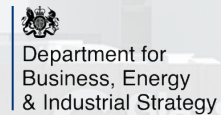




Hydrogen and Decarbonising The Glass Sector

Dr Palma González García,
Innovation Programme Manager

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Innovation Programme Manager



UK Research
and Innovation



INDUSTRIAL
STRATEGY



LIVERPOOL
CITY REGION
COMBINED AUTHORITY

METROMAYOR
LIVERPOOL CITY REGION

STRATEGIC INVESTMENT FUND

THE GLOBAL CENTRE OF
EXCELLENCE FOR GLASS
IN R&D, INNOVATION AND TRAINING

Glass An As Enabler



Pharmaceuticals

Defence and aerospace



Optics and
telecommunications

Power generation

What We Do

Glass is **under threat** as a material. Whilst being **infinitely_recyclable**, manufacturing is still **carbon intensive**. We need new solutions for **different regions across the world**.

“Insanity is doing the same thing over and over again and expecting different results”
Albert Einstein



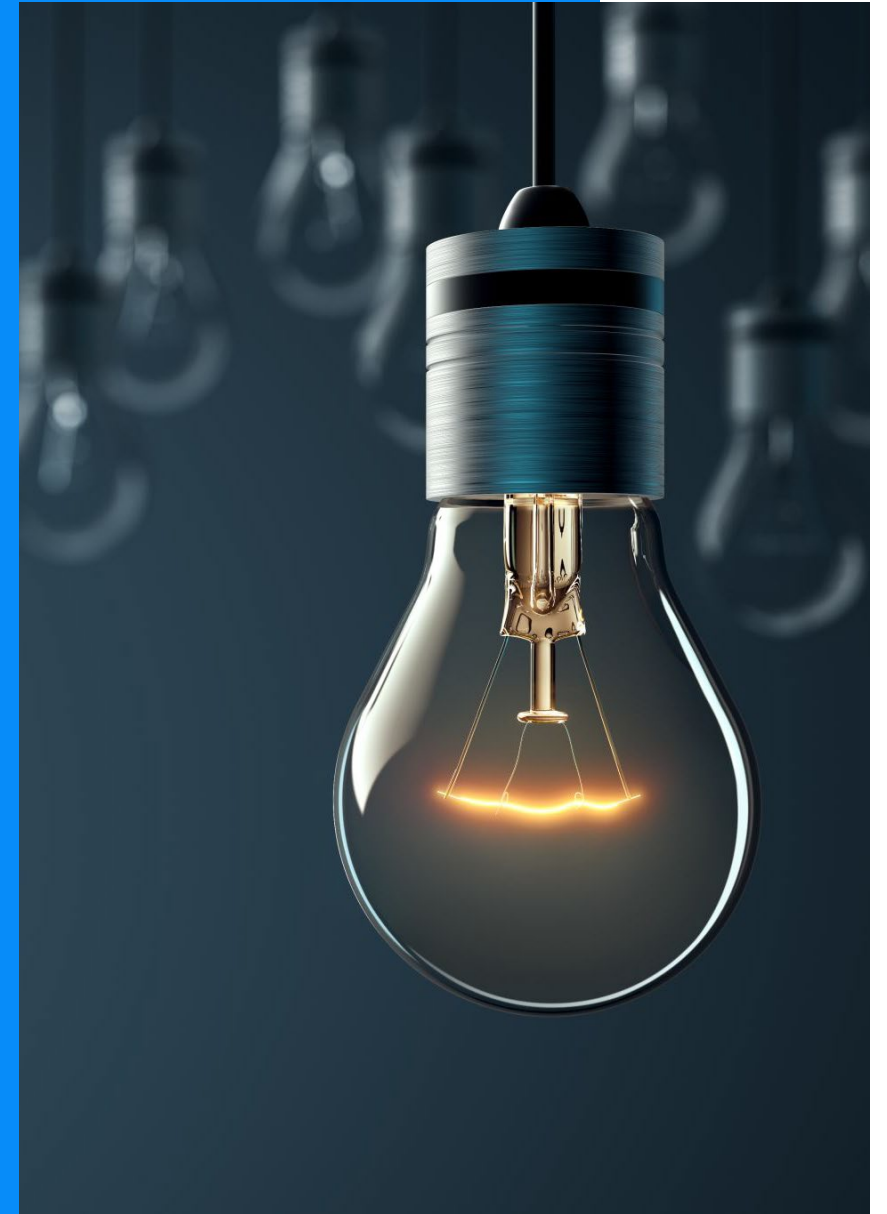
What We Do

No More Small Improvements We Need **Disruption**

This is why Glass Futures exists, we are here to be disruptors through collaboration and technical innovation.

Glass Futures is a new approach to deliver high impact, techno-economic change.

