

FUTURE ENERGY EXPORTS

Cooperative Research Centre

A pilot-scale facility to research, test and demonstrate decarbonisation technology solutions for the LNG and other energy-intensive industries.

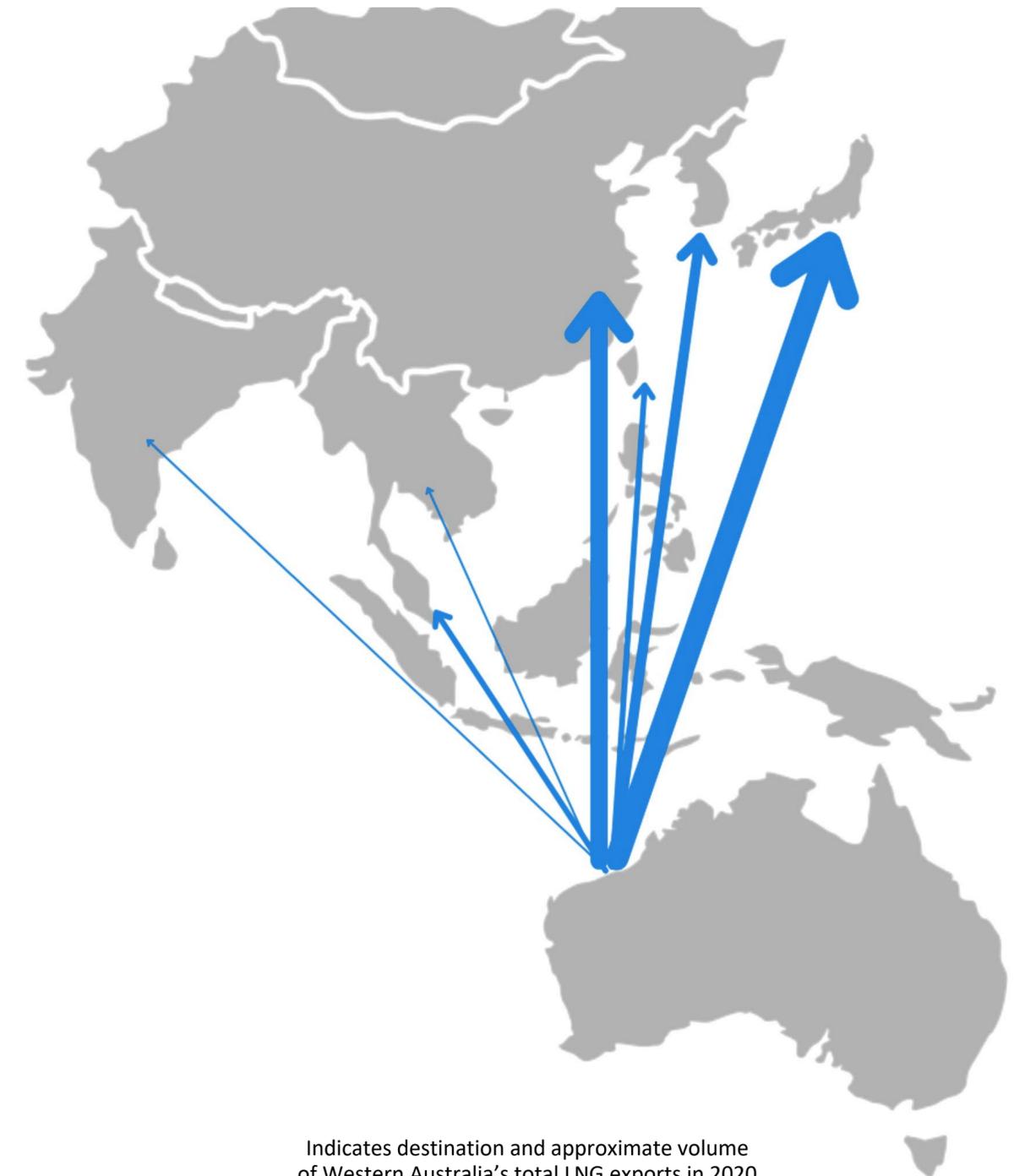


Kwinana Energy
Transformation Hub

Western Australia's Energy Trade



- Australia is the largest global LNG exporter, accounting for 22% of global LNG exports in 2020
- **\$60 billion annual export revenue, supporting 80,000 jobs**
- Western Australia accounted for 12% of global LNG exports and 57% of Australia's NG exports in 2020
- The first LNG export occurred in 1989 and established Australia as a leader and innovator
- Energy security concerns means the world needs our LNG now more than ever.

