Nordic's NetZero
An Energy Transition Journey

An Energy Transition Journey

The world needs maximum energy and minimum emissions.

Chief Executive, Abu Dhabi National Oil Company (ADNOC)

At ADIPEC 2022

HOWDEN

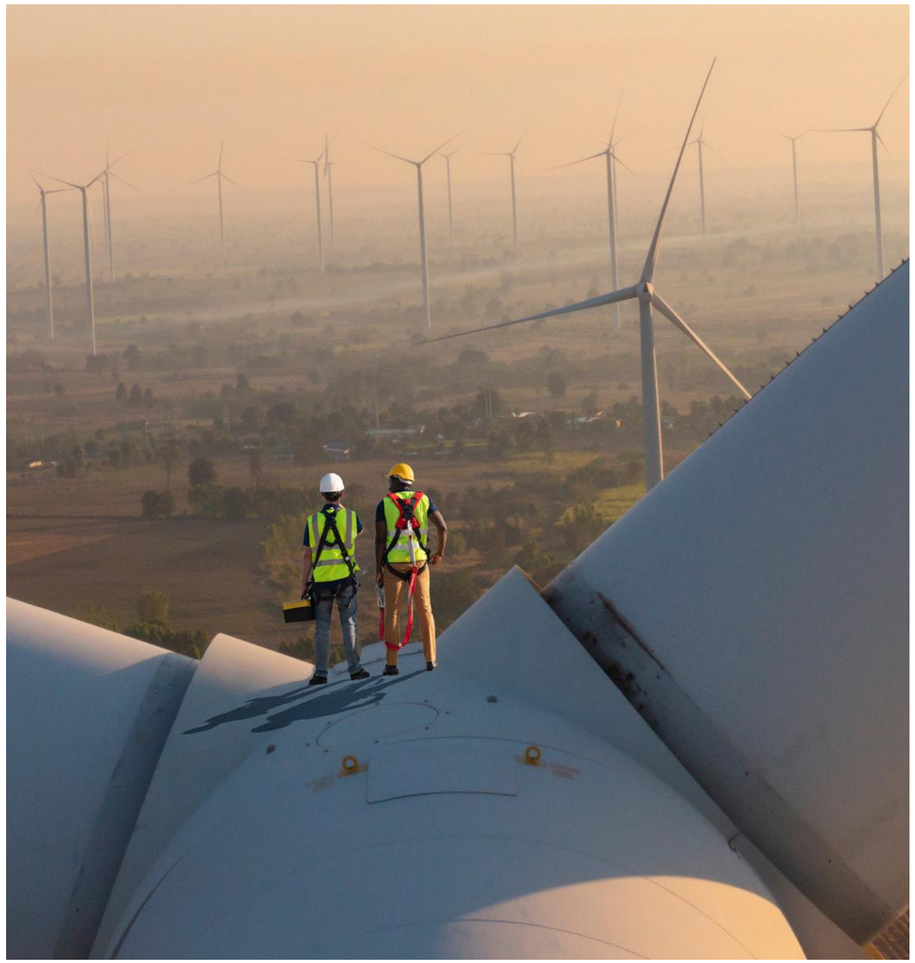
How much energy?

01 By 2030, renewable energy spending is expected to increase from $320B today to more than $740B.

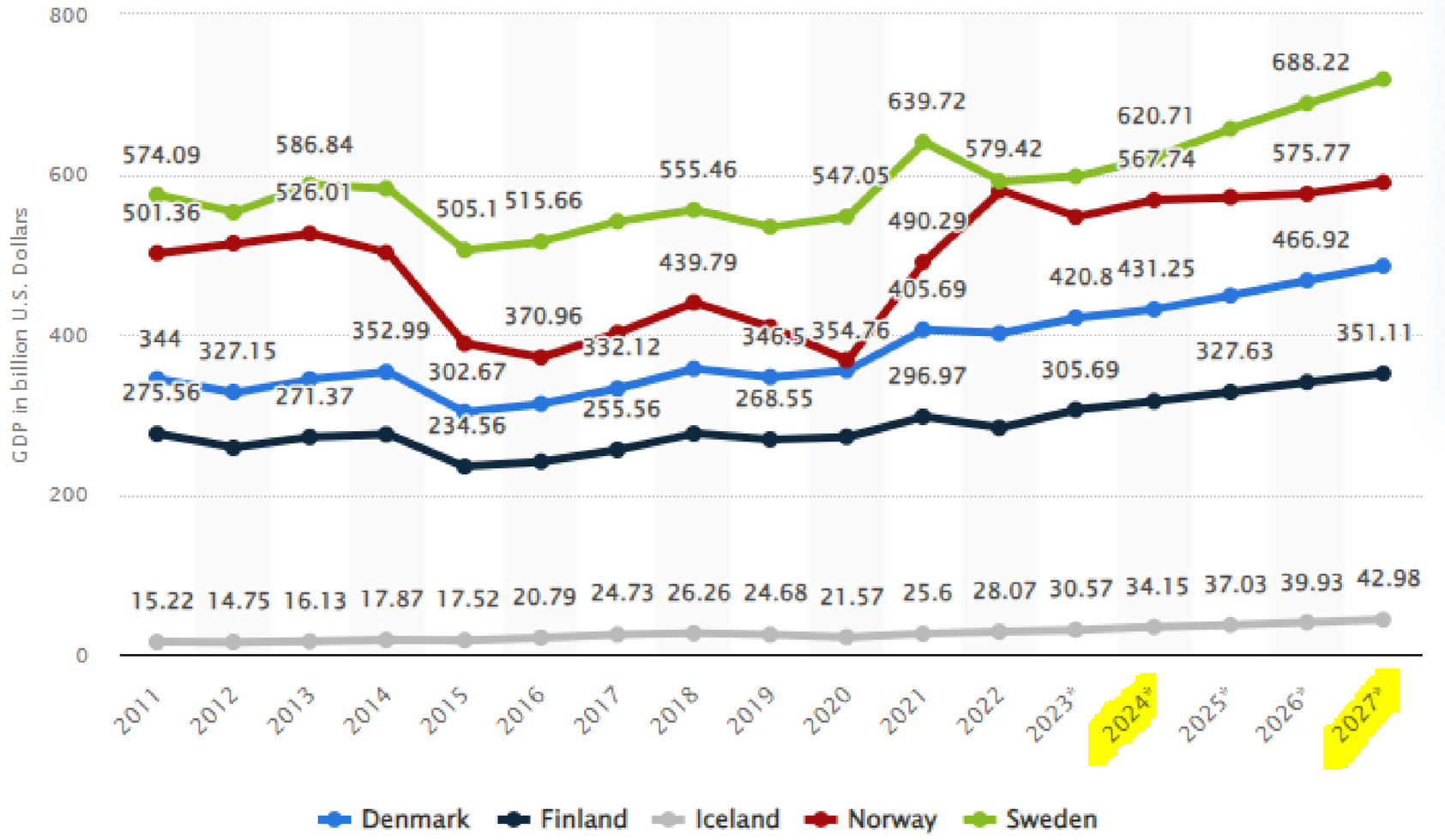
02 By 2035, as electrification increases, demand for lithium and cobalt is expected to grow as much by 600%

