



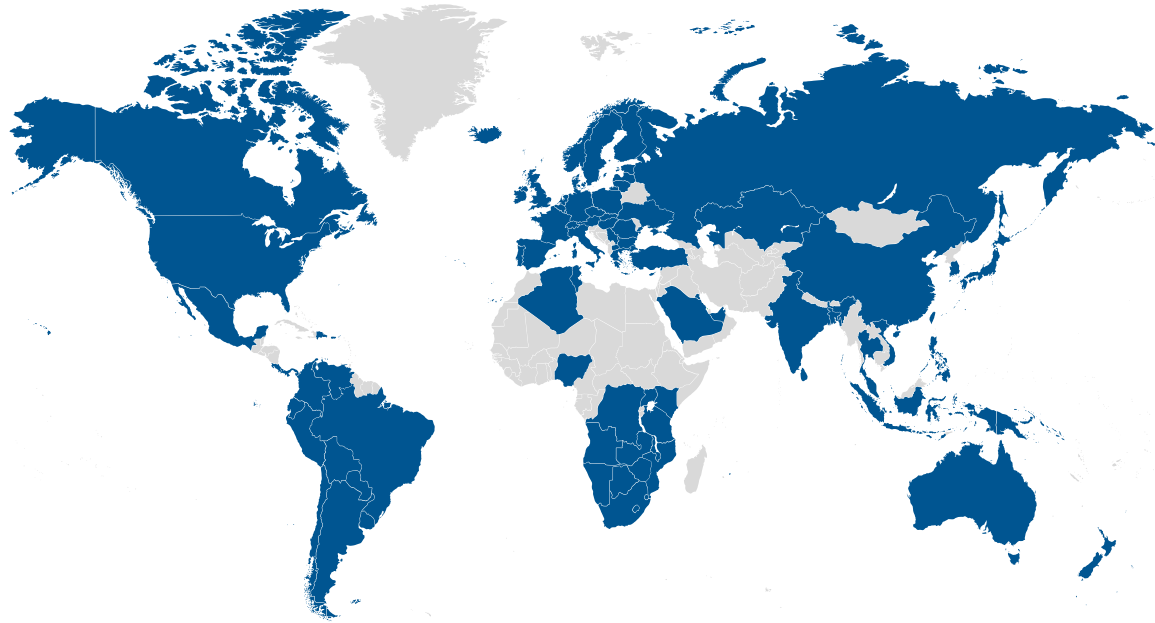
# BOC Clean Hydrogen for Mobility

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Over 140 years of technological progress

# Introduction to Linde



## 100+

countries

Enabling strong, complementary positions in all key geographies and end markets

## ~75,000

employees

Achieving our full potential, individually and collectively

## \$31 billion

2021 sales

Established presence where customers are and where their operations are growing

## 6,500+

active patent assets worldwide

Leading with innovative products, solutions and technologies

## Our Mission

We live our mission of *making our world more productive every day*. Through our high-quality solutions, technologies and services we are making our customers more successful and helping to sustain and protect our planet.

## Linde Profile

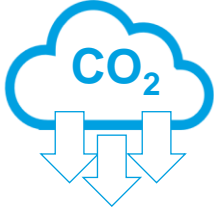




# Linde Clean Energy Outlook

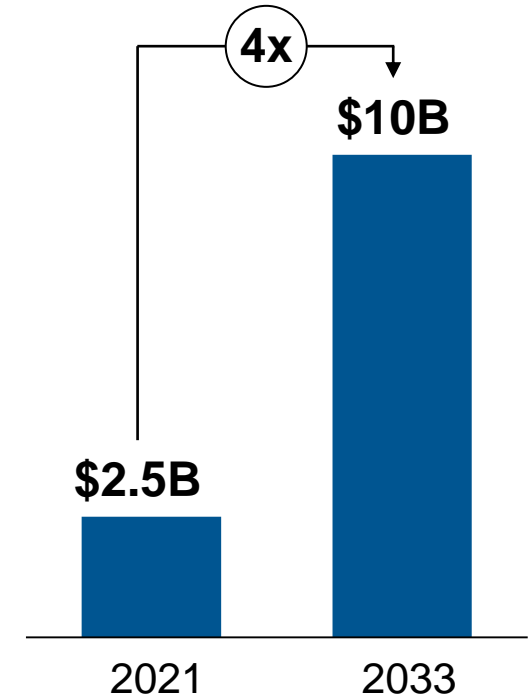
## Substantial Growth Opportunity for Linde