- Have a clear route to market for new technology
- Create unique glass research capability
- Bring different sectors together



The Partners

Network Space

Landowner and developer, also securing £12m private sector/institutional investment towards construction costs with a freehold and lease sale

network
space

UKRI

£15m through Transforming Foundation Industry (TFI) Challenge fund for fit out and commissioning of R&D facility



BEIS

£7.1m Industrial Fuel Switching contract secured



St Helen's Borough Council

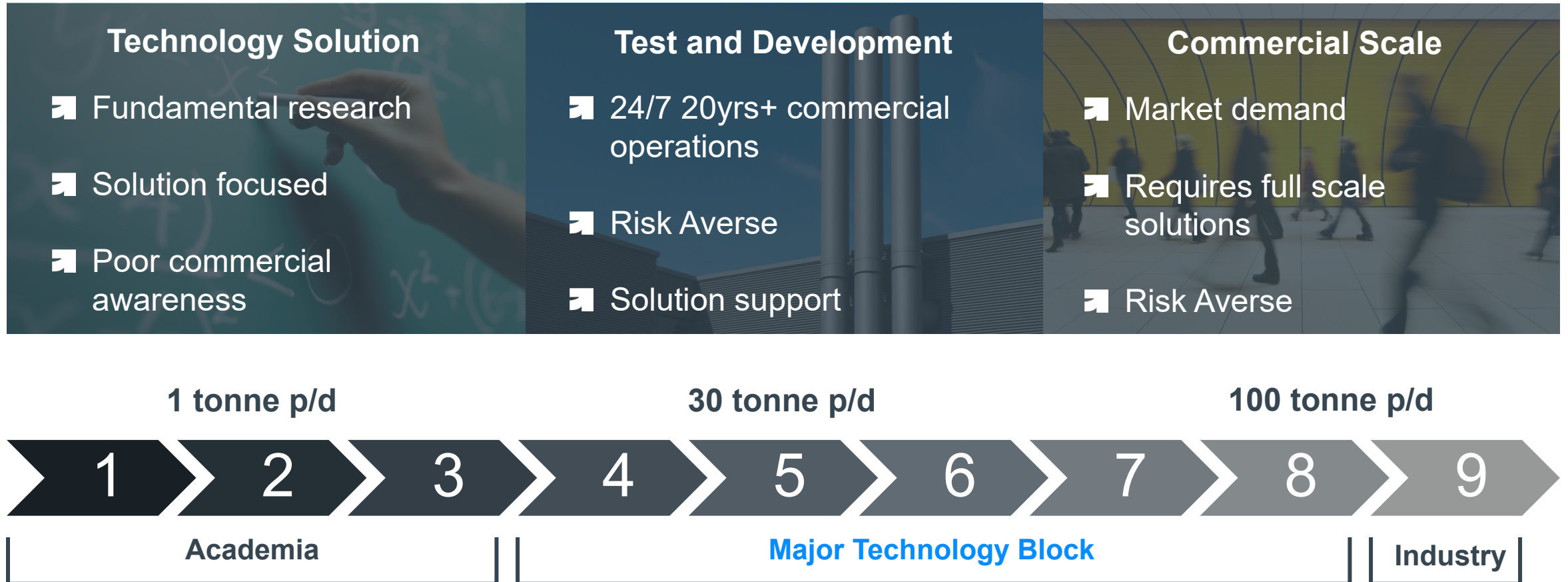
Supporting pre-development works



Liverpool City Region Combined Authority

£9m towards construction

Bridging The Technology Readiness Level (TRL) Gap





Pilot Facility: St Helens, UK

- Phase 1: 30T/day glass R&D capability
- Scope to develop a second line
- Designed to encompass all new technologies
- Benchmark low-carbon fuels:
 - Natural Gas
 - Hydrogen
 - Electric
 - Bio-fuels
- Open-Access
- Due to be commissioned: 2023

Key Technology Themes

Circular economy enablers – Driving towards very high recycled content, not just from cullet

Compositions and coatings.
Demonstrating improved strength and radical light weighting

RE USE
Smart packaging, Re-Use and new business models to market faster

Industry 4.0 implementation for secure supply chains and more business intelligence

Heat recovery and carbon capture demonstrations to reduce industrial impact

Low carbon fuels to drive low carbon manufacturing faster

G

The Journey So Far

2012

A vision was created to address an urgent industry need

2013-2018

Foundation members join the mission

2019

- ▣ First funded projects
- ▣ More members join the cause
- ▣ £7.1m low carbon contract from BEIS

