
Air Liquide
Acting for a sustainable future
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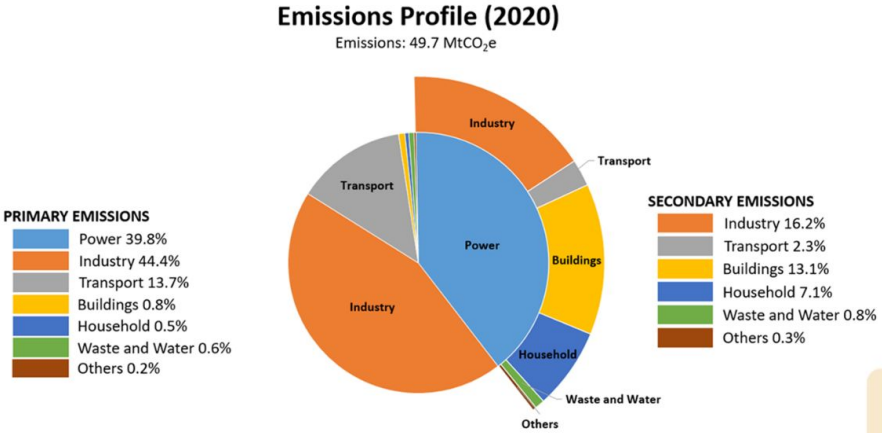
Singapore : Acting for a Sustainable Future



Power, Industry and Transport sectors are three major area for decarbonisation:

- **Power:** Renewable power and low carbon NG/H2/NH3 firing in GTs.
- **Industry:** CCS/CCUS, low carbon feedstocks, green energy.
- **Transport:** EV and H2 Mobility.

MITIGATION

Transformations in Industry, Economy, Society

POWER GENERATION	INDUSTRY	TRANSPORT	BUILDINGS	HOUSEHOLDS	WASTE & WATER
Energy efficiency	Energy efficiency	Zero private vehicle growth	80% green buildings by 2030	Mandatory Energy Labelling Scheme	Circular economy approach
At least 2 GWp of solar energy by 2030	System-level solutions	9 in 10 peak period journeys on "Walk-Cycle-Ride" by 2040	Super Low Energy Programme	Minimum Energy Performance Standards	Waste
Low-carbon technologies	Low-carbon technologies	Cleaner vehicles by 2040		Green Towns Programme	Recycling
					Energy efficiency of desalination and used water treatment

CARBON TAX Initial rate of S$5/tCO$_2$e ▶ S$10-S$15/tCO$_2$e by 2030

Chemical Industry's - Energy Transition Pathways

The chemical industry is essentially carbon-based and has to establish carbon neutral pathways

Feedstock

Fossil fuel based feedstocks reduction

- Biomass
- Waste
- CO2

Energy

- Combined Heat & Power
- Renewable Energy
- H2 - Role of H2 in energy storage and supply

GHG Emissions

Scope 1, 2, 3 emission reduction:

- Feedstock conversion
- CCUS

ABATEMENT OF CO_2 : Setting a trajectory to reach Carbon Neutrality

AIR LIQUIDE COMMITMENTS

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CO_2 emissions **start decreasing** in absolute value

Reach **Carbon Neutrality** before **2050**

~2025 — 2035 — 2050

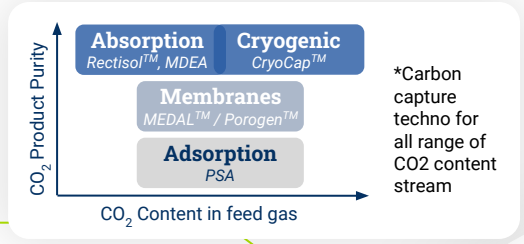
-30% Carbon intensity in kg CO_2/€ EBITDA[(a)] **vs 2015**

Decrease scope 1 & 2 CO_2eq emissions in **absolute value** by **-33%**[(b)]

(a) at 2015 exchange rate and excluding IFRS16 for greenhouse gas emissions scopes 1 and 2

(b) from 2020 Market based emissions of 32.5 million tonnes CO2eq (Scope 1+2)

Scope 1 - Decarbonization Levers



CCUS

- CCS - Development of regulatory & support schemes, infrastructure deployment, access to storage.
- AL E&C technologies for Carbon Capture incl. **CryoCap™, MDEA, CryoCap™XLL** for LCO2.
- CCU - **CO2 Synthesis process**, incl. Methanol.