03 By 2050, global demand for energy is expected to increase by 50%

04 By 2050, demand for chemicals is projected to rise by 300%



GDP Growth Nordics

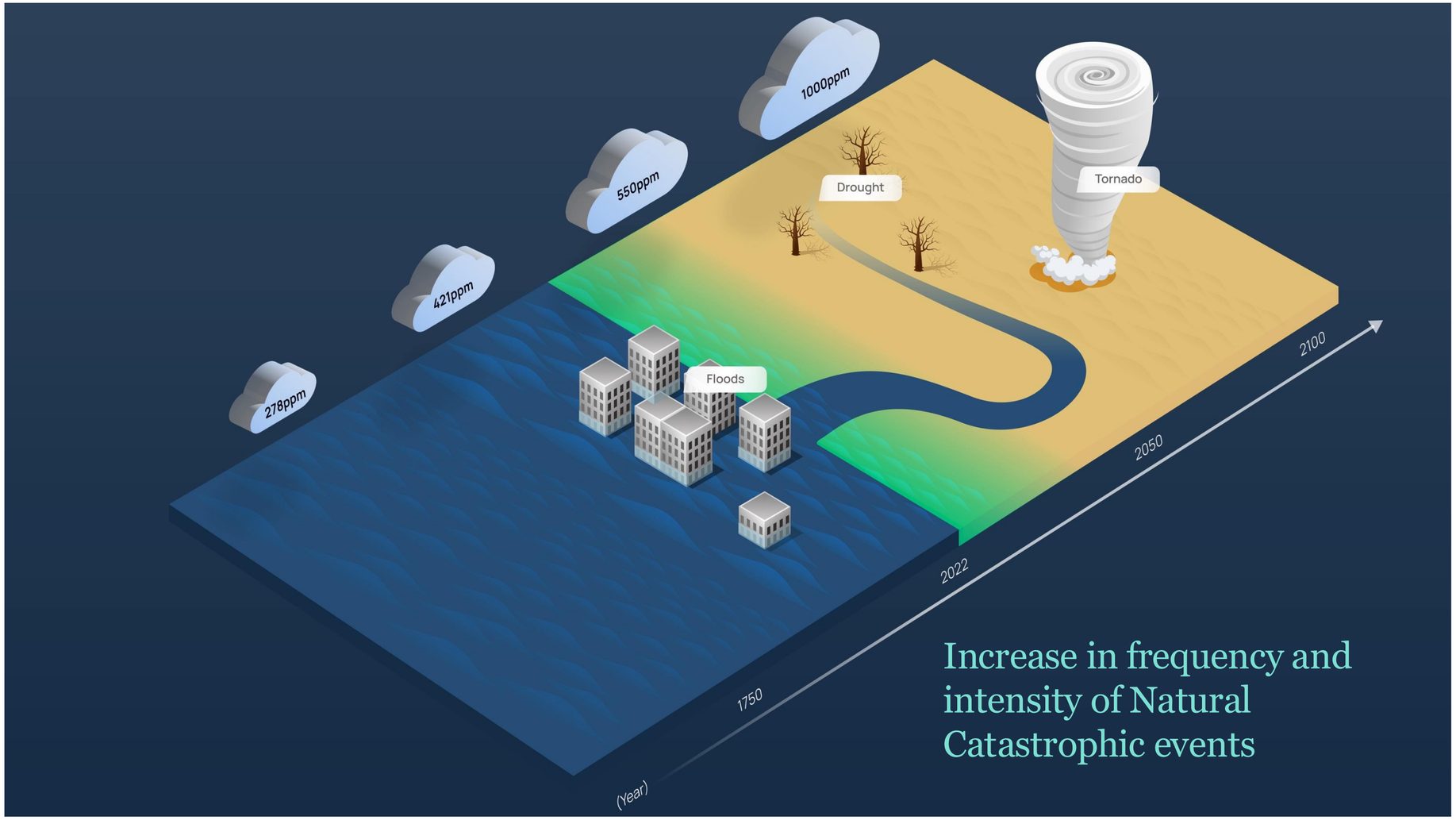


Current state of affairs

CO_2 Concentration in the atmosphere

2100	1000 PPM
2050	550 PPM
2022	421 PPM
1750	278 PPM

Natural catastrophe



How will it affect industries?

Carbon Budget:

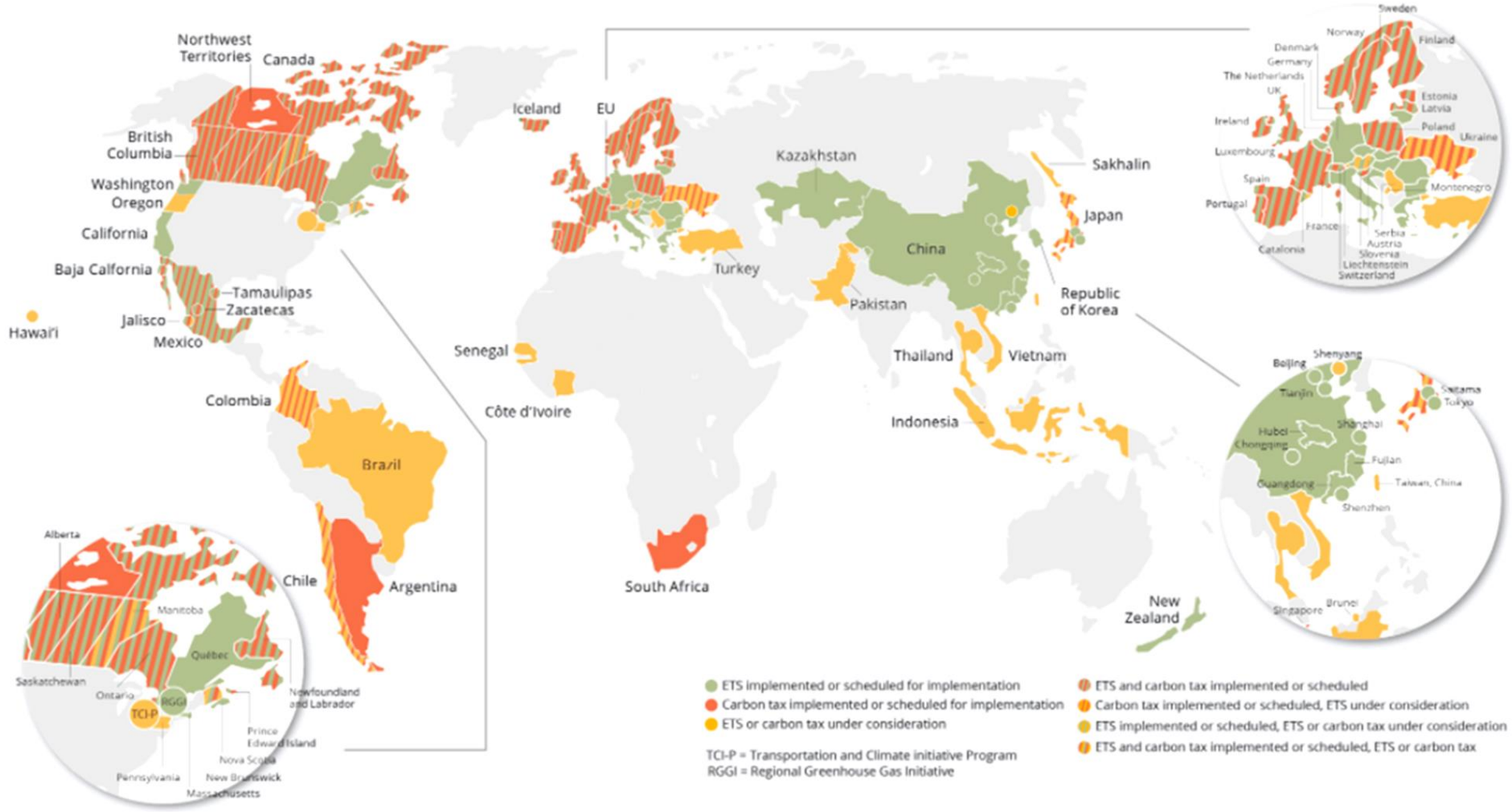
maximum amount of cumulative net global anthropogenic carbon dioxide (CO2) emissions limiting global warming