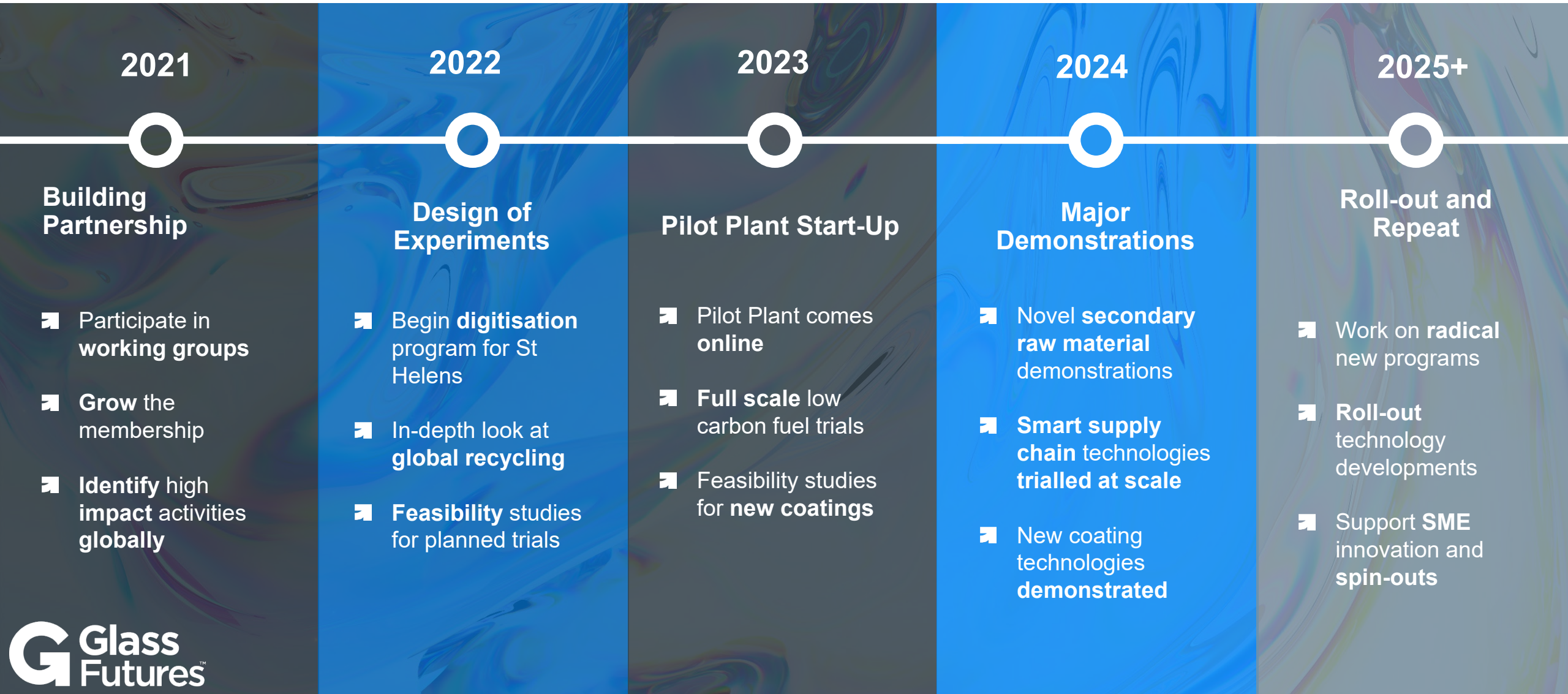
2020

- ▣ First GF employees
- ▣ £25m funding secured
- ▣ Design of experimental facility commences