Low Carbon Hydrogen

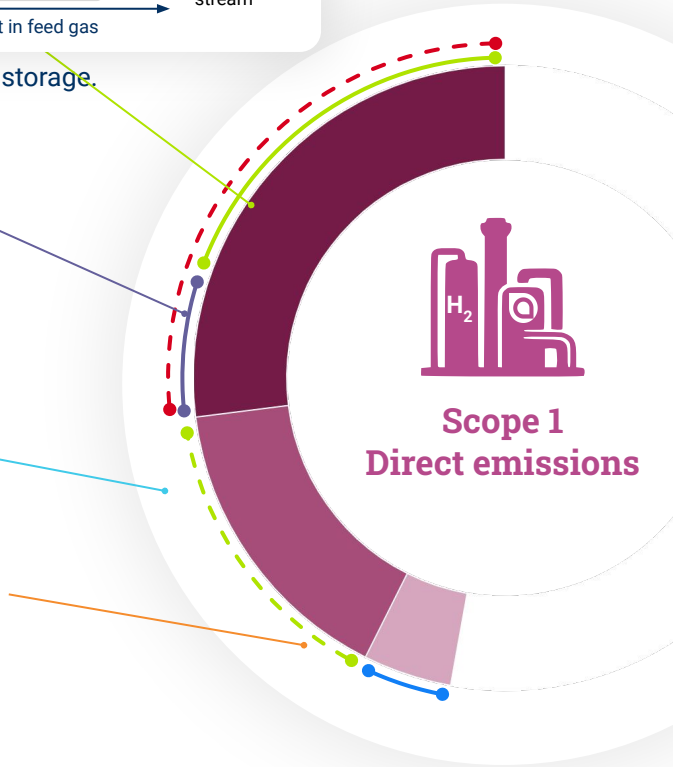
- **ATR / POX** with **Carbon Capture** for **large H_2 volumes**
- **NH3 cracking,** first industrial scale pilot plant ready in 2024 at **Port of Antwerp.**

Electrolysis for Green Hydrogen

- Competitive access to low-carbon electricity sourcing with right attributes
- **PEM** partnership with SIEMENS energy

Renewable feedstock

- Biomethane (small scale SMR) & Biofeedstock (SMR to bio-refineries)



Levers of action for Scope 2 - Increasing energy efficiency and low carbon electricity consumption

Consuming less energy

- Upgrade less efficient assets, including electrification of steam-driven motors/turbine
- Further deployment of Smart Innovative Operations leverage on data analysis for energy optimization

Consuming cleaner energy

- Focusing on countries with highest decarbonization potential
- Large increase in low carbon electricity sourcing

Innovative Air Gases Solutions

- **Renewable Electricity intermittency** management - Alive™
- **Ultra low energy** consumption ASU

Hydrogen makes it possible to address major challenges

One molecule, multiple uses

- A molecule used in various industrial processes, including refining, chemicals, electronics…

But it can also be used:

- As a feedstock to decarbonize industry
- As an energy carrier for industry and clean mobility

A solution for a better future

Hydrogen plays a role in:

- Fighting against climate change
- Tackling the energy transition
- Reshaping industry
- Deploying clean mobility

