Low-carbon biofuels for industrial heating

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Use of biofuels for industrial heating applications: Why this is a good option to consider

- **Compatibility with existing infrastructure:**
  - Most industrial furnaces and kilns can already operate on gaseous and/or liquid carbon-based fuels (or can be adapted with minimal CAPEX), so biomass offers a potentially lower cost, less risky, quicker route than e.g. switching to hydrogen or full electric, which require new infrastructure e.g. burners, transformers, refractories etc.
  - Biomass can be transported by truck, mitigating the need for expensive national infrastructure upgrades (e.g. H2 pipeline or new electricity substations)
- **Opportunities for BECCS**:
  - Given the scale, furnaces and kilns can make it more cost effective to incorporate carbon capture (either pre or post combustion), so provides a promising route to BECCS
- **Access to waste heat:**
  - Waste heat from the furnace/kiln can be used to improve the efficiency of the biomass conversion processes (thus improve economics and energy security)

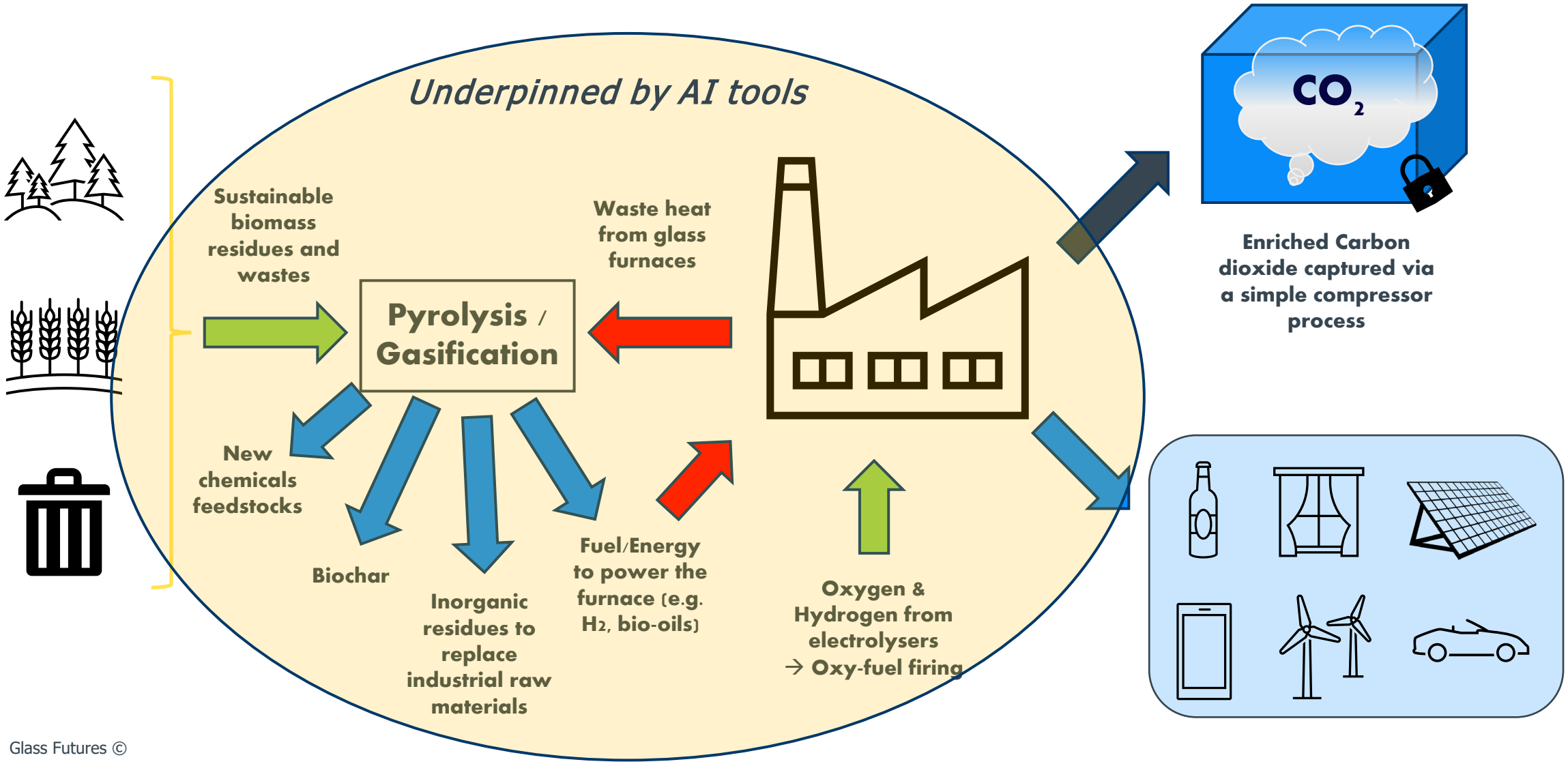
Use of biofuels for industrial heating applications: Challenges to overcome

