure 5). He is currently studying towards his Ph.D at Edinburgh College of Art, exploring sustainability in studio glass practice. His work is a strong commentary on the impact glass studio practice has on the environment as well as questioning the materials we use. His research is focused on finding low-impact alternatives for casting and for creating refractory moulds, to advance a more sustainable studio practice.

During their 2021 conference, the Glass Art Society organised 'Trace' the Virtual 2021 Green exhibition exploring sustainable glass art. The theme was devised to showcase the impact that many glass artists have on the social commentary around sustainability within glass art practice. The work of 30 glass artists was shown online [1], including work by British artist Abigail Reynolds, who created a film about making glass from locally sourced materials. She collected kelp that she made into ash to create a flux that could be added to beach sand, which she melted in a hand-built furnace to make glass. Other notable artists selected were Korean glass artist Min Haeng Kang, she transforms leftover waste by rearranging it into cell forms, and American glass artist

Figure 3. Inge Panneels, 'Material Journey', 2018, cast glass boat with a rubber plughole atop a fused glass wave, with poem text in the background

Source: Inge Panneels

Christopher Kerr-Ayer, who uses found and ready-made objects which are cold assembled (without heat) to create his artworks. 'Waste Glass Landscape', is a piece of my own work, which was included in the exhibition. This series is concerned with the effect human activity has on our climate and environment and the impact our processes and materials have on our landscape. The piece is recycled waste glass and is concerned with material reuse. The opaline effect is a form of crystallisation in the glass that creates an opaque quality in it (Figure 6).

Sustainability drivers within the international Art Glass community are now high on the agenda; glass artists continue to pioneer the use of recycled and sustainably sourced materials or to develop low-impact alternatives. The small batch, limited edition and one-off production runs of glass are not over-consumed, they are conscious, deliberate and intentional acts. Production is closely connected to the glassmaker; they often make to order and take great care and time over their work. Glass Art inherently contributes to the *slow movement*. Glass Art does not cause major environmental pressures, it creates artefacts of legacy that will outlive their owners but most importantly, it can become activated as a vehicle for glassmakers to voice their concerns of the sustainability issues we face, in the form of craft-activism. Sustainable art glass production can be viewed as a vital antidote to the environmental issues we face.

Figure 4. Juli Bolaños-Durman, 'Wild Flowers Collection', Collaboration x Jorum Studio, 2019

Source: Shannon Tofts

SDG UN SUSTAINABLE DEVELOPMENT GOAL 4 QUALITY EDUCATION

To achieve inclusive and equitable quality education and promote lifelong learning opportunities for all. The equal education of all groups and minorities within society is a necessary right, to ensure access to free schooling by 2030 and to provide equal access to affordable vocational training and to eliminate gender and wealth disparities with the aim of achieving universal access to quality higher education.

UN SUSTAINABLE DEVELOPMENT GOAL 5 GENDER EQUALITY

To achieve Gender equality and empower all women and girls. The equal representation of women and girls within society is a necessary right; goal 5 aims to end discrimination and violence against women in all public and private spheres. It also makes a call for women to be able to fully participate in all levels of society and have equal opportunities to take on leadership roles across all political and economic spheres.

Finding ways to create inclusive and equitable quality glass education and studios regardless of gender, race or an individual's societal demographic is still an issue many countries face. Examples of good practice, however, do exist and could be used as a model for the future. The Kitengela Glass