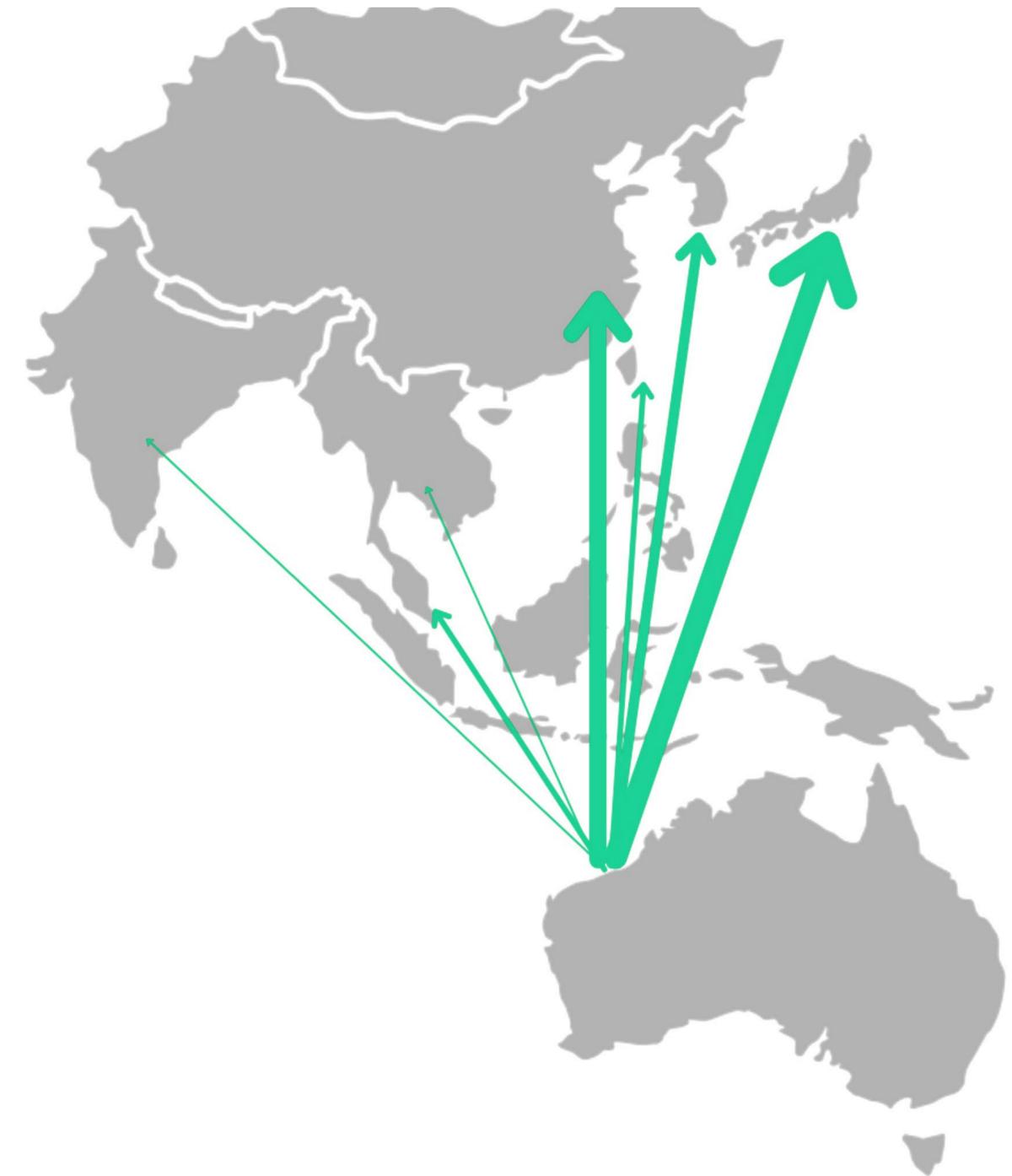


Indicates destination and approximate volume of Western Australia's total LNG exports in 2020