Carbon Tax:

government sets a price that emitters must pay for each ton of greenhouse gas emissions they emit

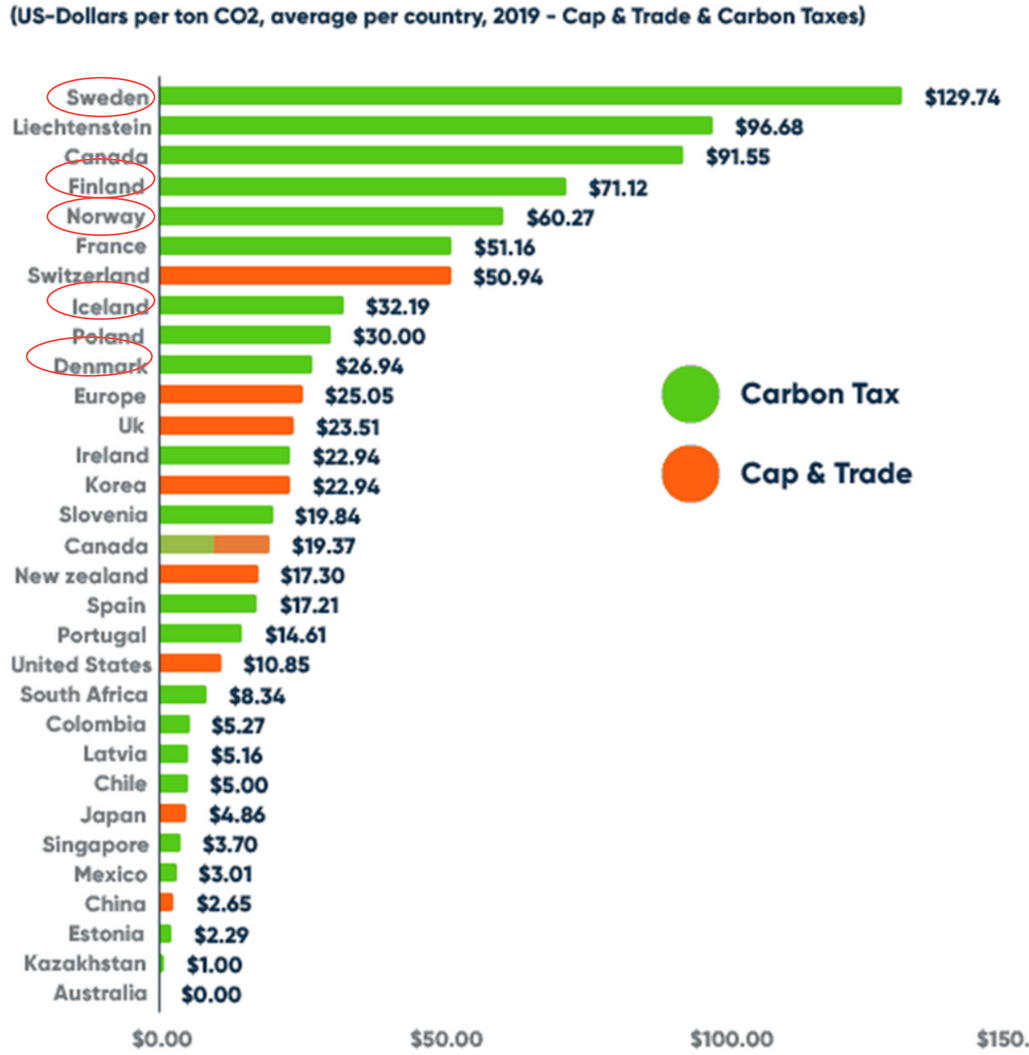
SRC Emits 2.1 Mmtpa = $10 Mil Carbon tax @$5/tn (will be $63 Mil in 2030 at $30/tn)

Carbon pricing implementation globally



Source : State and Trends of Carbon Pricing 2021. World Bank 2021

Carbon pricing implementation globally



Current Carbon Taxes (2023)

Sweden: USD 132

Finland: USD 84

Norway: USD 72

Denmark: USD 27

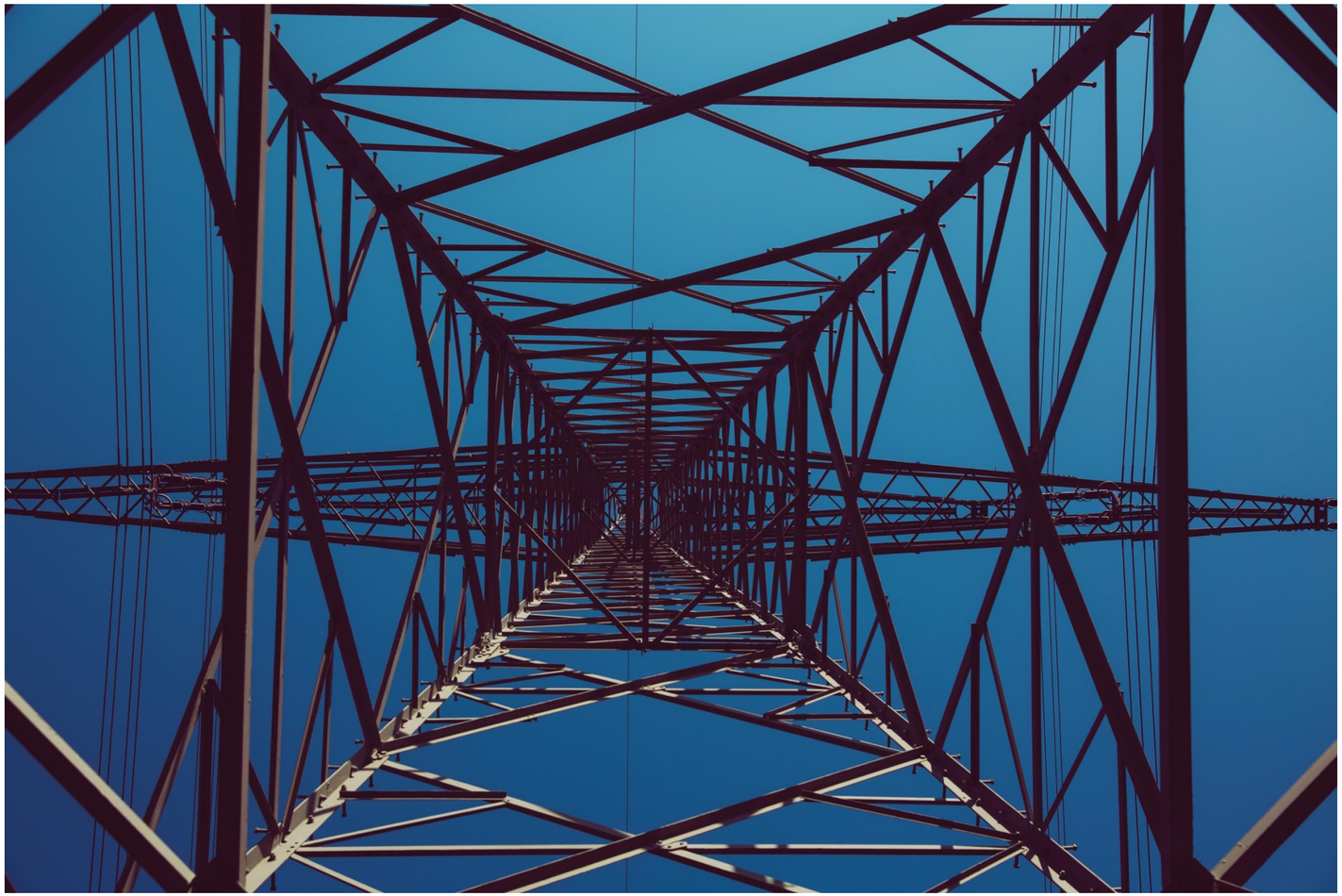
Iceland: USD 39

Energy Transition (ET)