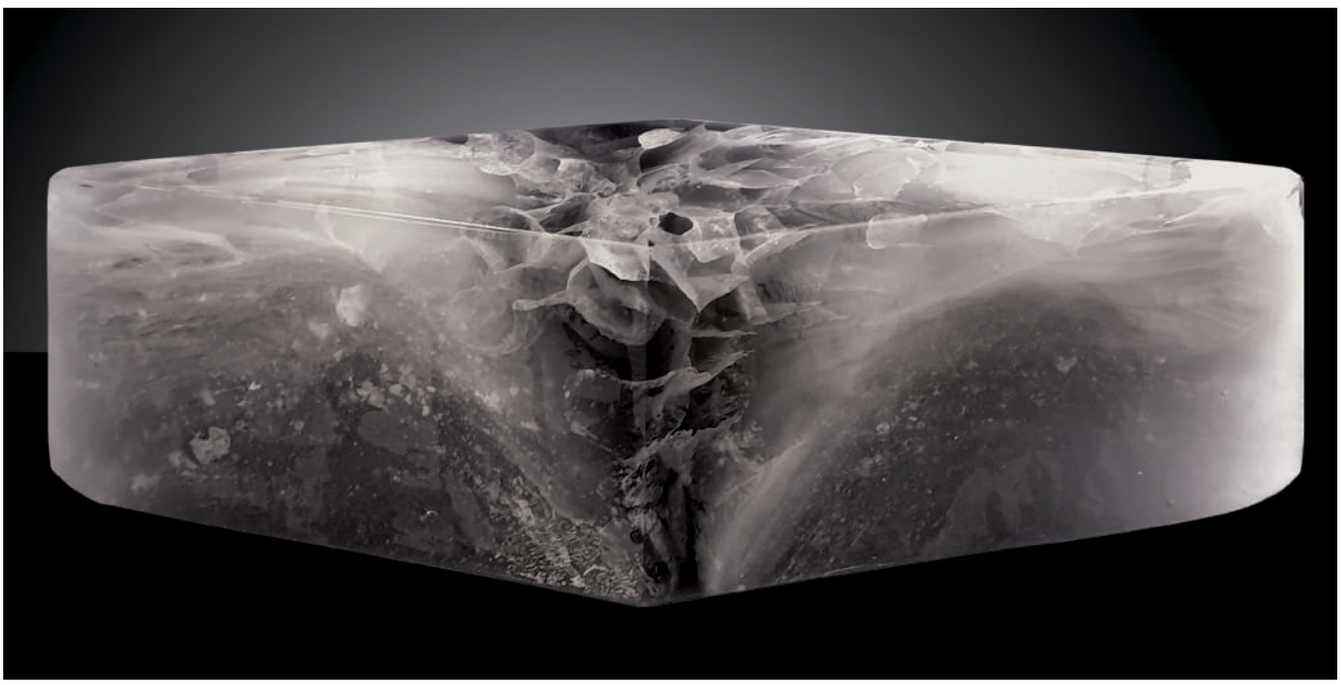


Figure 5. Gregory Alliss, Transparent Flow, kiln cast CRT Glass, 2019, 14 x 26 x 10cm

Source: Lauren Puckett

Studio, based in Nairobi, Kenya, in collaboration with researcher Julie Ross, ran a series of funded workshops for local women from Kibera in 2018. The workshops introduced transferable art glass skills such as glass mosaic and bead making, to empower local women through glass making. Transglass, based in Guatemala City, in Central America, was originally set up by Emma Woffenden and Tord Boontje in 2005. It is a micro-enterprise that creates recycled glass products made by young people who are taught the transferable skills of glass cutting and polishing. Both of these glass studios highlight the potential that glass has to provide a vital source of income to vulnerable, low-income communities by offering them a route that tackles poverty and unemployment through a micro-enterprise driven by glass making. There are also systemic issues to consider, in caste system countries such as India, Bangladesh and Nepal where glass making is seen as a low status, male dominated profession. People are born into castes and carry out work that has always been carried out by their family. The caste system has had a major impact on glass making in these countries, however, it is changing and in busier urban areas non-caste glass workers are allowed to work in glass, whether or not this allows more equitable or inclusive access to glass is unclear.