Hydrogen Export Outlook



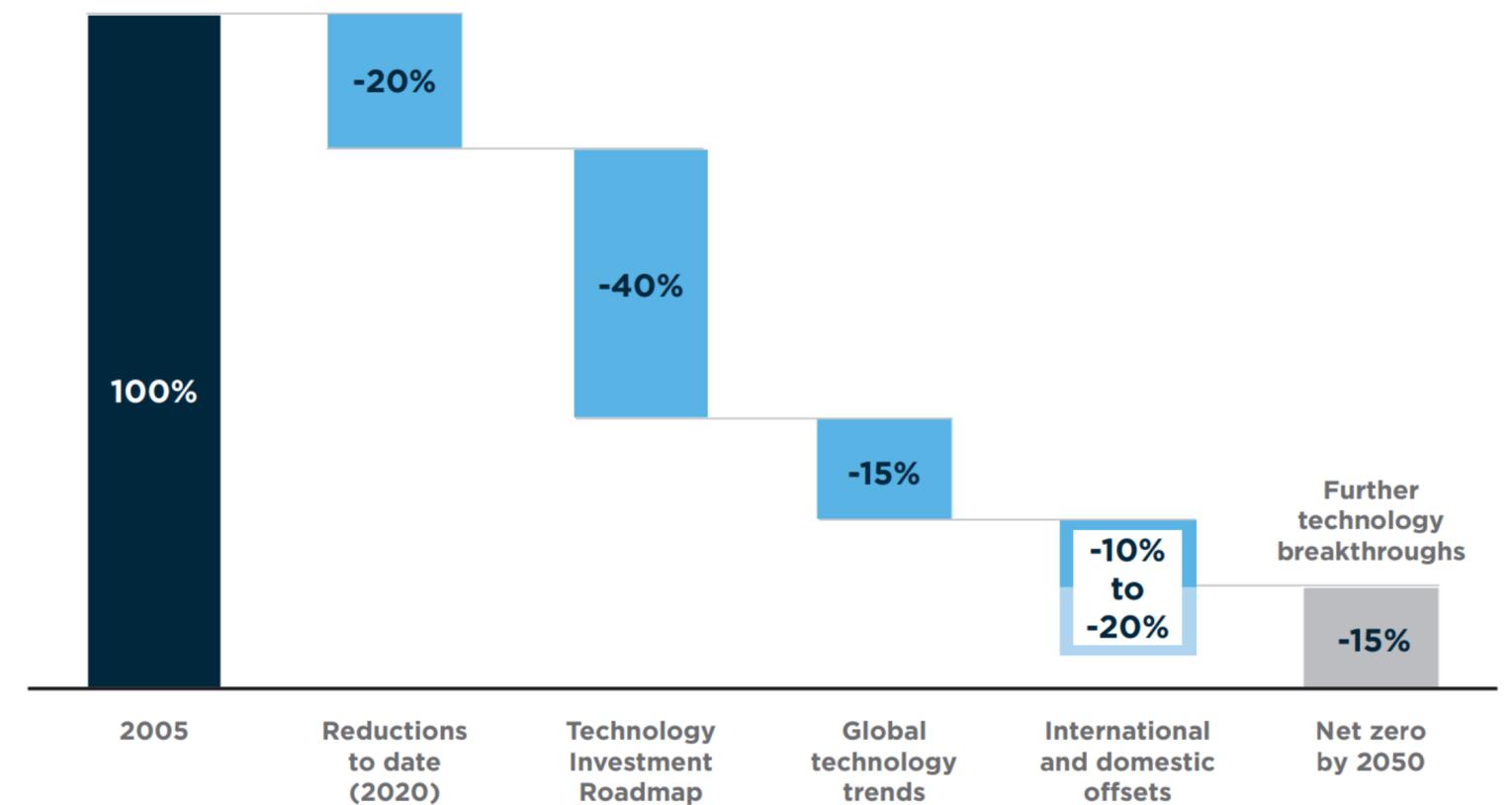
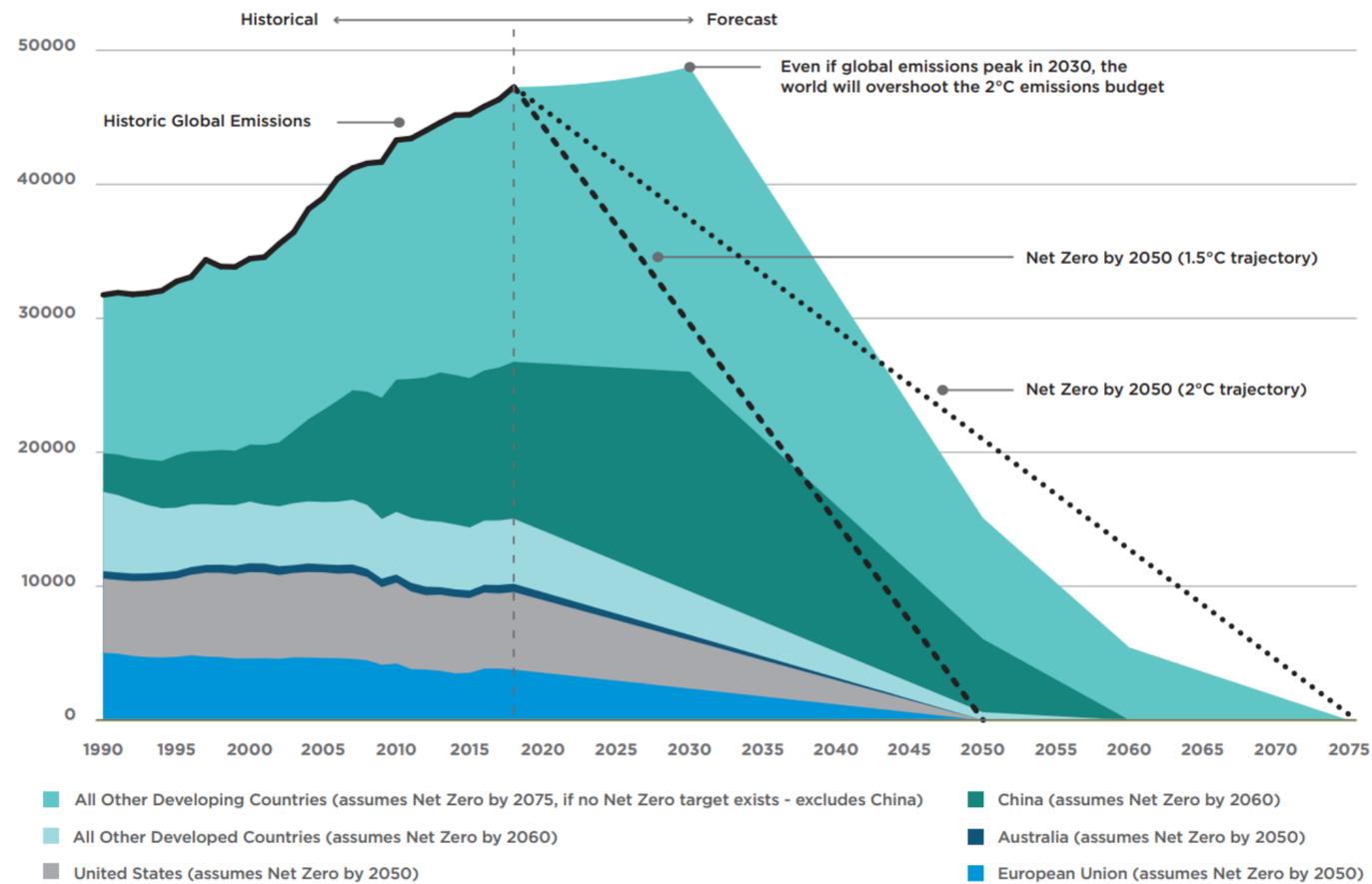
- Leveraging LNG sector experience to create a new hydrogen sector
- Western Australia's government has set an ambition to have a market share in renewable hydrogen exports in 2030 similar to LNG market share in 2021
- A key challenge is how to develop supply when demand is only just emerging