- **Economics**: Cost effective sources of biomass (need to factor in preprocessing (e.g. removing moisture) and transportation), and CAPEX investments
- **Availability**: Need to be available in the required volumes, typically >100kT/year per site
- **Variability of feedstock properties**: Industrial processes like consistency, new methods will be required for managing variable feedstock properties and calorific values
- **Contamination**: Methods for managing contaminants in biomass will need to be developed (e.g. ashes, acidic species, halogens)
- **Skills**: New skills will be required to deploy and run biomass plants

Use of biofuels for industrial heating applications: Opportunities to maximise value

- **Utilising waste heat** to maximise efficiency of processing/converting biomass into fuels (e.g. use waste heat from furnace to preheat/dry biomass, then put hot outputs from biomass reactor directly into the furnace/kiln)
- **Improving the economics** of the process through producing **high value co-products** (e.g. proteins, chemical precursors or solid-carbon derivatives, rather than just combusting everything)
- **Integrating carbon capture** into the process (e.g. through production of biochar);
- **Use of AI** be to optimise the process (e.g. manage any variability in biomass feedstock to ensure consistent energy input into furnace/kiln)
- **Design for flexibility** e.g. ability to turn up/down so that a furnace/kiln can increase/decrease electricity usage to help balance local energy grids

Maximising the value of biomass for industrial heating…



OPPORTUNITIES TO COLLABORATE WITH INDUSTRY

- Facilitate industrial engagement
- Pilot scale demonstrations
- Market engagement & insights
- Techno-Economic assessments
- Expertise and advice

WHO WE ARE

We were built by the glass industry, for the glass industry to create the Global Centre of Excellence to make glass the low carbon material of choice.

Conceptualized in 2014

First major funding in 2020

Furnace started in 2025

Non-Profit, Membership Organisation

Research and Technology Organisation

Leading the global shift to sustainable manufacture

MEMBERSHIP

Glass Futures

encirc

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GUARDIAN GLASS

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SIEMENS

AGI GREENPAC

ArdaghGroup

KNAUF INSULATION

SINA MEDICAL GLASS

RYZE HYDROGEN

merkle international

Calumite

Wiegand-Glas

dsf

MOLSON COORS beverage company

F.I.C. (UK)

