



Sharing Experience from Practical Demonstrations to Support Hydrogen End-Users and Pathways to Decarbonisation

Wayne Bridger

Sales Manager for Decarbonisation and Hydrogen Applications

BOC Ltd

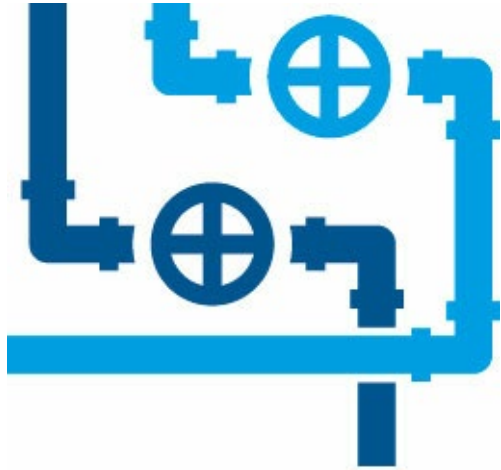
Making our world more productive

 **BOC**
A Linde company



BOC & Linde – Gases and Technologies

Supporting H2 End Users & Decarbonisation Technologies



World's Largest Industrial Gases Company

- Sales at \$31 billion
- Market Capitalisation at \$160 billion
- Activities in 100+ Countries
- 75,000+ Employees
- Investing >\$1 billion per year in Clean

World-leading Supplier of Hydrogen

- Sales \$2.5 billion/year
- Active Across the Whole Value-chain
- Equity Partner of ITM Power Electrolysis
- Building world's largest PEM Electrolyser
- Tripling Clean Hydrogen Capacity by 2028

Provider of Leading Energy Efficient Technologies

- **REBOX®** 180+ installs in Reheating & Annealing
- **IONIC Compressors** Leading refuelling technology
- **CoJet®** 70+ installs in Electric Arc Furnaces
- **OXYGON®** 200+ installs in Ladle Preheating

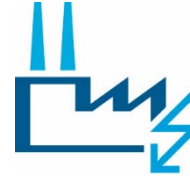
Options for industry - three pillars of decarbonisation



Fuel Switch



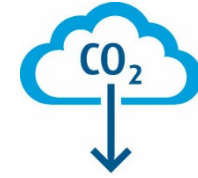
Fuel Switching to hydrogen



Electrification



Low carbon Energy



CCUS



Linde carbon capture plant

Key Themes



Not Only About H2
Supply – Energy
Efficiency First...