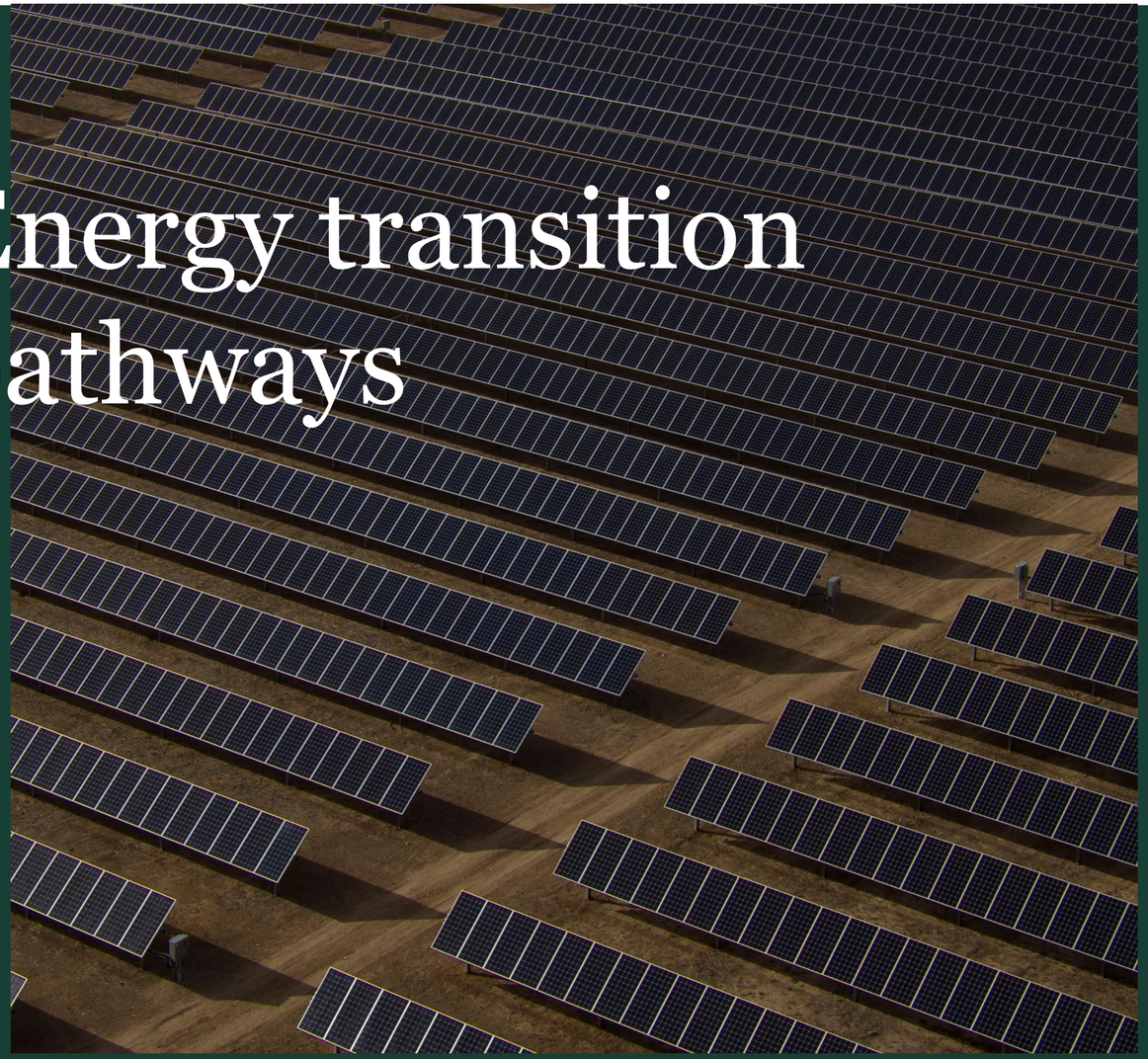
The energy transition is a pathway toward transformation of the global energy sector from fossil-based to zero-carbon by the second half of this century.

At its heart is the need to reduce energy-related CO2 emissions to limit climate change.

Source : International Renewable Energy Agency (IRENA)



Energy transition pathways



Hydrogen
(H2)

Carbon Capture Storage
(CCS)

Carbon Capture Utilization
(CCU)

Biofuels
(Lignocellulosic & Lipids)

Pyolis
(Pyrolis Oil)