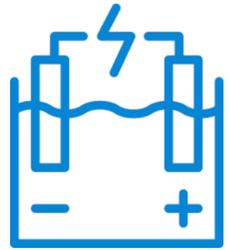
Net-Zero by 2050



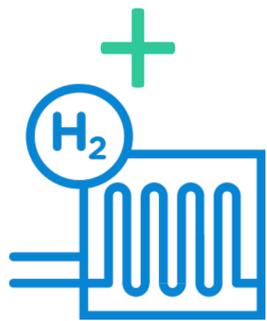
Technology development will play a key role to reach Net-Zero



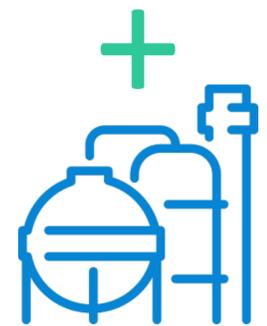
Concept: Kwinana Energy Transformation Hub



2 MW Electrolyser
(800 kg/day green H₂)

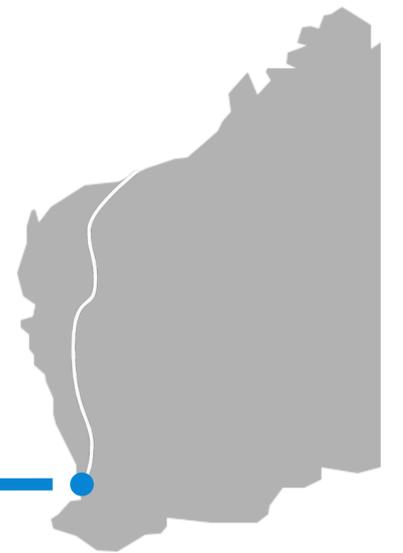
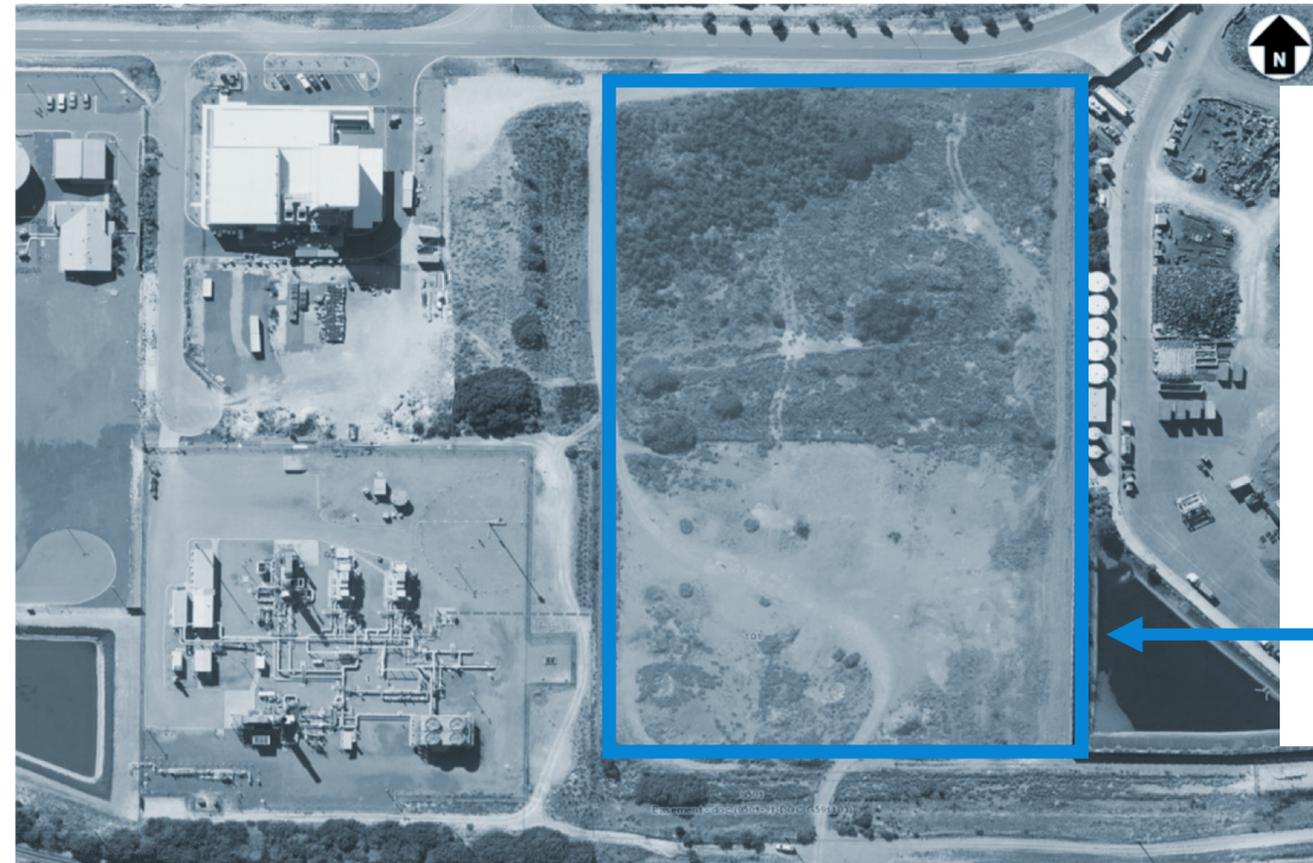