2021

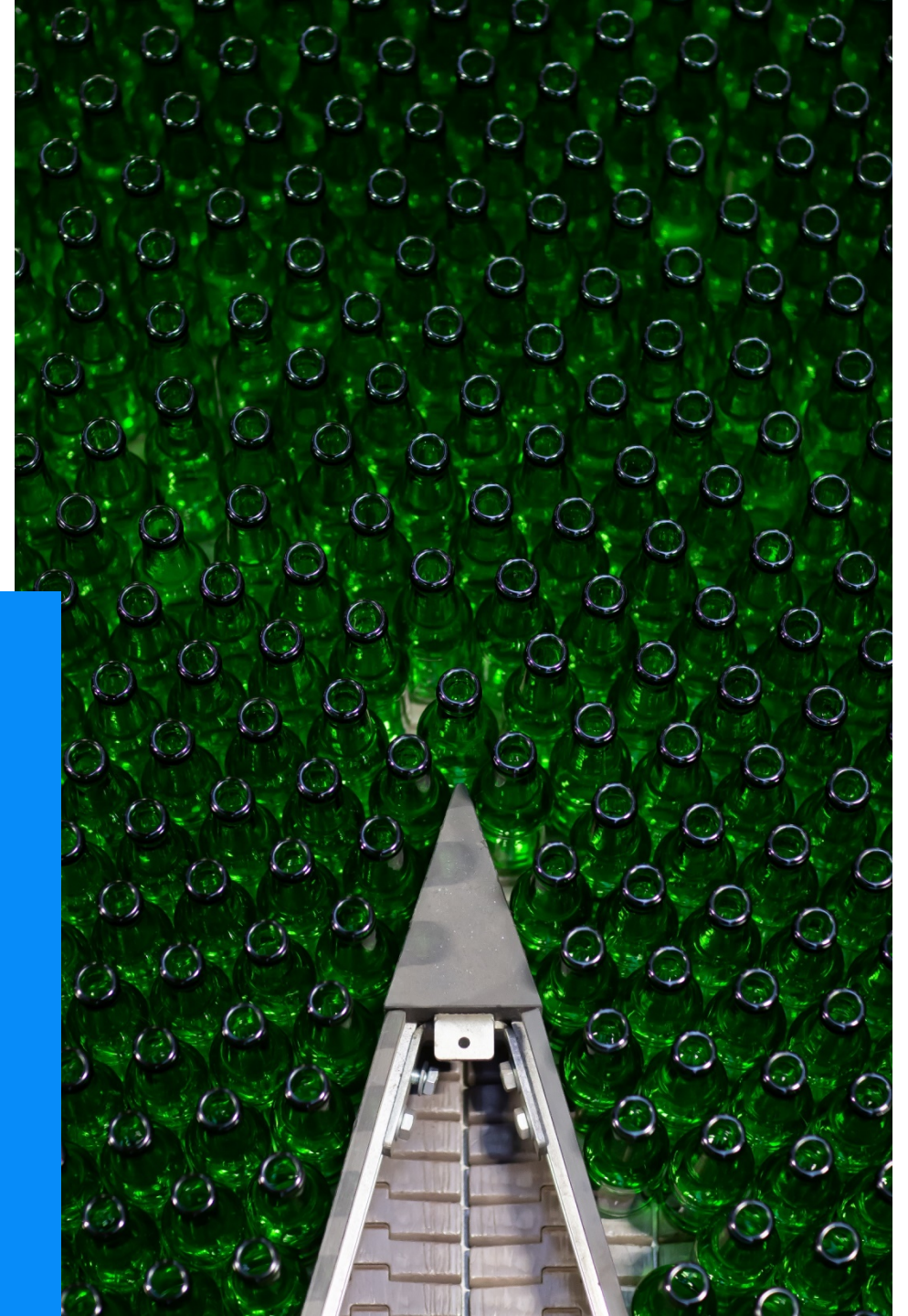
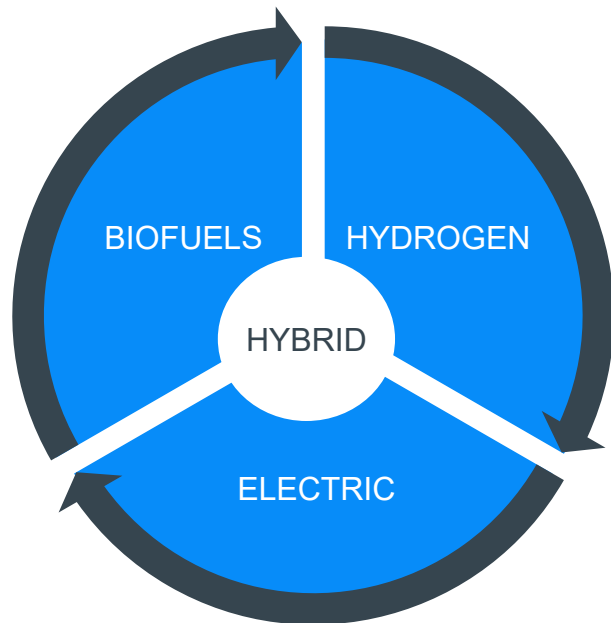
- ▣ Membership launched
- ▣ The 15th GF employee recruited
- ▣ Successful major ultra low carbon trial

Looking To The Future



Industrial Fuel Switching Programme

- £7.1m BEIS funded project
- Key first major project started in Jan 2020
- Partners from industry, supply-chain and academia





Industrial Fuel Switching (IFS): Approach



TECHNICAL



ECONOMICS



H&S



ENVIRONMENTAL

Pilot-Scale Tests

- CelSian HTMOS: Hydrogen glass melting studies
- DNV: Oxyfuel & Hydrogen trials
- 350kW combustion test-rig: Natural Gas, Hydrogen, Biofuels and blends

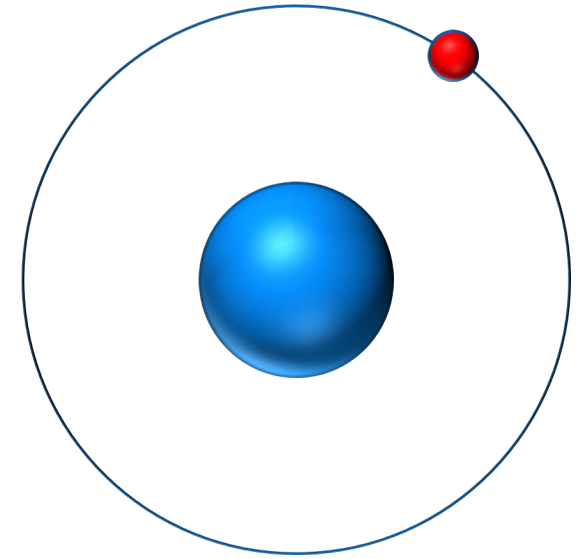




Up-Scaling Technologies

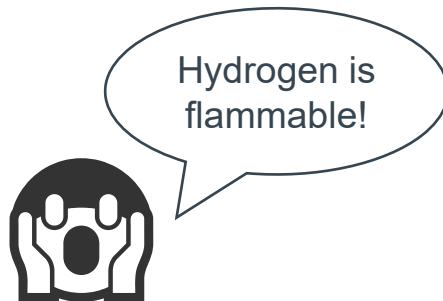
- 100% funded, 3 week Biofuel Trial on commercial manufacturing plants
- Study into converting a commercial glass plant from natural gas to hydrogen (H&S, economic, engineering)
- Computer modelling of fuel scenarios