Since the inception of the studio glass movement in the 1960s, glass education has spread widely throughout Europe, the United Kingdom, North and South America, the Antipodes and Asia. However, is Art Glass education accessible to all? Many European Higher Education Institutions offer reasonable fees or free education to resident students, however, international fees charged to study glass can be extremely high. It is this factor that has always restricted and inhibited access to those who wish to study glass, which has resulted in a lack of diversity and inclusivity. In the UK, widening participation schemes are in action, campaigns such as the Crafts Council *Make Your Future* [2] recognises that craft education in the

Figure 9.6. Jessamy Kelly, Waste Glass Landscape, Recycled glass, Bombay Sapphire Gin Bottle (lost wax cast, kiln cast glass, diamond cut and finished), 2020, 18 x 8.5 x 48 cm

Source: Jessamy Kelly

UK is in crisis. The project has made considerable contributions to the field since its launch in 2014.

The recent Crafts Council England 2021 report, *Making Changes in Craft* [3], laid bare a review of racism and inequality within the UK Craft sector. The key findings in the report revealed the narrowness of the craft canon, the lack of alternative histories and narratives in craft; an urgent need to de-colonise the craft curriculum and the lack of initiatives to nurture Black and ethnically diverse makers. Examples of Racism and micro-aggression in craft spaces were also evidenced in the report findings. Finally, the perception of craft as a career was an issue. Many were discouraged from a career in craft by their families who viewed it as low paid, unstable work. Problems with the curriculum were also highlighted, with many courses dominated by a white, Eurocentric history. The report is an important move in the Crafts; how the Art Glass responds to this will be an important challenge to the field.

Hot glass workshops and factories have historically been a prime space for gender inequality, with men often dominating the field of blown glass in particular. In past decades, many renowned international educational centres for glass making have profited from essentially male only displays of macho, technical prowess in front of large audiences, often side-lining female counterparts. In the last decade, things have started to change with many glass artists challenging the *status quo* and taking their work to new professional and often performative levels. Glass artists such as Danish artist Maria Bang-Espersen have refreshed the field with their astounding technical and experimental displays in glass. She actively challenges restrictive norms and established hierarchies through her work (Figure 7). Other artists that are actively challenging the *status quo* are El Cocal Glass Studio, a collective of all young women glassblowers based in Murano, Venice, a place renowned for its male dominated environment. They call themselves the Vetraie Ribelli, 'Rebel Glassmakers'. The premise of their studio is simple— to eradicate a common prejudice that the profession of a glassblower is not suitable for women.

The recent winner of 'Blown Away', a glass blowing competition aired by the online streaming service Netflix, is also a timely example. Deborah Czeresko, a feminist glass artist won the show in 2019 with her inclusive approach, through her sharp social commentary wowing audiences with her free blown glasswork, which combines traditional Venetian techniques mixed with her own social commentary on contemporary feminist issues. Czeresko's 'Man-Bun in the Oven' project, created an external womb for men to wear to gestate and her feminist take on breakfast, which included a fecund fried egg and a chandelier of sausage links. Czeresko is a role model to many within the LGBTQIA+ community and is keen to elevate the role of women in the field. She is well aware of the decades of patriarchy that has freely flown through the studio glass movement, stating: "While there are more women coming into the glass world now than ever before, it's important to keep this momentum going and for women to begin occupying a space that's been historically very macho" (Czeresko, 2019) [4].

Unique narratives and social commentary by women for women, that speak out about feminist issues through the medium of art glass is an exciting juncture for the Art Glass world. What is needed within the field is a wider range of voices, as teachers, mentors and role models to inform

Figure 7. Maria Bang-Espersen, International Glass Prize in Lommel, Belgium (2012)