AGC

STOELZLE GLASS GROUP

Magma

SEFPRO

GRENZEBACH

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EDRINGTON

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STARA GLASS

LAND

Sheffield Hallam University

UNIVERSITY OF CAMBRIDGE

THE WORSHIPFUL COMPANY OF GLASS SELLERS OF LONDON

British Glass

Net Zero North West

UNIVERSITY OF LIVERPOOL

UNIVERSITY OF LEEDS

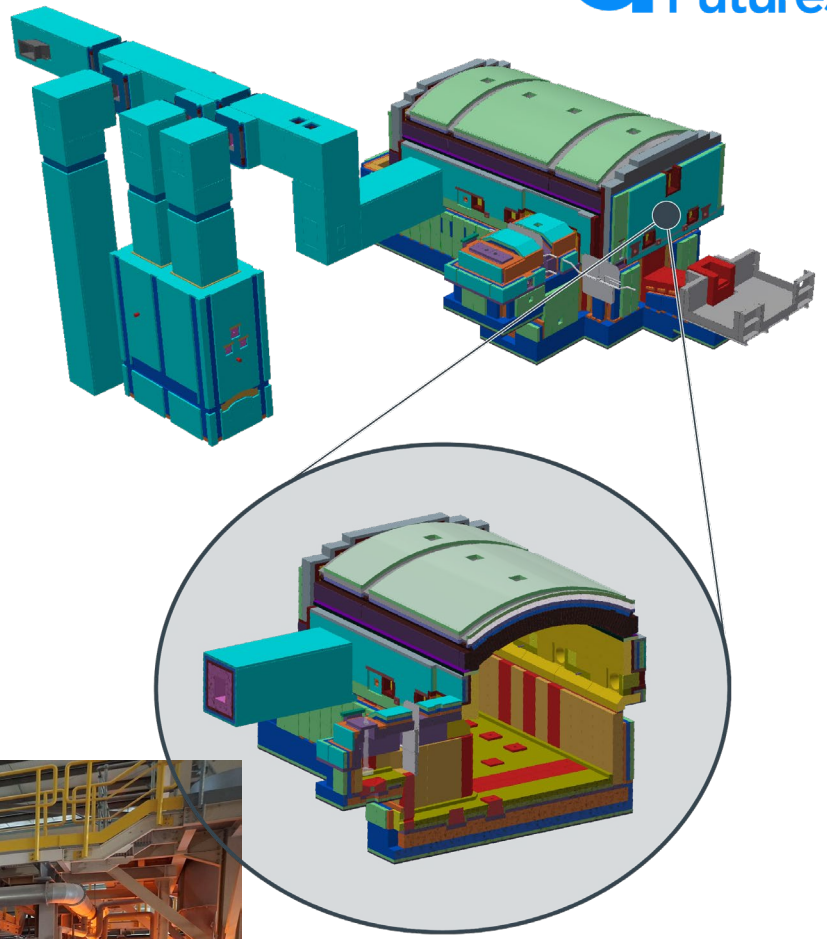
binkyo

Glass Technology Services

The University Of Sheffield.

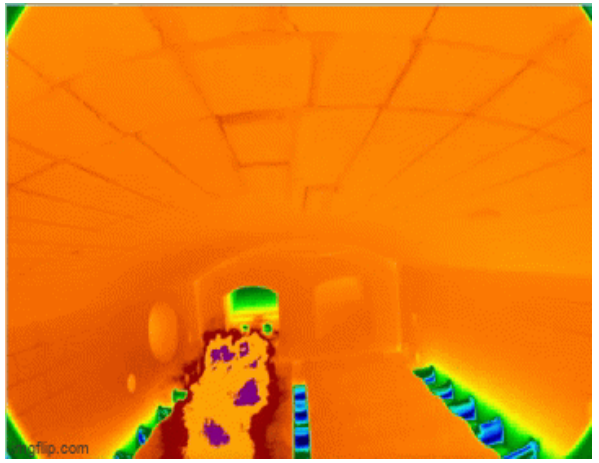
Pilot-scale Furnace

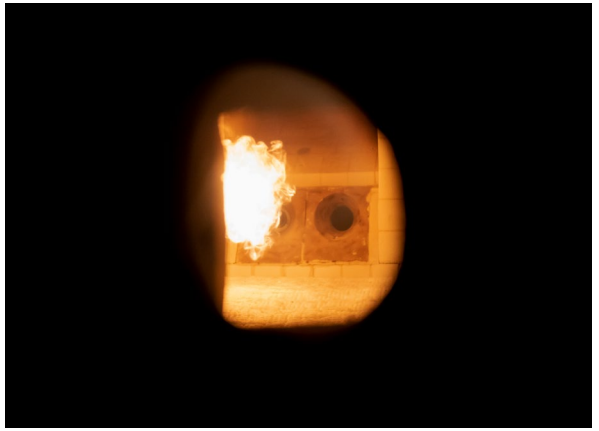
- Output: 30 tonnes/day
- Furnace can be fired on biofuels & hydrogen
- Can be fitted with waste heat recovery systems
- Capability to integrate carbon capture technologies onto the exhaust