Hydrogen, An Amazing Molecule



- The most abundant molecule in Universe
- Can't be found on Earth's atmosphere
- Must be produced
- Most common production technology – SMR
 - Downside is CO₂ as by-product
 - Green hydrogen production – solution for carbon-free power in the future

The Fear Of Hydrogen: A Myth To Be Broken



Can You Imagine A Clean Green Future?



The Path To A Clean, Green Future

- Collaboration across academia and industry
- World experts working together
- Disruptive technology





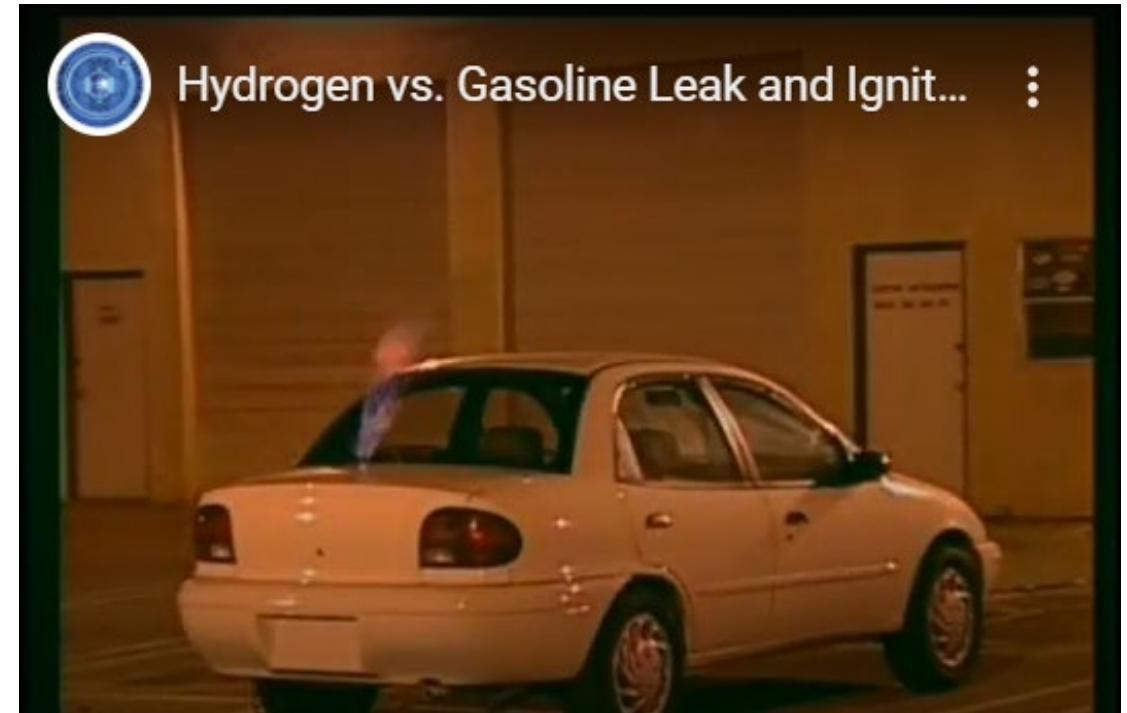
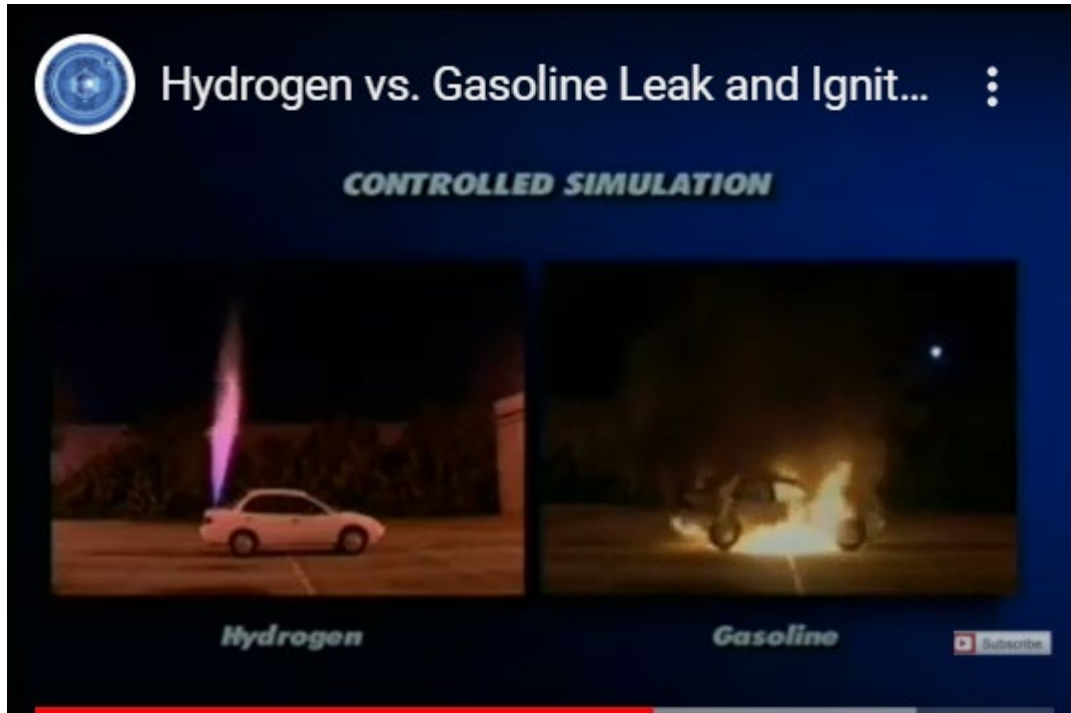
UK Government