500 kW Fuel Cell



Small LNG Plant
(10 tonnes/day)

- Strategically located in the Kwinana industrial zone
- Adjacent to infrastructure and utilities



Value Proposition



- New technology centre in WA to demonstrate decarbonisation technologies to transform Australian Energy
- Renewable H₂ linked to an industrial process based on natural gas
- De-risking of energy transition strategies before the next wave of investments targeting net-zero
- Collaboration between governments, industry and academia
- Unique training & testing environment for energy transition technologies, equipment qualification and developing new standards



Research & Development

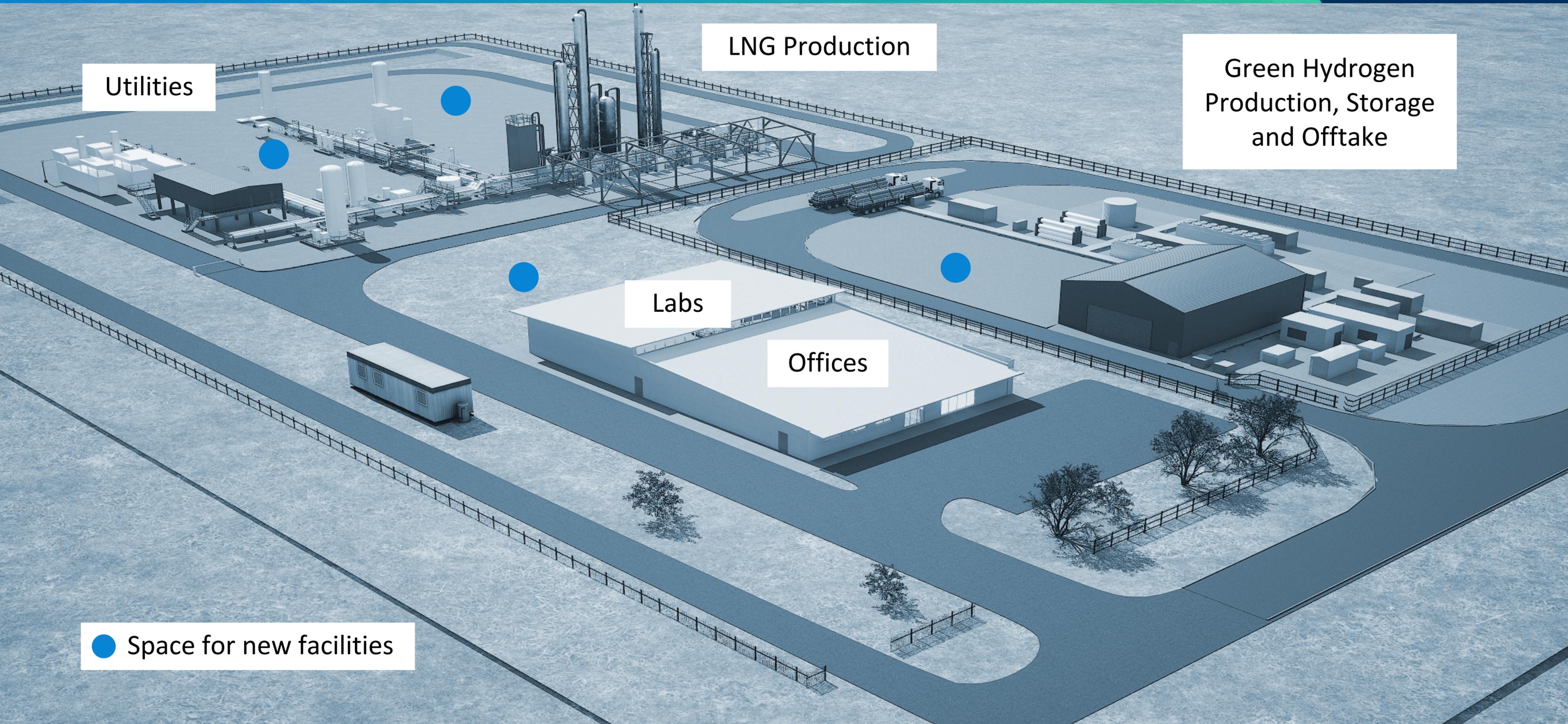


Demonstration



Net-zero Investment

Layout



Utilities

LNG Production

Green Hydrogen
Production, Storage
and Offtake

Labs

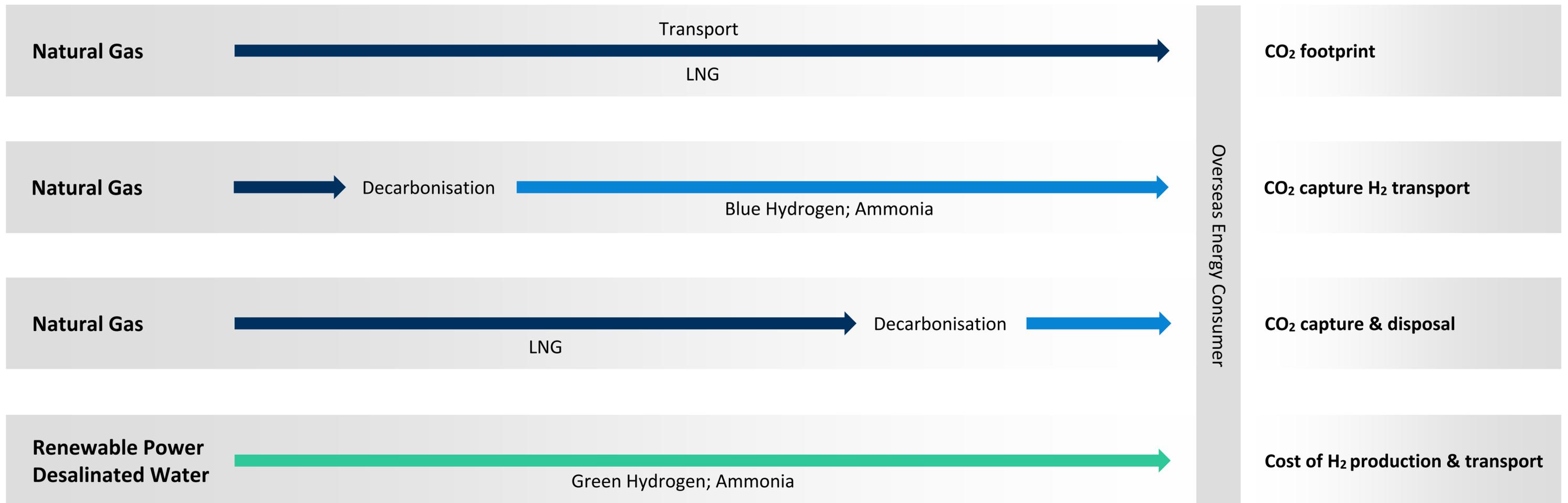
Offices

● Space for new facilities

No Silver Bullets...