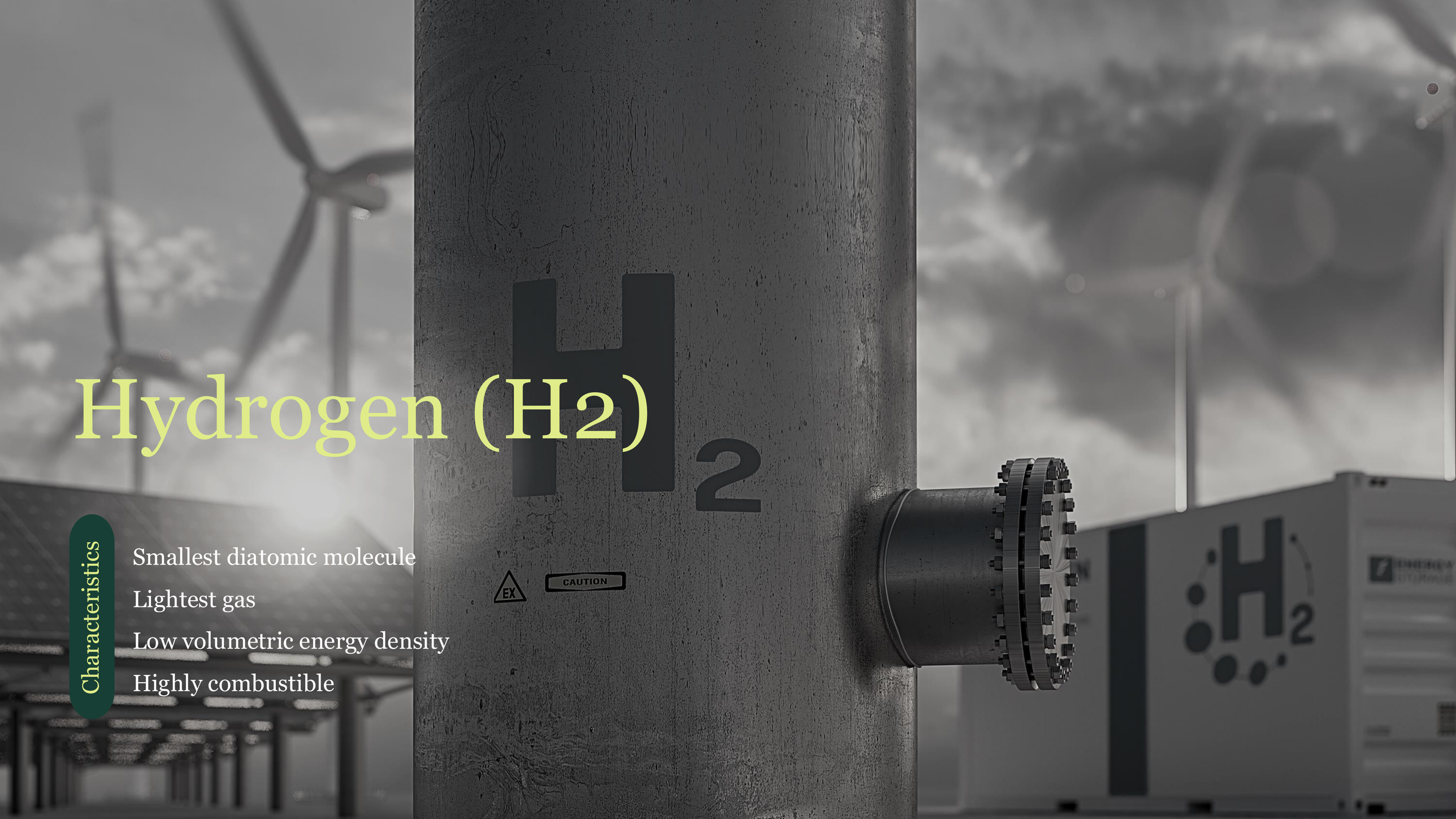
Carbon Markets

- **Efficiency of process**
- **Cost of entire value chain**
- **Volume of production**

Hydrogen (H2)

Characteristics

- Smallest diatomic molecule
- Lightest gas
- Low volumetric energy density
- Highly combustible



An Energy Transition Journey

The Hydrogen economy

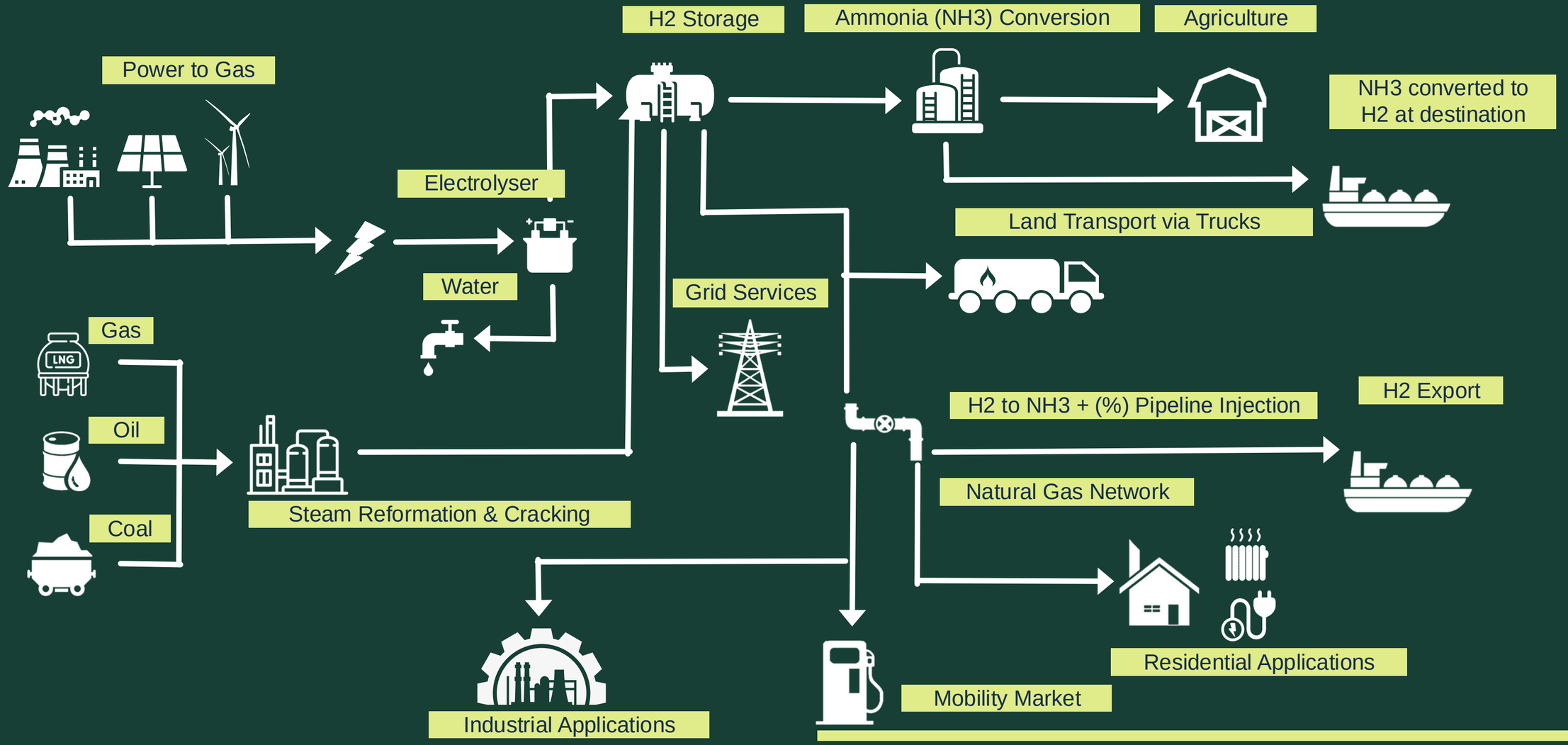
Key facts about the developments in the hydrogen economy by 2050

22% of global energy demand

6Gt of annual CO2 abatement

2.5tn annual sales (H_2 + equipment)