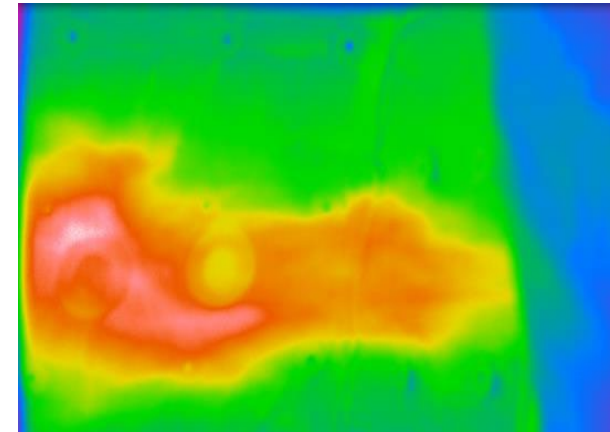
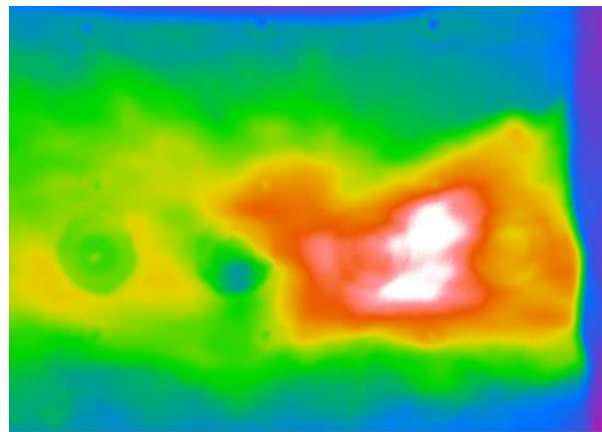
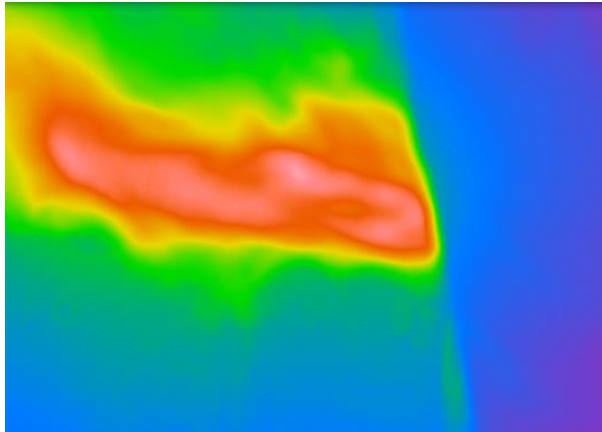
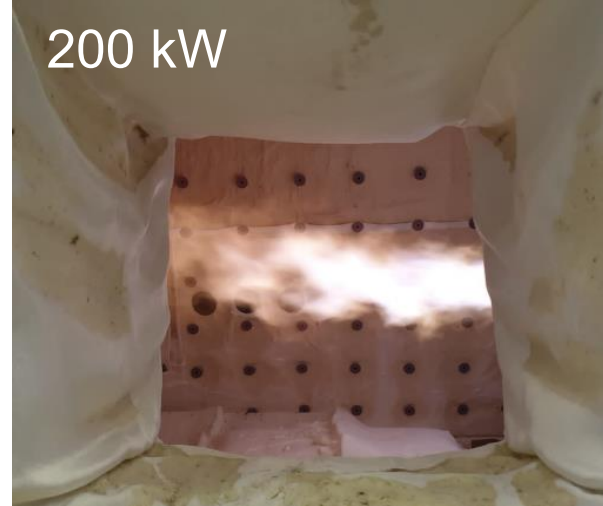
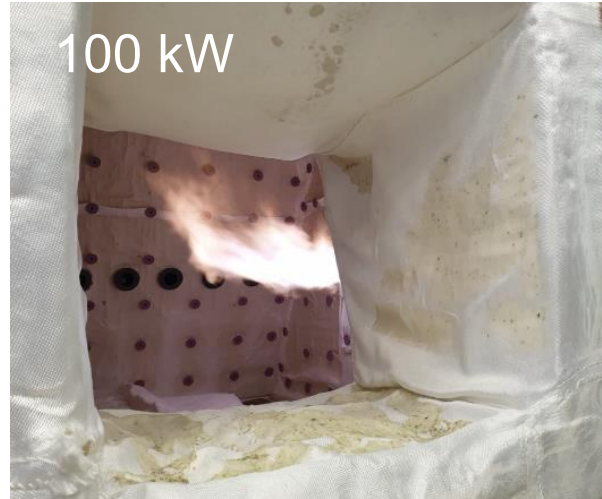
TOGETHER
FOR OUR
PLANET