### Clean Energy Opportunity Potential

Carbon solutions	Blue Hydrogen (incl. ammonia & methanol)	Green Hydrogen (incl. ammonia & methanol)
 <p>CO<sub>2</sub> capture from industrial processes with CO<sub>2</sub> storage or utilization</p>	 <p>Grey cycle with CO<sub>2</sub> capture, storage or utilization</p>	 <p>Electrolysis powered by Renewable Energy with no CO<sub>2</sub> emission</p>
CO <sub>2</sub> captured and utilised in BOC's existing CO <sub>2</sub> business	BOC Teesside shortlisted for BEIS £1bn CCS infrastructure fund	Large scale hydrogen production hubs for mobility demand

### Growth Outlook, \$B



**>\$1bn investment per year in Clean Energy projects worldwide**

# BOC H2 experience in the UK

Extensive supply network and more than 100 years of experience



Largest supplier of H2 for industrial use  
Steam methane reformer, Teesside



Extensive supply network

Hydrogen distribution supported by 24/7 scheduling team in Sheffield



- 5x hydrogen production plants in UK and 1x in Ireland
- 1x hydrogen refuelling station with onsite electrolysis
- Approx 70 tube trailers
- Remote monitoring of customer stocks
- 24/7 delivery scheduling team
- Plants monitored by Regional Operating Centre
- Team of field based Technicians supporting BOC equipment

- H2 production - electrolysis
- H2 production – steam methane reforming



# A world leader in H2 for fuel

## Experienced supplying hydrogen for transport

### H<sub>2</sub> bus refuelling using electrolysis Kittybrewser, Aberdeen

- Largest HRS in Europe when constructed
- fuelling buses since 2015
- Fuelling Wrightbus double decker's since 2020
- Most reliable HRS in Europe



### 200 refuelling stations worldwide 200<sup>th</sup> HRS in California, USA

- Cars, buses and forklifts have refuelled over 1.5million times using our technology
- Today, we are building refuelling stations at major bus depots in locations all around the world



### World's first H<sub>2</sub> refuelling system for passenger trains Bremervörde, Germany

- 14 hydrogen-powered passenger trains
- 1,000km emissions free per refuelling
- 1,600kg H<sub>2</sub> per day – one of the largest HRS' ever built



### World's first liquid H<sub>2</sub> fuel-cell ferry Rogaland, Norway

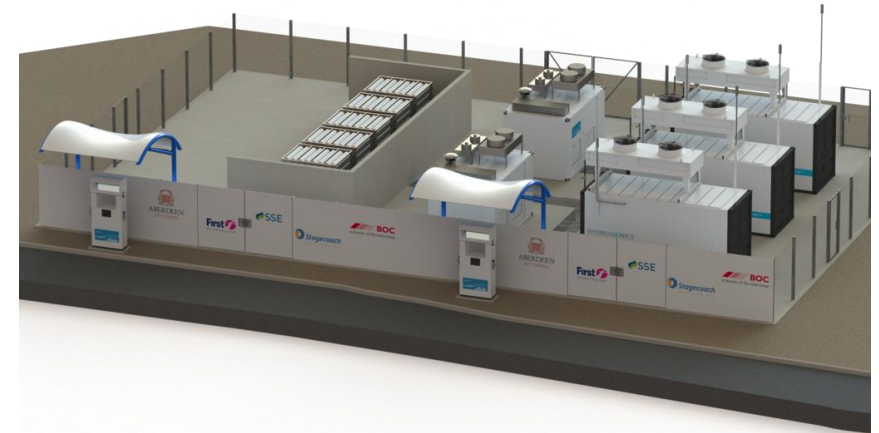
- Linde to supply liquid hydrogen and related infrastructure to the world's first operational hydrogen powered ferry
- 1 delivery of LH<sub>2</sub> every 3 weeks
- To be commissioned 2022



# BOC Aberdeen, Kittybrewster Hydrogen Refuelling Station



- Opened in March 2015
- Lessons learned from earlier HRS project in Swindon
- Was the largest H2 bus refuelling station in Europe
- Supported by EU, UK and local funding
- First 5 years – 10x Van Hool single deck buses
- Now – 15x Wrightbus Double Deck buses (supported by JIVE)
- Upgraded to 700 bar





# Hydrogen refueling stations (HRS)

## Deploying Linde proprietary refueling technologies



### Leading expertise and know-how

- Over **200 HRS** installed **worldwide**
- More than 1.5 million successful fueling of cars, buses and forklifts
- Only provider of **LH2 90 MPa stations**
- Supplier of the world's **first** hydrogen station for **passengers' trains**

### Fueling tomorrow

#### Global projects



Berlin



Tokyo



Emeryville, CA

### Cutting-edge technologies



CP – Cryopump (LH2)



IC – Ionic Compressor (GH2)

# Gearing up for clean hydrogen

How Linde supports customers and industry partners



## Hydrogen production with electrolysis

Global green gas solutions at industrial scale using ITM Power's modular PEM electrolysis technology and Linde's world class EPC expertise and technologies.