Hydrogen Ceramics kiln

Hydrogen Combustion Test Bed



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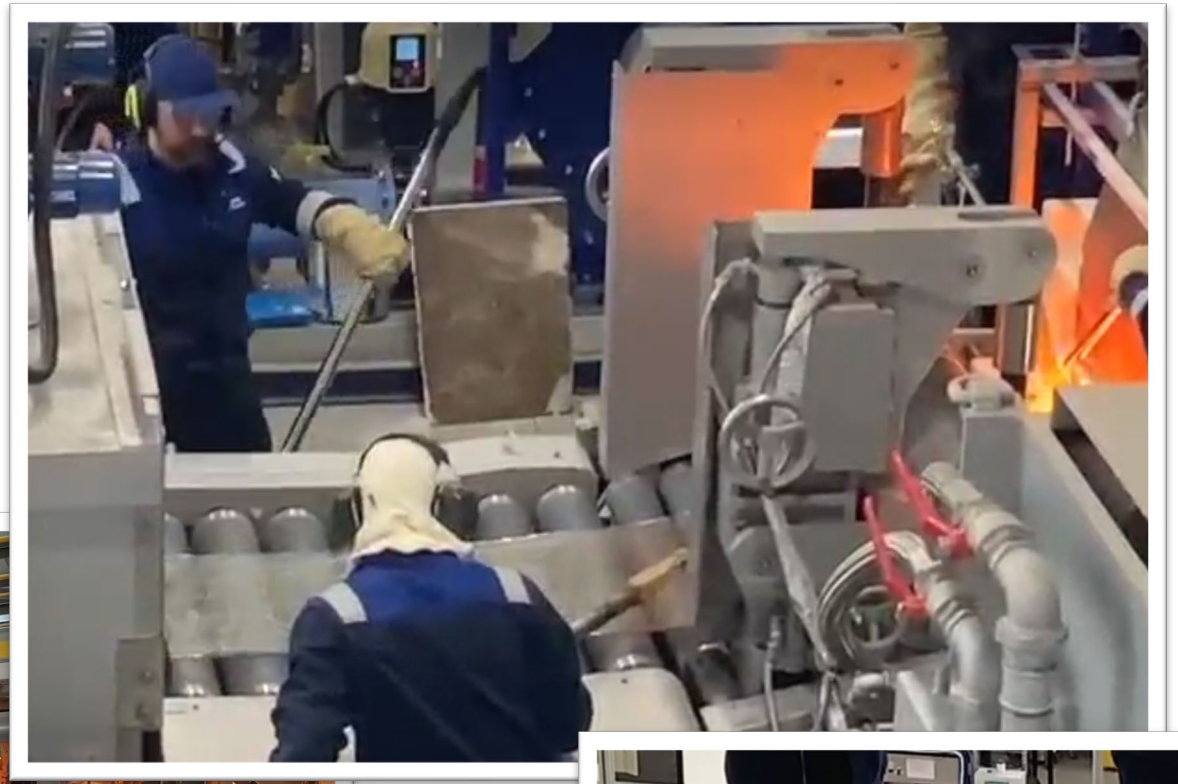
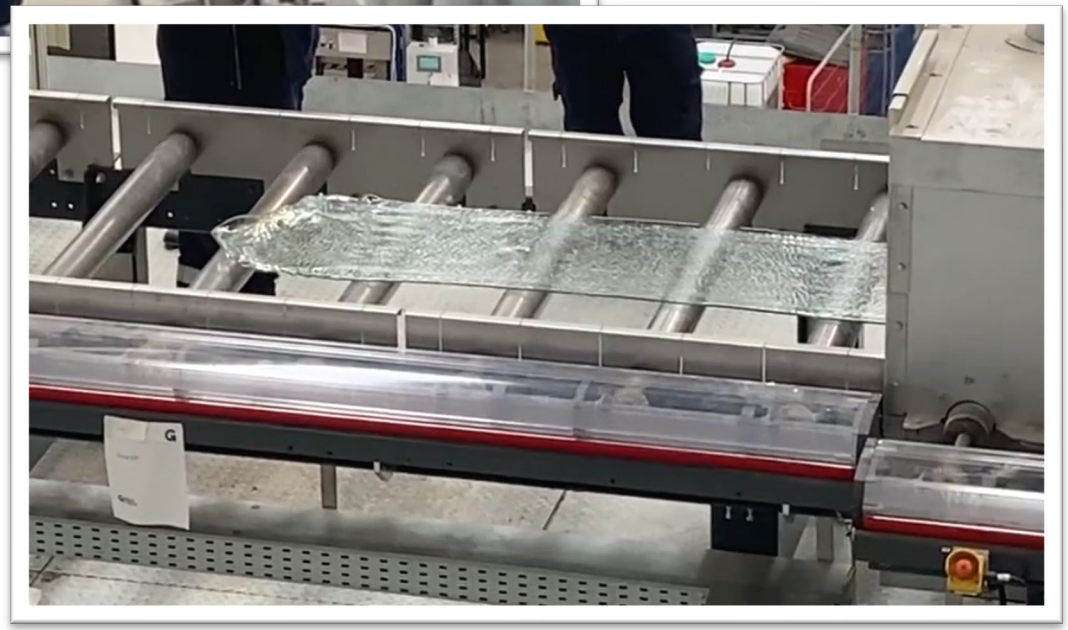
Photos from pilot plant commissioning process





THANK YOU

ANY QUESTIONS?

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