H2 Lifecycle



Source : Altas Copco

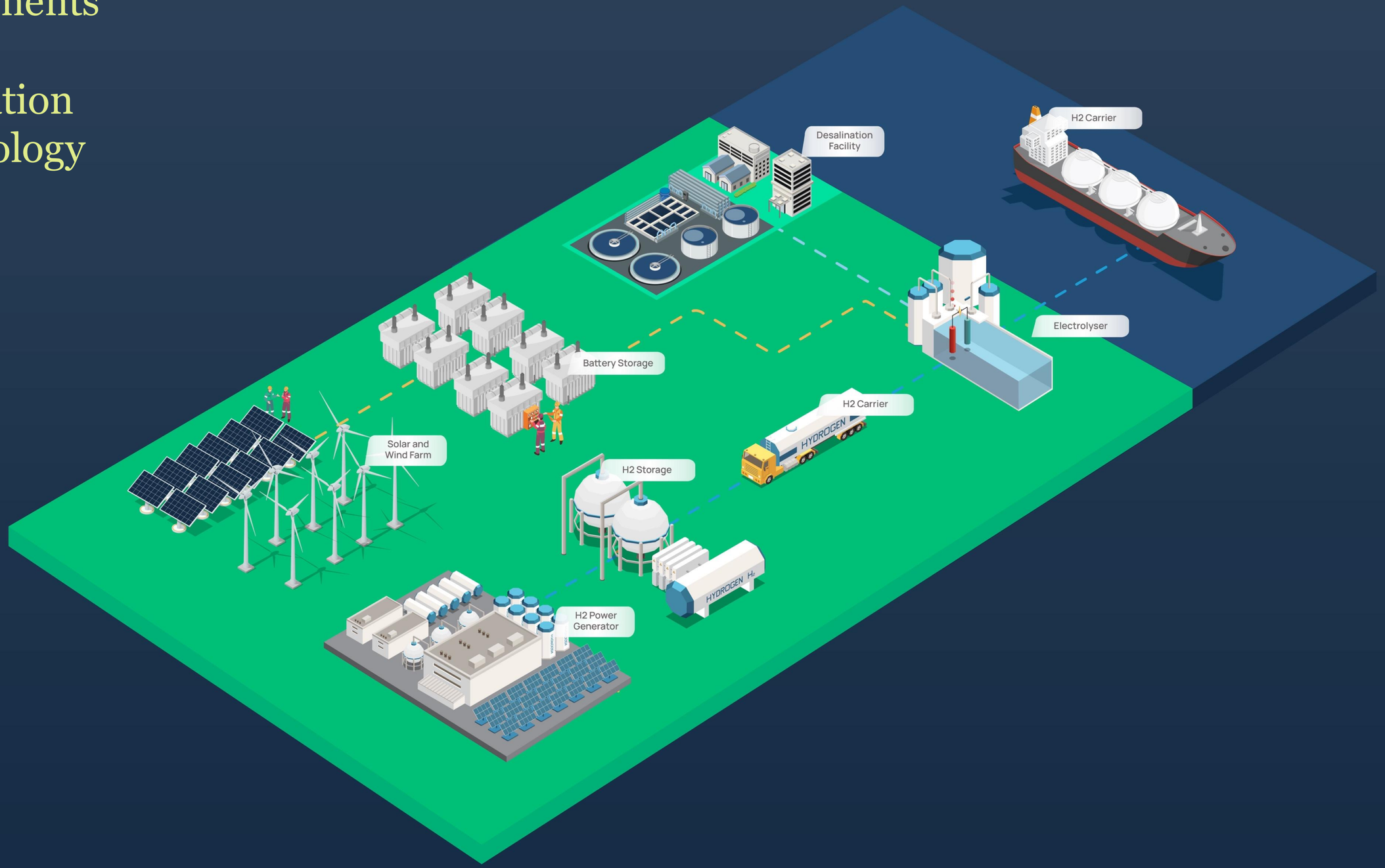
H2 Market

Production & Transfer

Internal Utilisation

Source : Britannica

+Investments
+Risks
+Regulation
+Technology



Commitment to H2

Nordic Hydrogen Valley as Energy Hubs

Started: 2022 – Ongoing
Funding: NOK 98 663 053
Founders: Programme funders: Nordic Energy Research; Icelandic Centre for Research, Business Finland, Swedish Energy Agency, Innovation Fund Denmark, and The Research Council of Norway

Sweden:
Emission-free steel plant using H2 to produce 2.5Mt of steel annually using 800MW electrolyser

Norway:
Govt H2 strategy is for production, refuelling, maritime, transport, aviation

Finland:
Plug Power (US) to build 3 H2 plants USD6 Billion produce H2 and NH3 for Europe

Denmark:
1GW H2 project by H2 Energy Europe close to FID, up to 700 jobs created during construct

Iceland:
Green Fuel's GNH3 facility will be one of the largest GNH3 facilities in Europe

Carbon Capture Storage (CCS)

Definition

Capture and sequestration of CO_2 underground for permanent storage

CO2 and CCS

Basics of Co2

Colourless, odourless, non-combustible (non-explosive) gas in ambient conditions

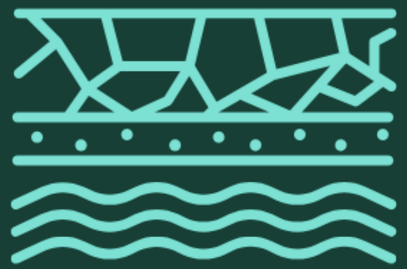
Heavier than air and can accumulate in depressions – danger of asphyxiation

What is CCS?

Capture

Process

Store



Why CCS?

01 Fastest & Highest Carbon Abatement Route

SRC Singapore
2.1Mt of CO2/yr

Net Zero

Petronas CCS Facility
Stores 3.3Mt of Co2/yr

$$

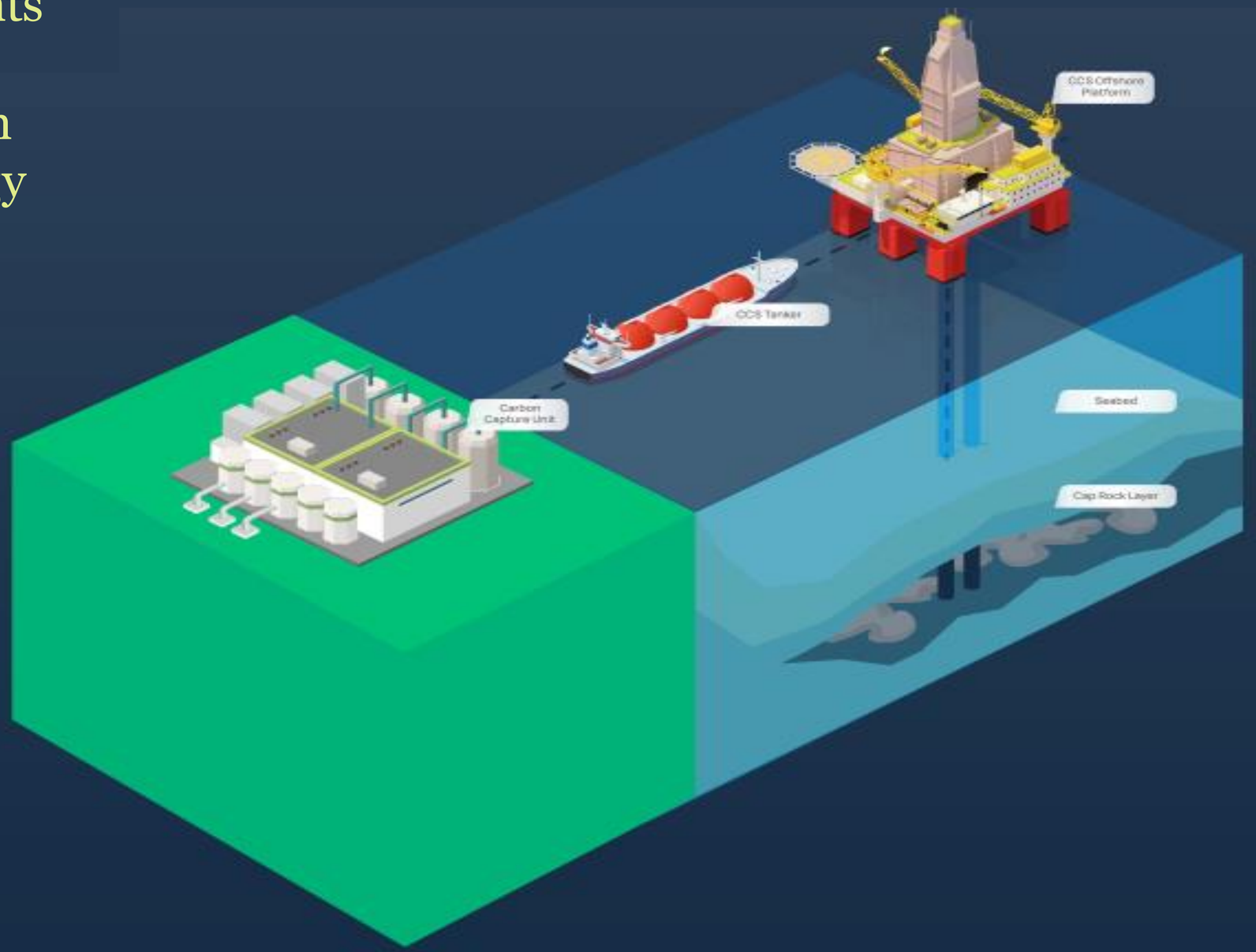
Transport & Storage for smaller emitters