HYDROGEN as a cornerstone of the energy transition…

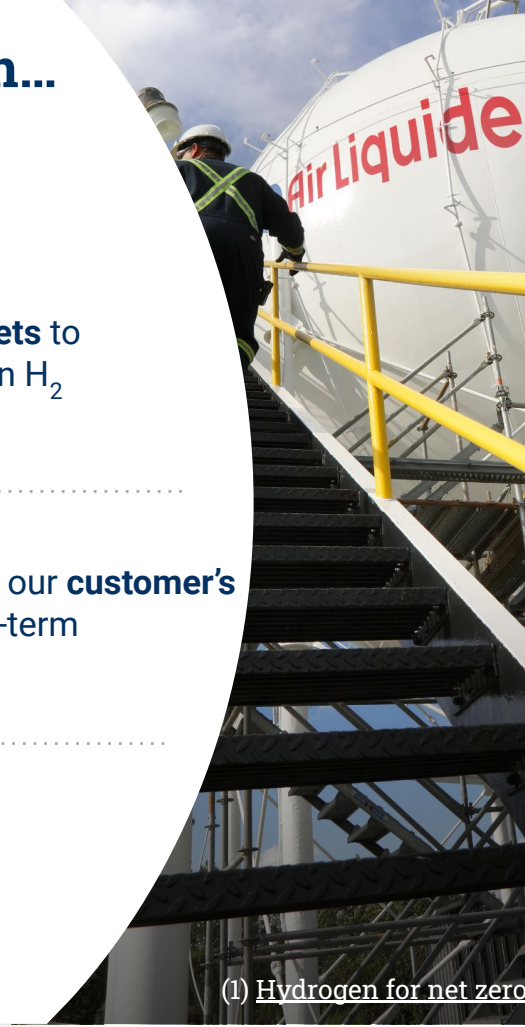
2050

>20% of final world energy demand(1)

- Power generation, buffering
- Transportation
- Industry energy
- Building heating and power
- Industrial feedstock (CCU, DRI)