**REDUCING UK EMISSIONS
BY 78% BY 2035**

Invisible Hydrogen Flames?



Oxyhydrogen Flames

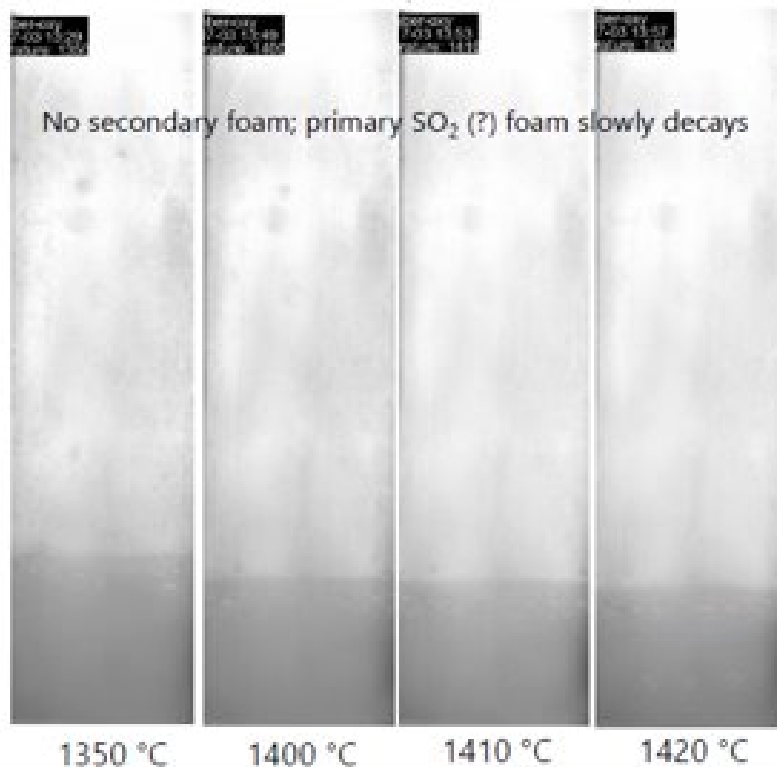


Hydrogen Rich Combustion

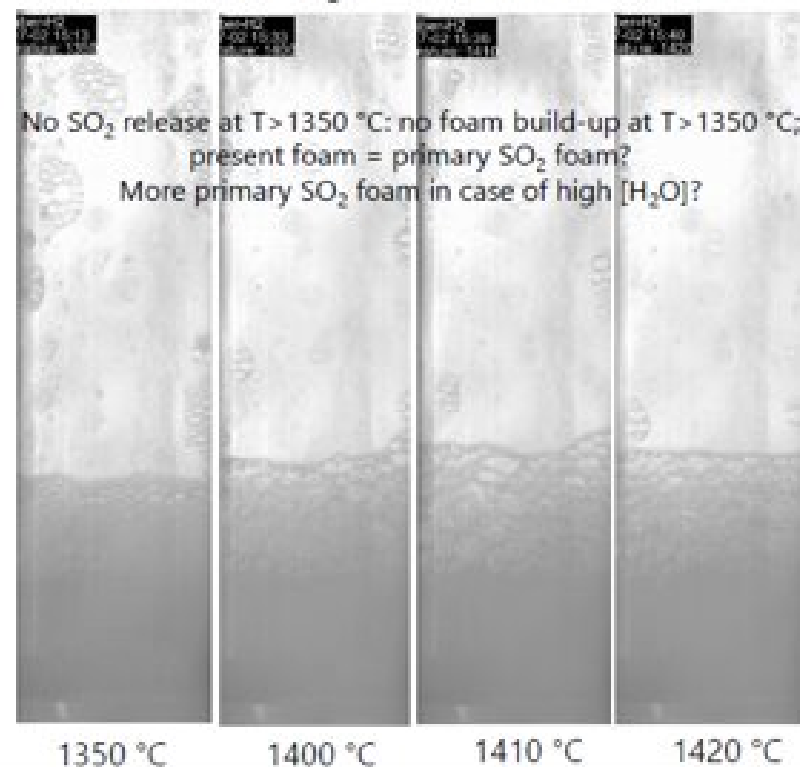


CelSian Amber results: Trail B2 (amber, oxy) and B3 (amber, H₂)