02 Economic Potential

03 Easy to retrofit CCS Units

04 Targets stationary high-concentration stream emitters

+Investments
+Risks
+Regulation
+Technology



CCS Market

Capture & Transfer

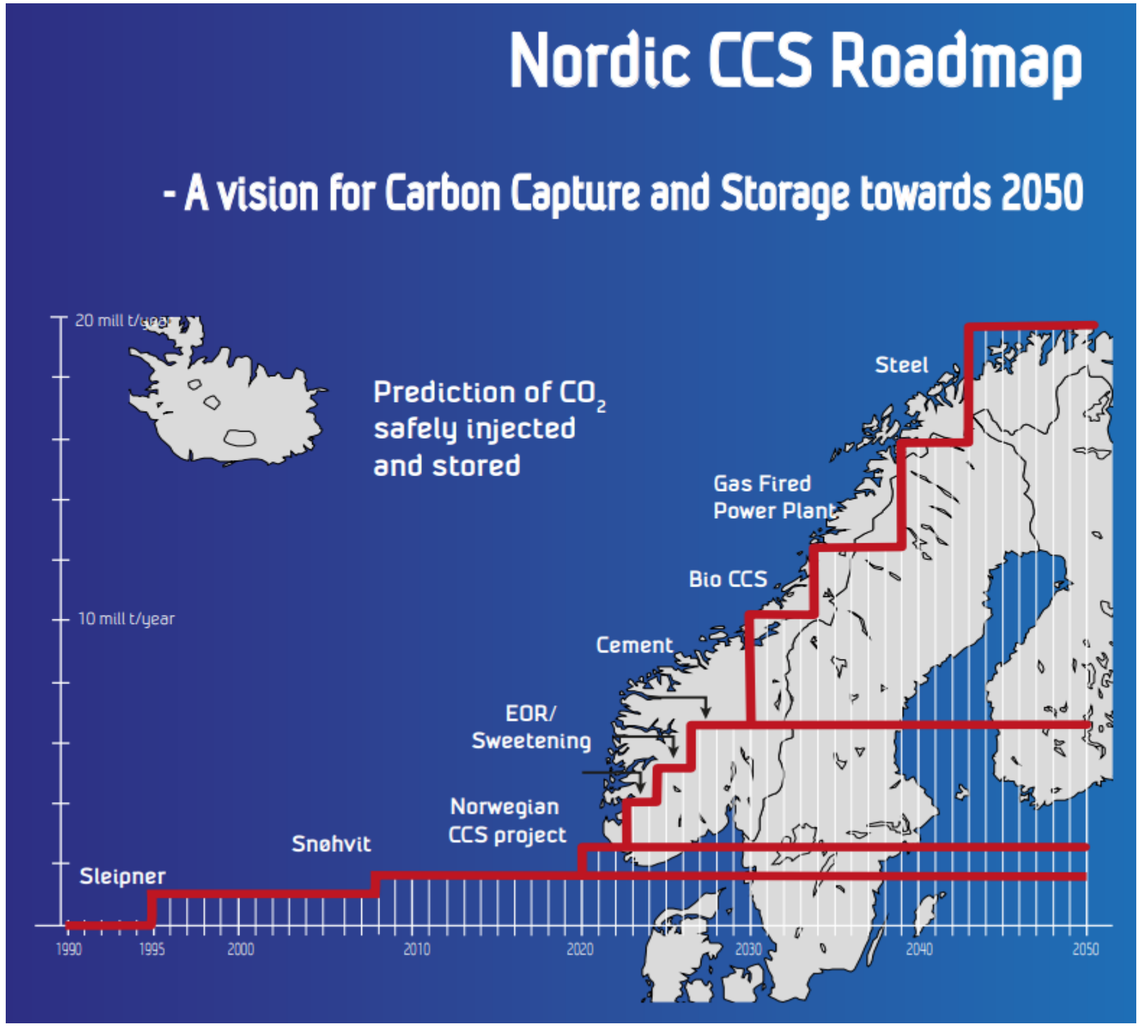
Transboundary Shipment

Source : Britannica

Commitment to CCS

North Sea Activities:

- **Northern Lights**
- **Stella Maris**
- **Greensand**



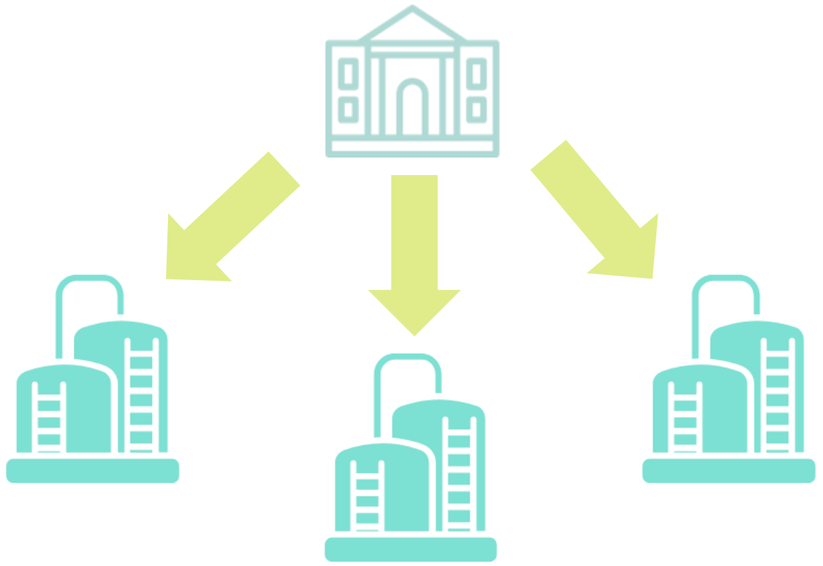
Carbon trading

Definition

Market-based system designed to provide economic incentives for organizations to reduce their environmental footprint

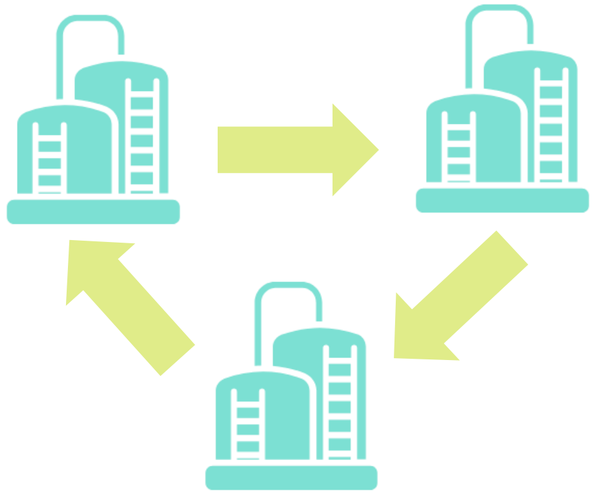
Carbon trading explained

Compliance markets



Allowances are allocated or auctioned. Companies trade allowances in secondary markets .