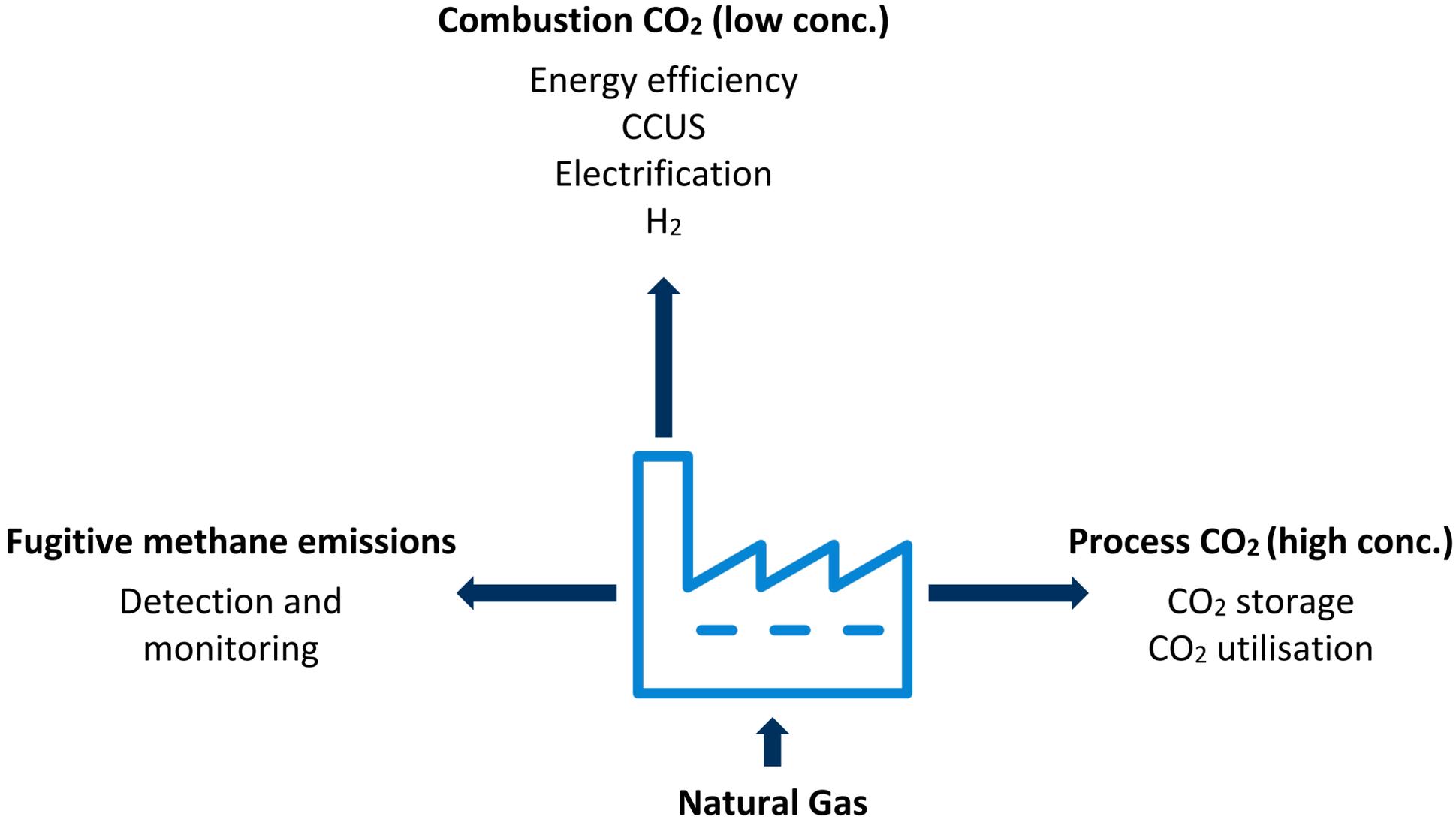
Challenged Business Cases due to cost, complexity & immature supply chains



Scope 1: Emissions from Industrial Processes



Optimum decarbonisation route is uncertain for many manufacturing processes



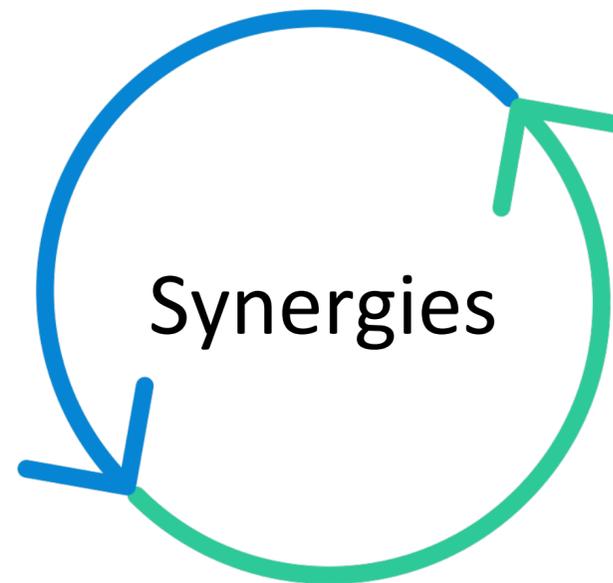
KETH: The Swiss Army Knife of Decarbonisation Technologies



KETH is an enabling test bed for innovative technologies with real-life application

Towards Net-Zero Production Processes

- **Digitisation & Remote Operations**
Energy & operational efficiency
- **Fugitive Emissions**
Detection and reduction of methane fugitive emissions
- **"LNG Train of the future" - Electrification**
Renewable energy to power industrial processes
- **Combustion CO₂ capture***
Amine & cryogenic capture, oxyfiring