Amber batch in oxy-fuel conditions

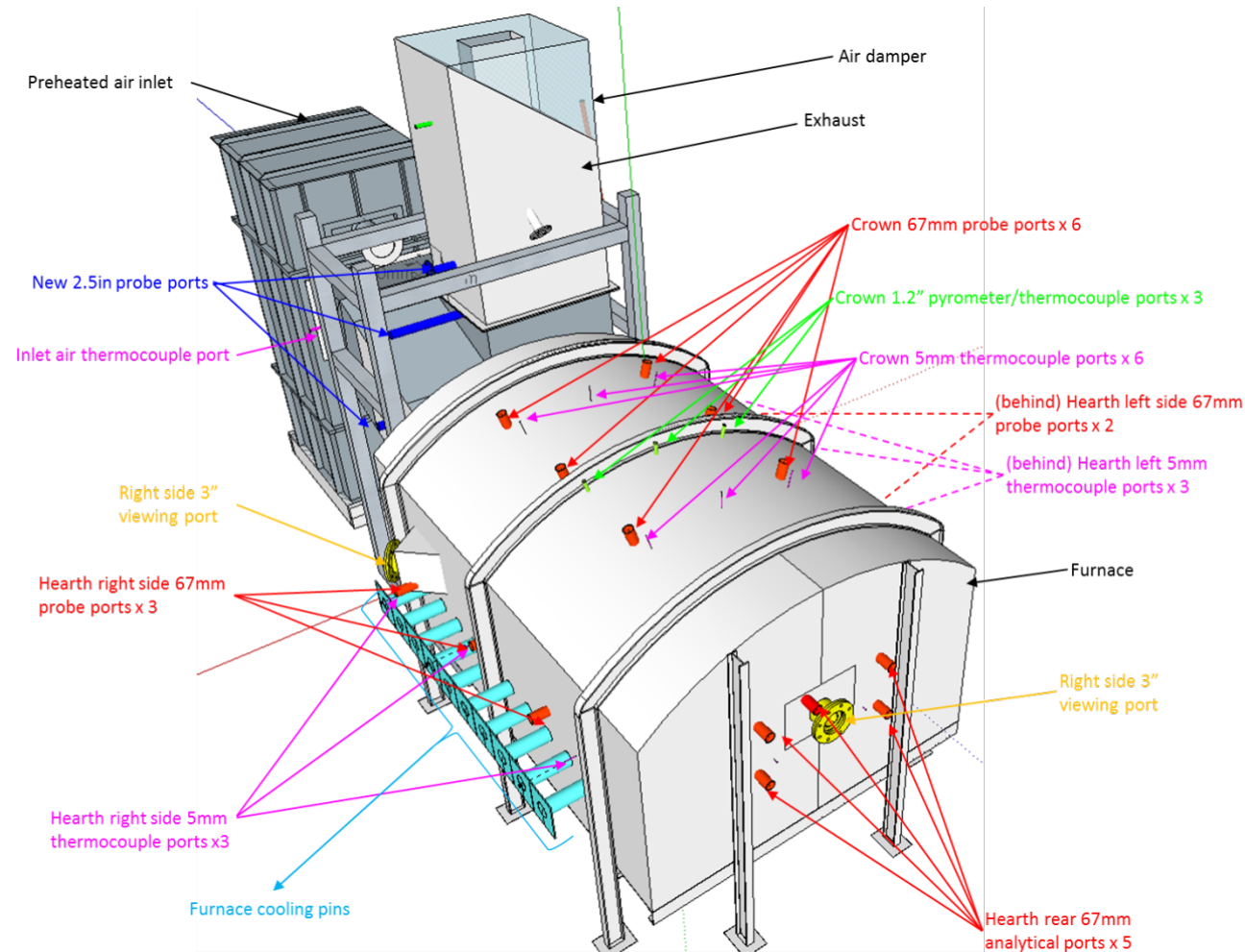


Amber batch in H₂-rich combustion conditions



Combustion Test Bed

350kW combustion test-rig: Natural Gas, Hydrogen, Biofuels and blends



Engagement Opportunities

➤ Designing the St Helens Pilot Facility

➤ Fuel Switching project:

- Economic modelling study
- Future technical developments

➤ Partnering in funding bids

➤ Networking events (across industry, academia and other sectors)

Member of



Supported by



METROMAYOR
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STRATEGIC INVESTMENT FUND



Hydrogen: The Flame Of The Future

- Hydrogen can be safe
- Overcome the misconception together
- Endeavour to become disrupters – it's the only way!



Photograph: Vitaliy Pakhnyushchyy/Alamy Stock Photo

Let's Embrace The Challenge Together

Thank you!

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