PROUD MEMBER OF THE GLASS SERVICE PARTNERSHIP

- Hydrogen and liquid fuel Burners

- Electric Furnaces and Boosting
- Decarbonisation of Furnaces

- NIR Furnaces Cameras

- Process Simulation (CFD)
- ESIII Expert System Control (AI)
- Defect & Bubble Analysis
- Specialized Engineering
- Benchmarking Furnaces (economically& ecologically)
- Raw materials

F.I.C. (UK) LIMITED

OUTLINE/CONTENT

- WHY IS CHANGE HAPPENING?
- EXISTING TECHNOLOGY
- WHAT CHANGES WILL HAPPEN
- HOW WILL IT WORK
- WHERE ARE WE NOW?

WHY ARE WE DISCUSSING NEW FURNACE DESIGNS

Climate change is universally accepted as real

Legislation in Europe

Public perception and customer requirements

Cost of fuels is changing rapidly

HOW DO WE DECARBONIZE?

OPTIONS

BioFuels

Hydrogen

CARBON CAPTURE, UTILISATION OR STORAGE

Electric Melting

BIO-FUELS

It's still producing CO_2

How quickly does it renew?

Efficiency, reliability, price.

Variability of calorific value

HYDROGEN

IT LOOKS LIKE WE CAN USE H2

IT'S GOING TO BE AVAILABLE

WE HAVE BURNERS

IT'S RELATIVELY EASY

HYDROGEN

NO!!! Some major issues!!

Foam

Refining

Price and availability

HYDROGEN

Some major issues!!

Refractories.

HYDROGEN

CONSIDERATIONS

AVAILABILITY

SAFETY

INVESTMENT COSTS

RISK PROFILE

CARBON CAPTURE, UTILISATION OR STORAGE

Glass Futures

More than 20 possible options investigated

IS IT THAT EASY?

SO THE CONCLUSION, SO FAR, IS THAT USING HYDROGEN IN THE GLASS INDUSTRY AS THE PRIMARY FUEL IS PROBABLY THE LEAST LIKELY.

ELECTRIC MELTING

General consensus is that this is only option available long term and is most efficient.

But not as you currently know it.

Horizontal not Vertical melting.

ELECTRIC MELTING

Modelling proved that a Horizontal Hybrid Electric Melter H^2EM is feasible

H^3EM if using Hydrogen

Container 350-450 TPD at 2.7 GJ/Ton

Float 600-800 TPD at 2.9 GJ/Ton

HYBRID MELTING

A hybrid melter is Horizontal Electric Melting.

It has an almost identical footprint.

Unlimited tonnage

Life expectancy 8-10 years

HYBRID MELTING

80% of the total energy is from inglass electrodes

Remaining 20% of energy is top heat

Top heat can be electric elements

Or can be Hydrogen/Biofuels etc.

Top heat is over the refining layer

ELECTRIC MELTING

This proposal has been extensively modelled by us and many others!

STEPS TO HYBRID MELTING

Boost

Superboost

Oxy fuel

Hybrid

HYBRIDS HAVE ARRIVED

- THAT'S THE THEORY BUT WE HAVE TWO IN OPERATION
- MY THANKS TO INTERNATIONAL COOKWARE, CHATEROUX & A CUSTOMER IN INDIA
- INTERNATIONAL COOKWARE FURNACE IS 54% ELECTRIC, REST OXY-GAS
- FURNACE IN INDIA IS CONTAINER AND 38% OF ENERGY IS ELECTRIC

SUPERBOOST

ALL MAJOR INTERNATIONAL FLOAT PRODUCERS ARE TRIALLING BOOST INSTALLATIONS.

ONE IS PLANNING A 12 MW INSTALLATION IN 2024

H^2BRID Furnaces are the Future.

- HYBRID FURNACES MAKE BETTER USE OF GREEN ELECTRICITY
- HYBRID FURNACES ARE MORE EFFICIENT THAN OXY-HYDROGEN
- HYBRID FURNACES HAVE GOOD CAMPAIGN LENGTHS
- HYBRID FURNACES DON'T REQUIRE NEW UNPROVEN TECHNOLOGY
- HYBRID FURNACES ARE LESS RISK THAN HYDROGEN FIRED FURNACES
- HYBRID FURNACES ARE NON POLLUTING. NO CO2 OR NOX
- HYBRID FURNACES ARE MELT AND REFRACTORY FRIENDLY, NO EXTRA FOAM

THE FUTURE OF THE GLASS INDUSTRY

THE FUTURE IS BRIGHT, THE FUTURE IS ELECTRIC.

THANK YOU FOR YOUR ATTENTION

WITH THANKS TO MY CO-AUTHORS

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HANS MAHRENHOLST & THE MODELLERS OF GLASS SERVICE