Process Focus –
Oxygen is 1st
Decarbonisation
Gas

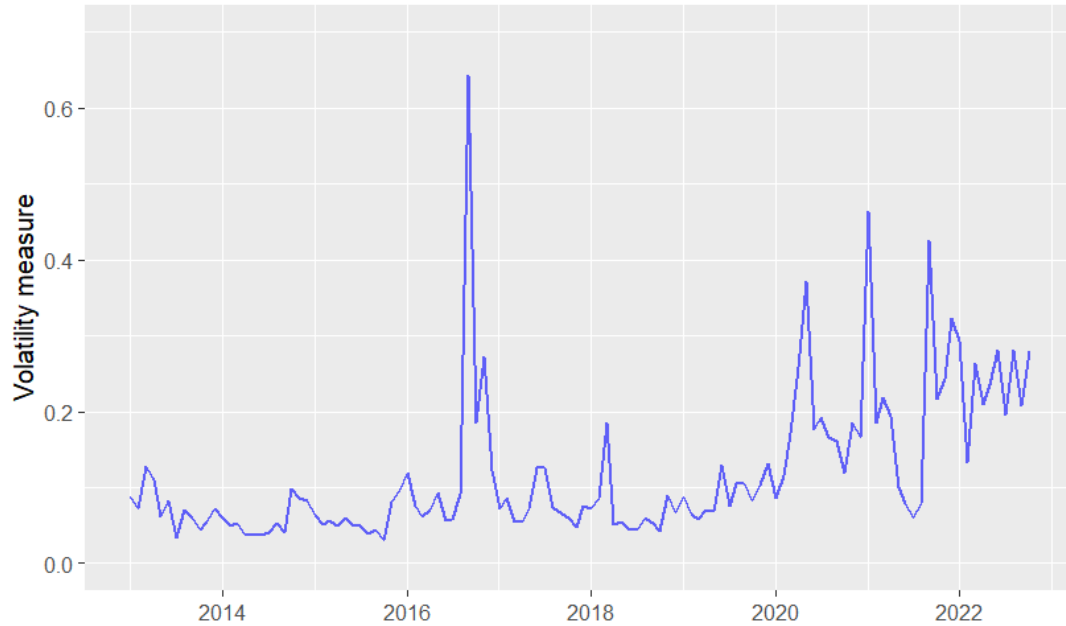


Build Experience –
Trials are Essential
to Successful
Transition

Energy price volatility - impacting business planning

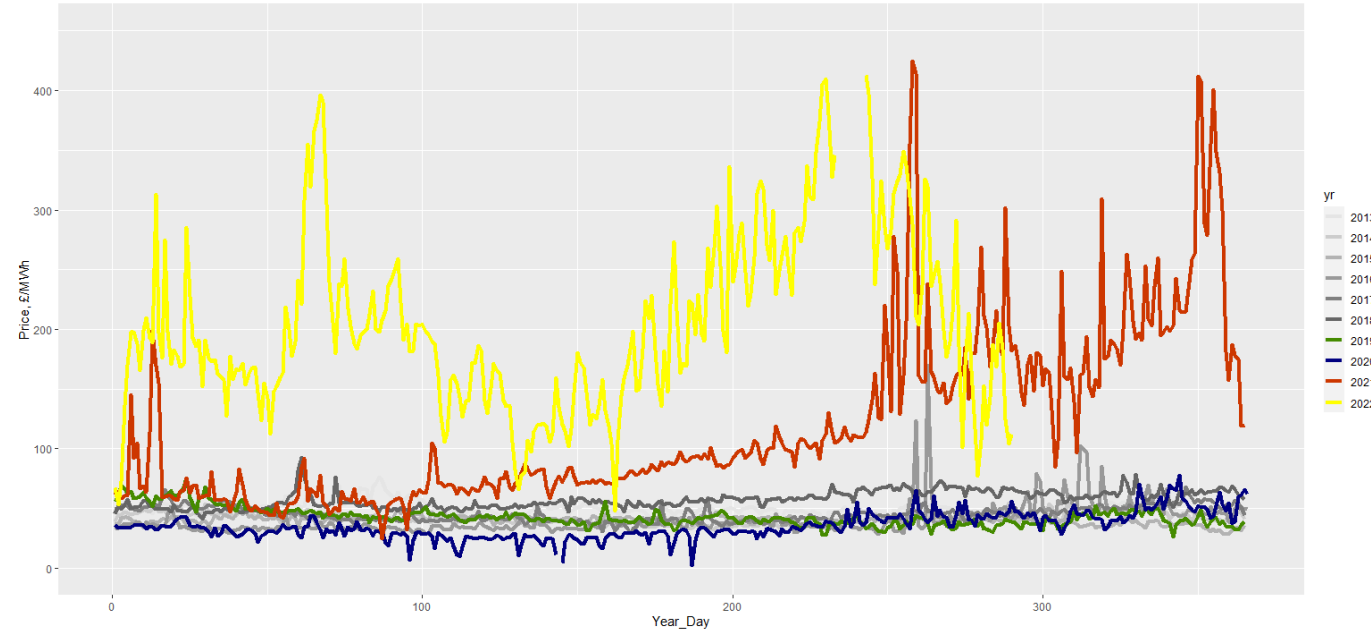
Price volatility

N2EX Monthly StDv of Daily Prices - Normalised on Monthly Mean Price



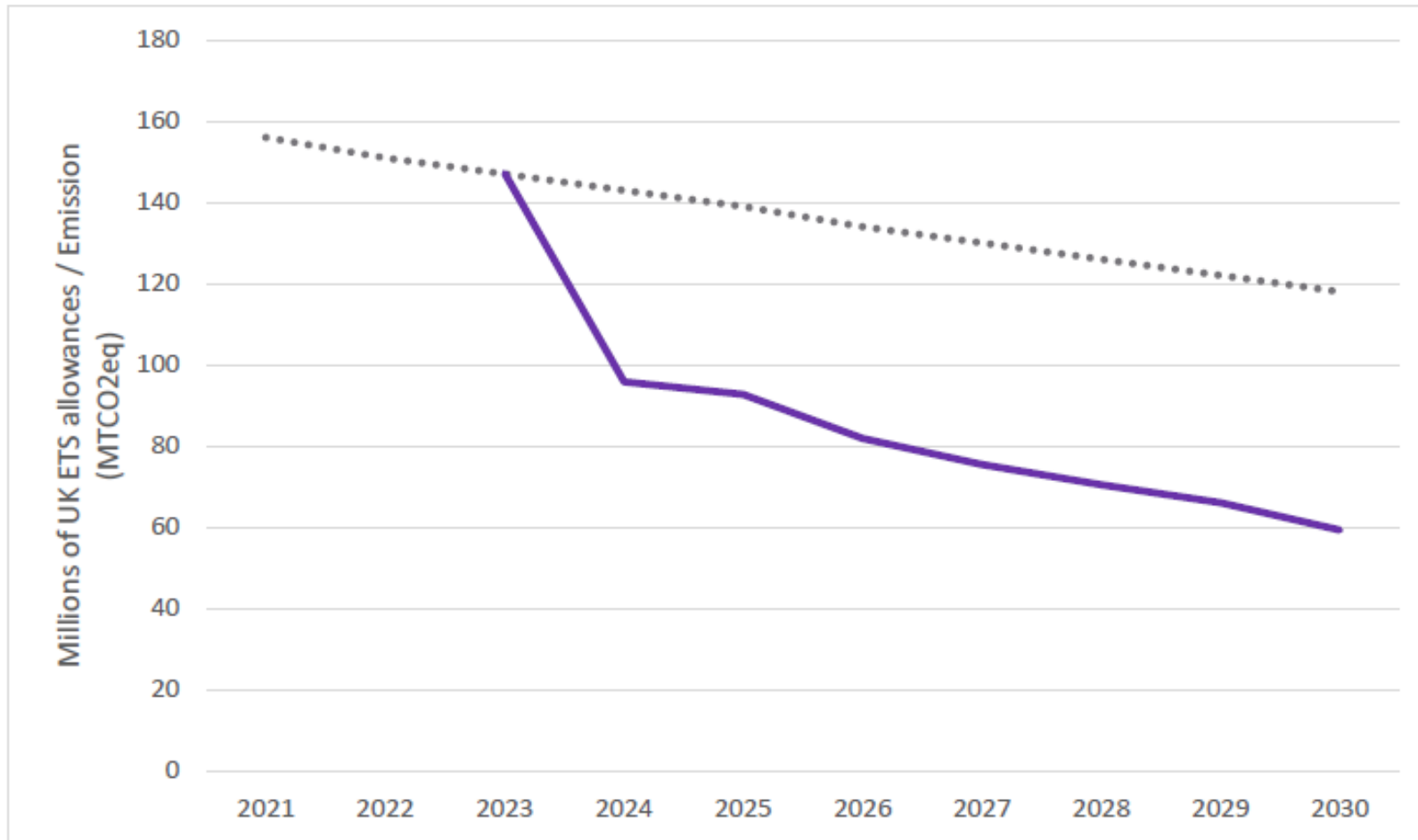
High energy price

Day Ahead Price
N2EX Market



- The consequence of high volatility is energy price uncertainty
- Energy costs will still be strongly linked to gas prices for some time to come
- Decarbonising the grid/low carbon energy mix increases price volatility

The UK Emission Trading Scheme – anticipated free allowance reductions



- The UK's net zero strategy (dotted line) is based on this path
- Anticipated reduction in free allowance (solid line)

Key Themes



Not Only About H2
Supply – Energy
Efficiency First...