Source: Kristof Vrancken

Figure 8. Choi Keeryong, 'Dam-Dah', kiln formed glass, 23.5ct gold leaf 2019

Source: Choi Keeryong

and lead the future generations of the international art glass movement. In reviewing the field of Art Glass, we still have a long way to go in terms of gender equity and diversity with many artists still discriminated against, under-represented and under-valued. Exhibitions, conferences and workshops are vital in raising awareness of the professional, high-level calibre of glass artists who are out there, possibly undiscovered. Finding new ways to represent them is a vital way to give their workspace to be seen and their voices heard. Exhibitions such as 'Unbreakable: Women in Glass' in Venice (2020) presented by Berengo Studio, which displayed a range of contemporary female artists working in glass. We should treasure spaces in which female artists are able to take centre stage… Many people in the art world would like to believe that we have achieved parity but the truth is we still have a long way to go. This is why spaces celebrating female artists remain so essential (Sterling, Fondazione Berengo Art Space, accessed online 31.08.20).

The 'New Glass Now' exhibition held in 2019 at the Corning Museum of Glass featured a wide range of female and intersectional artists, of the 100 selected artefacts 59 were by women. Notably, within this exhibition was a project by glass artists and educators Karen Donnellan and Suzanne Peck. In their 2017 lecture, "Blow Harder: Language, Gender and Sexuality in the Glass Blowing Studio" delivered at the Glass Art Society Conference in Norfolk, Virginia, they studied the vocabulary of the hot shop and proposed an alternative lexicon of terms that question the power dynamics, safety and inclusivity of glassblowing. Another notable work included in this exhibition is that of South Korean glass artist Choi Keeryong, whose work deals with otherness —the quality or state of being other or different. He debates the subject of cultural expectations

Figure 9. Jeff Zimmer, 'To Love You in Shadow', kiln formed glass, 29.5 x 51cm

Source: Shannon Tofts

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through his work (Figure 8) and is inspired by his personal experience of being in a state of cultural in-betweenness, in terms of his current cultural location (Scotland) and his cultural origin (South Korea).

In 2020, North Lands Creative launched their online campaign — *Glass Lives Week*, with a range of films, podcasts, interviews and exhibition that showcased the diversity of the field [5] and celebrated a wide intersection of UK and European glass artists. This included Christopher Day, a glass artist of mixed English and Jamaican heritage. His recent solo exhibition at Vessel Gallery London 'Blown, bound and Bold' (2020) powerfully explored the treatment of black people in the UK and USA. His work references the 18th century slave trade and the social upheaval and events leading up to the American civil rights movement. In a recent podcast he was able to talk about how he became empowered through glass education, during his time at the University of Wolverhampton [6]. Also of note, is the work of Edinburgh-based, American Glass artist Jeff Zimmer who came second in the European Glass in Context (2021) Exhibition at the Bornholm Art Museum, Denmark with his glass work the "Shadow/Shelter", an exploration of the lives of LGBTQ+ people in and from Caithness, a place in the extreme north of Scotland (Figure 9).

In summary, by defining the far-reaching effects of the international Art Glass movement, it is hoped that this text has offered an engaging and exciting space for us to celebrate the contribution that Art Glass brings to the UN Sustainable Development Goals. We should also take reassurance in an advanced community of glass artists, educators, curators, writers, collectors and enthusiasts who are finding new ways to express, represent, connect and make diverse voices heard. As well as the opportunity to introduce the powerful narrative of Art Glass to a new audience through the distinct social, political and environmental commentary of the discipline ■

REFERENCES

1. https://www.glassart.org/programs/exhibitions/ virtual-2021-green-exhibition
2. https://www.craftscouncil.org.uk/learning/education/ make-your-future
3. https://www.craftscouncil.org.uk/documents/1512/Making_Changes_in_Craft_-_Craft_Expertise_ Phase_One_Report_2021.pdf
4. https://www.theartnewspaper.com/2019/10/04/ glass-artist-deborah-czeresko-wants-to-elevate-the-role-of-women-in-the-field
5. https://northlandscreative.co.uk/event/glass-lives-week/
6. https://podcasts.apple.com/gb/podcast/chris-day-on-glassblowing-the-black-experience-and/id1450375359?i=1000533981567 ■

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