Voluntary carbon market



Projects generate credits, which are sold to companies to meet emissions compliance obligations (ESG requirements/targets).

EU ETS Updates

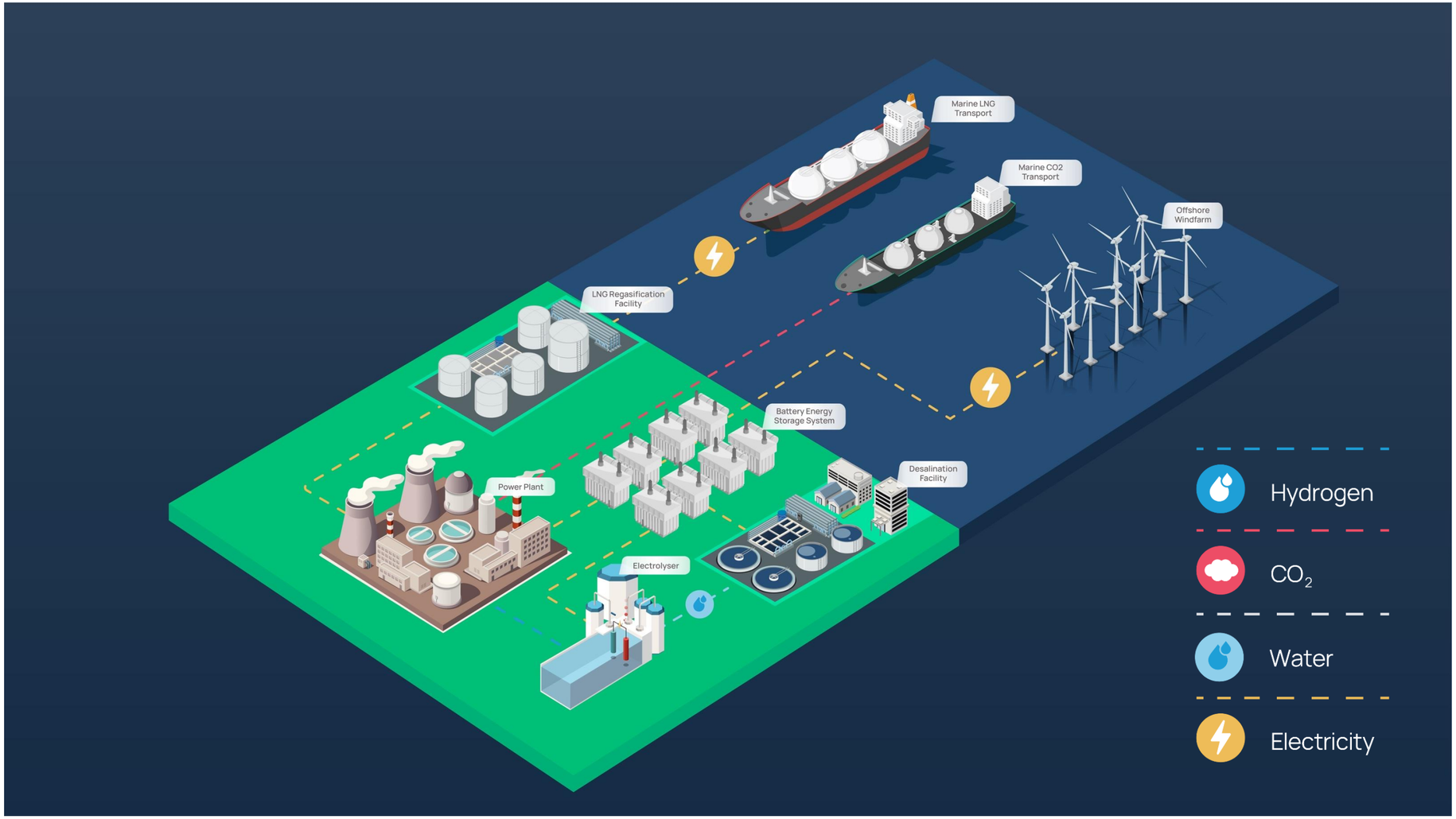
- Till date since inception (2005) 47% reduction in emissions
- 2030 target is 62% reduction from baseline

- Shipping will start to be included
- Previously, aviation, large industry, fossil power gen

- Cross Border Adjustment Mechanism (CBAM)
- Importers will in 2027 for 2.5% of embedded emissions for 2026, and will go up to 100% of grey emissions by 2034

** tn of CO_2 per MWh or tns of CO_2 emissions per tn of each product type*

Future Energy Mix



Source : ICAP Status Report 2021

Energy transition developments

Advisory

- Strategic
- Techno-economic
- Legal Liability
- Climate Analytics

Knowledge sharing

- Seminars & Conferences

Risk Transfer

- Hydrogen Value chain
- CCS Value chain
- Carbon Credits
- Natural Disaster

Partnerships

- Global Carbon Capture Storage Institute
- Techno-commercial Consultants
- Legal Firms
- Technology Providers

Coverages

- Construction
- Operation
- Marine
- Environmental Liability
- Loss of Credits
- Facility Development
- H2 Project Placement

Food for thought

What will the future Energy Mix look like to you?

- Full Electrification?
- Hydrogen dominance?
- Majority Renewables w BESS?
- Proliferation of CCS/M?
- Biofuels & Pyroils?
- The End of Fossil Fuels?

Cobalt Mining in Congo, 12 Oct 2022

(Circa 20,000 miners, in shifts of 5,000)

Boeing Unveils Hydrogen and Electric Concepts That Could Power the Future of Flight

By FuelCellsWorks | July 19, 2022 | *4 min read* (700 words)

Future Planet

What is BBC Future? Future Planet Lost Index

- **The new use for old coal mines**
- **Why environmental lawsuits are on the rise**

In your average battery recycling plant, battery parts are shredded down into a powder, and then that powder is either melted (pyrometallurgy) or dissolved in acid (hydrometallurgy). But Li batteries are made up of lots of different parts that could explode if they're not disassembled carefully. And even when Li batteries are broken down this way, the products aren't easy to reuse.

"The current method of simply shredding everything and trying to purify a complex mixture results in expensive processes with low value products," says Andrew Abbott, a physical chemist at the University of Leicester. As a result, it **costs more to recycle them than to mine more lithium** to make new ones. Also, since large scale, cheap ways to recycle Li batteries are lagging behind, only **about 5%** of Li batteries are recycled globally, meaning the majority are simply going to waste.

But as demand for EVs escalates, **as it's projected to**, the **impetus to recycle** more of them is set to barrel through the battery and motor vehicle industry.

Wind Turbine Blades Can't Be Recycled, So They're Piling Up in Landfills

Companies are searching for ways to deal with the tens of thousands of blades that have reached the end of their lives.

By Chris Martin

February 5, 2020 at 6:00 PM GMT
at 12:54 AM GMT+8

Pakistan says difficult to outbid European nations for LNG procurement amid war in Ukraine

Products from Oil

Graphic, Rachel Niebergal, Calgary Herald. Source: loga.com.

Thank you

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