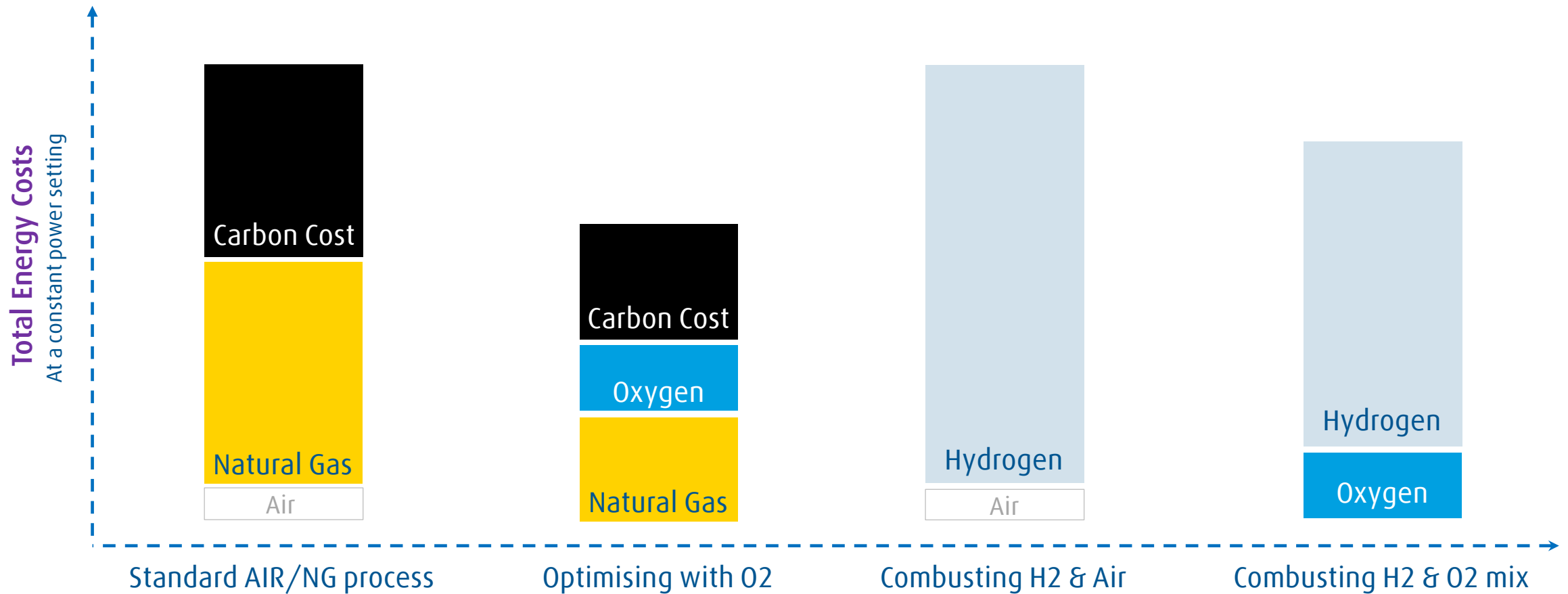


Process Focus –
Oxygen is 1st
Decarbonisation
Gas



Build Experience –
Trials are Essential
to Successful
Transition

The journey to hydrogen



Key Themes



Not Only About H₂
Supply – Energy
Efficiency First...



Process Focus –
Oxygen is 1st
Decarbonisation
Gas



Build Experience –
Trials are Essential
to Successful
Transition

Hydrogen Fuel Feasibility Demonstrations



Department for
Business, Energy
& Industrial Strategy

Form

Industrial Fuel Switching competition phase 3: successful projects

Updated 18 February 2020



The \$73 million Industrial Fuel Switching competition will support innovation

In the development of pre-commercial fuel switch and fuel switch enabling technology for the industrial sector to help industry switch from high to lower carbon fuels. Funding will be awarded through Small Business Research Initiative (SBRI) contracts providing 100% funding for pre-commercial solutions.

There are 2 phases to the competition:

- **Phase 1 – Feasibility:** funding for feasibility studies into fuel switch and fuel switch enabling solutions with \$66,200 to \$397,200 available per application.
- **Phase 2 – Demonstration:** funding for projects to demonstrate fuel switch and fuel switch enabling solutions with \$1.3m to \$7.9m available per project

Minerals



Glass



Food & Consumer Goods



Taking the first steps on the pathway - no one size fits all approach



Energy efficiency

Oxy Fuel Combustion

H2 Feasibility

H2 fuel switching

Improvement /utilisation of
energy efficient technology
in existing process

The role of Oxygen in energy
efficient combustion

Trial capability to generate
operating knowledge and
data

Supply chain capacity – ATR /
electrolysis / LH2 exists at
scale



Thank you for your attention

Wayne Bridger

Wayne.bridger@boc.com

Making our world more productive

 **BOC**
A Linde company