## Renewable energy storage

Experienced partner in the development of energy parks. Operating the first commercial high-purity H<sub>2</sub> cavern for over a decade.



## Infrastructure

Approximately 1000 km of H<sub>2</sub> pipeline. Decades of experience in operating high-purity, high-pressure H<sub>2</sub> pipelines. Largest global hydrogen liquefaction capacity and distribution fleet of liquid and gaseous trailers.



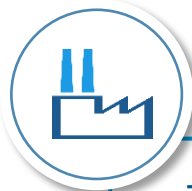
## Hydrogen Refueling Stations

Highly efficient and fast fueling concepts for cars, trucks, trains, forklifts and buses. Worldwide leader in installed H<sub>2</sub> refueling stations.



## Carbon capture, utilization and storage

Linde offers proven CCUS technologies and is part of numerous R&D alliances to leverage government funding.



## Industry feedstock

Trusted supplier of heavy industries, such as steel, chemicals and refining, Linde is well equipped to support the transition to a low carbon production.



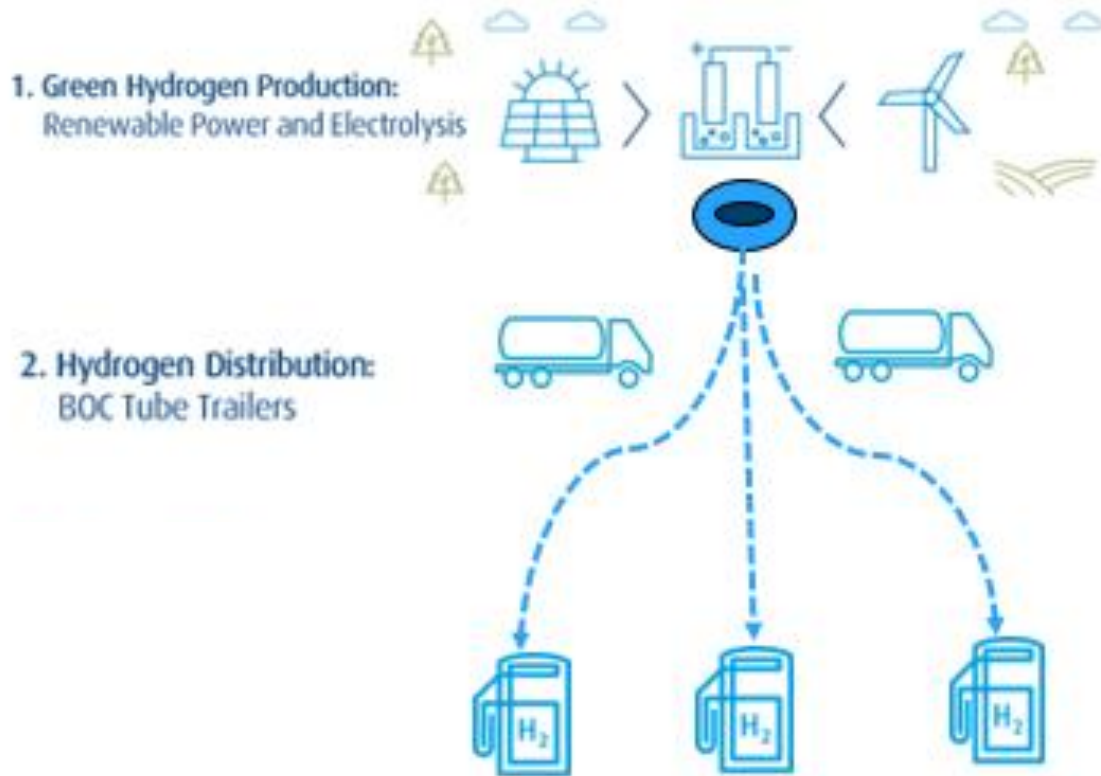
# Linde's Hydrogen Value Chain – Mobility

## H<sub>2</sub> supply and consumers



# Hydrogen production hubs - enabling H2 for transport

Achieving economies of scale



- **Scaling up green hydrogen production**

“Going from a 1-MW plant, typical today, to a 20-MW plant could already reduce the cost by over a third and reap the largest benefits by around 50 MW.”

- IRENA, International Renewable Energy Agency

- **Scaling up green hydrogen supply**

“Distribution of hydrogen as compressed gas via road trailer is the best option to stimulate the UK market for hydrogen fuel for heavy-duty transport. Over the longer term, as the market expands into new geographies, both liquid and gaseous hydrogen have potential to play a role.”

- Bp and BOC joint feasibility study into H2 for heavy duty transport.



# Thank you for your attention

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