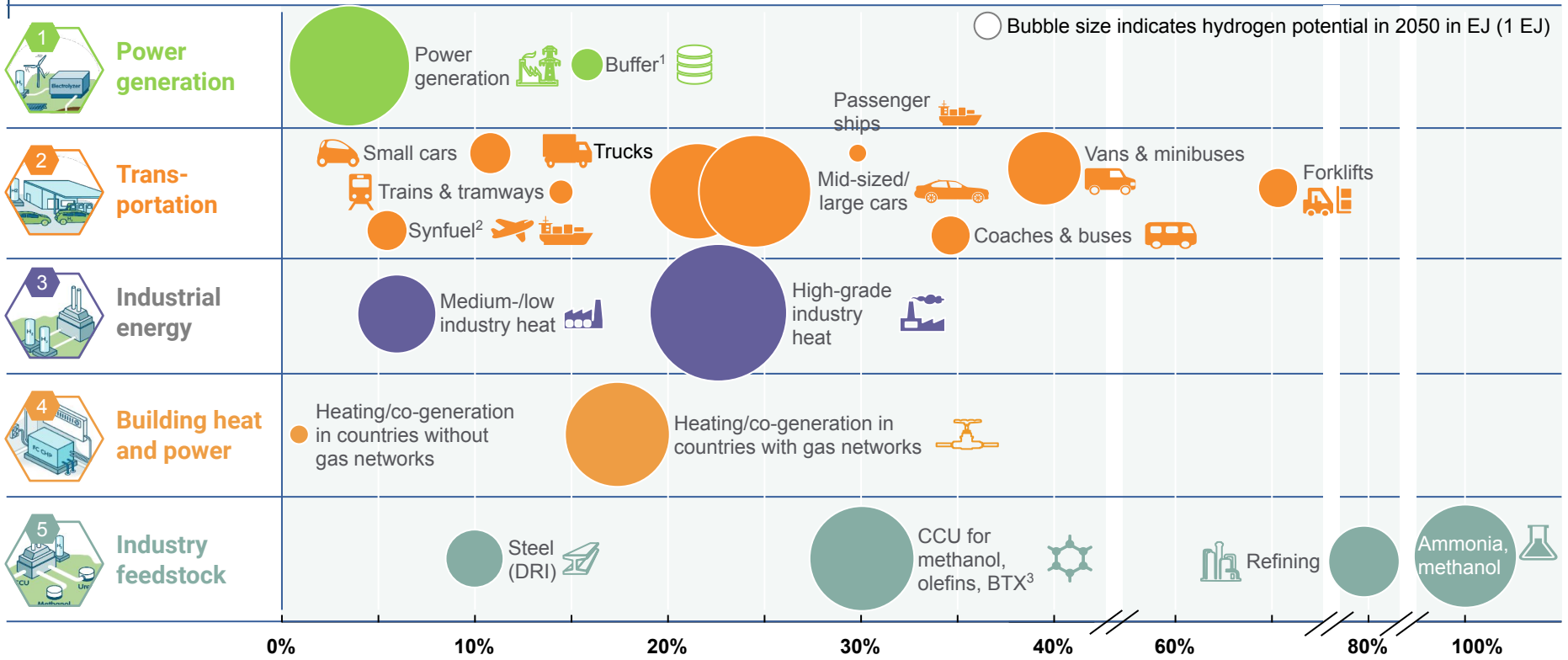
Our ENGAGEMENT

- **Decarbonize** our **production assets** to develop a competitive low-carbon H_2 offering at large scale.
- **Create value** by **decarbonizing** our **customer's processes**, leveraging our long-term relationships.
- Be a **key enabler** of the **Hydrogen society** thanks to our assets, technology, and expertise.



(1) Hydrogen for net zero

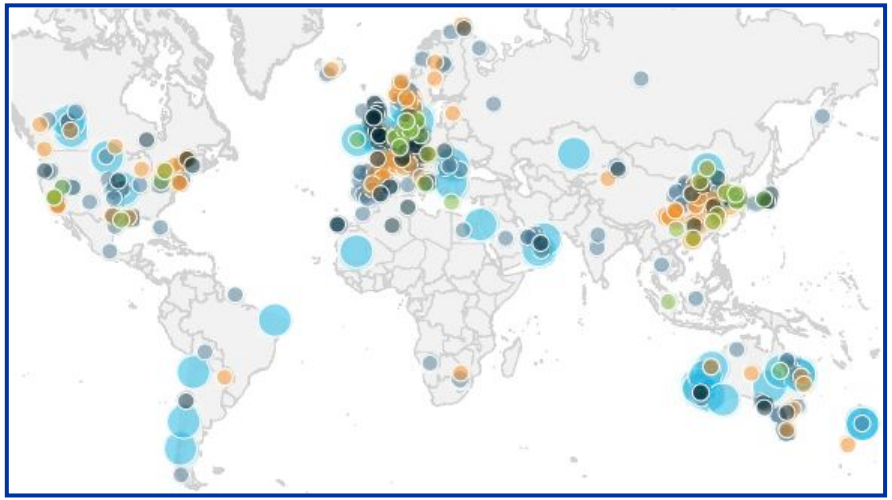
Hydrogen has significant potential across all applications



1 Percent of total annual growth in hydrogen and variable renewable power demand
2 For aviation and freight ships
3 Percent of total methanol, olefin, BTX production using olefins and captured carbon

Source: McKinsey & Hydrogen Council 2017

Significant international momentum



60+ Giga-scale production
(renewable and low-carbon projects)

330+ Large-scale Industrial usage
(refinery, ammonia, methanol, steel and industry feedstock)

150+ Transport
(trains, ships, trucks, cars and other mobility applications)

75+ Integrated hydrogen economy
(cross-industry, projects with different types of end-uses)

60+ Infrastructure
(hydrogen distribution, transportation, conversion and storage)

680+ projects announced with **investments** of **$240 bn** (and a target of $610 bn by 2030)

48% **industry**

22% **transport**

+ large infrastructure projects emerging (exports, pipelines)

Updated in July 2022

Thank you

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