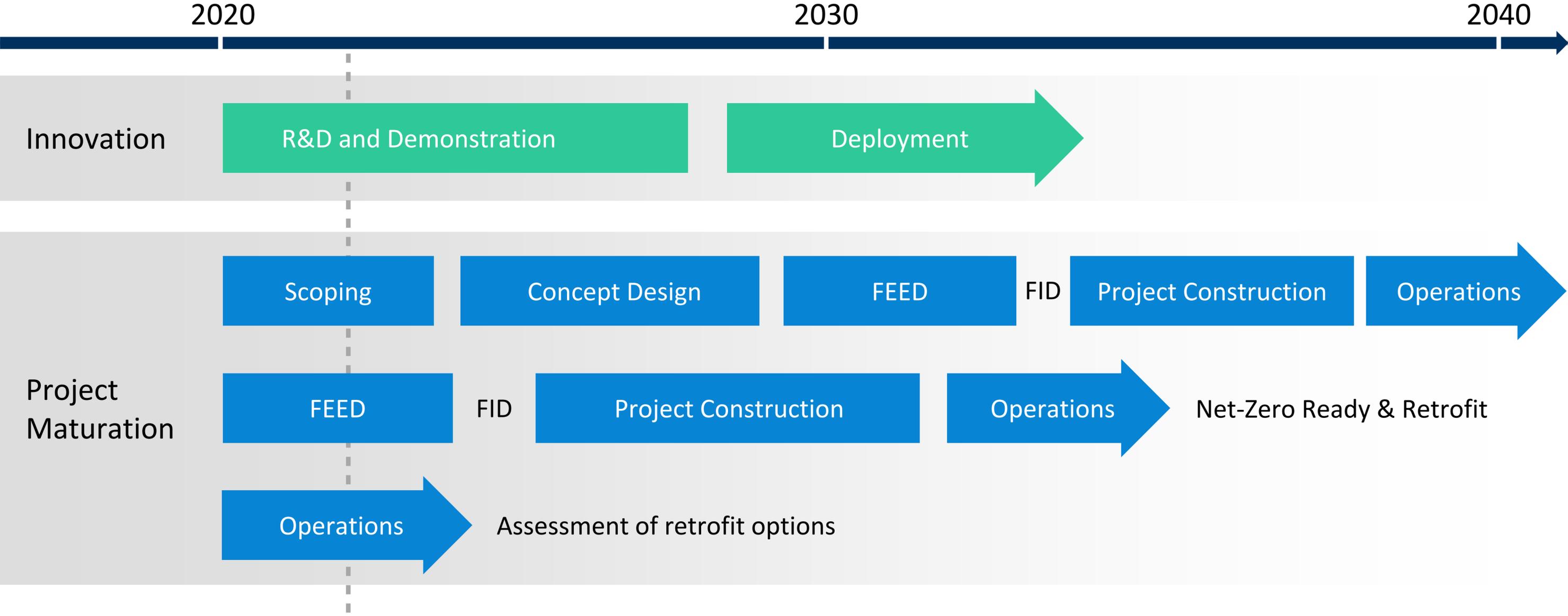
- **Operator Training & Equipment Qualification**
- **CO₂ Utilisation***
Methanation with green hydrogen
- **Hydrogen blending***
Reduction of combustion CO₂ from gas turbines, industrial furnaces, etc.

The Hydrogen Economy

- **Hydrogen & Fuel Cells**
Load demand management
- **Electrolyser optimisation**
Testing of different technologies*
- **Supply and Usage**
Standardisation, regulation, markets
- **Hydrogen Liquefaction***
Higher density long distance transport
- **Blue Hydrogen, Ammonia***
Hydrogen & ammonia from natural gas

* - Requires facility expansion

This is the decade for Net-Zero Innovation



Global analogues of collaborative technology centres



Net Zero Technology Centre, Aberdeen, Scotland

- Co-invested £176m with industry
- Screened more than 1,300 technologies
- Generated £10-15 billion GVA potential
- Delivered over 64 field trials
- Commercialised 20 technologies
- Supported 33 tech start-ups



Technology Centre Mongstad, Norway

- the world's largest and most flexible plant for testing and improving technologies for CO₂ capture
- Has given unique results
- Fellowship with the industry has been crucial
- Has opened doors internationally



KETH progress to date



- ✓ Luth Eolas Pty Ltd established to fund, build and operate the KETH
- ✓ 3 ha land secured at the Kwinana Strategic Industrial Area
- ✓ H₂ Concept Study completed & ready to start FEED.
- ✓ Shovel-ready Q4 2022 (operations by late 2024)
- ✓ Strong support from WA government and UWA
- ✓ Significant R&D funding committed through FEnEx CRC
- ✓ Significant interest from industry to trial technology and strategies

Final Thoughts



- ✓ Requirement for energy decarbonisation is only getting stronger
- ✓ There are no silver bullets - each option has pros and cons
- ✓ The risk and costs of picking winners too early can be high
- ✓ This decade is about technology development & demonstration

The KETH is the intermediate step to de-risk large future investments from resources & manufacturing industries to transition to net-zero



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Thank You



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