Industrial Clusters and Hydrogen Production: uncertainties and opportunities ahead

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WEF, 7 December 2021

Agenda

1. About Uniper and hydrogen
2. Uniper Humber Hub development
3. Cluster development perspectives

Uniper at a glance

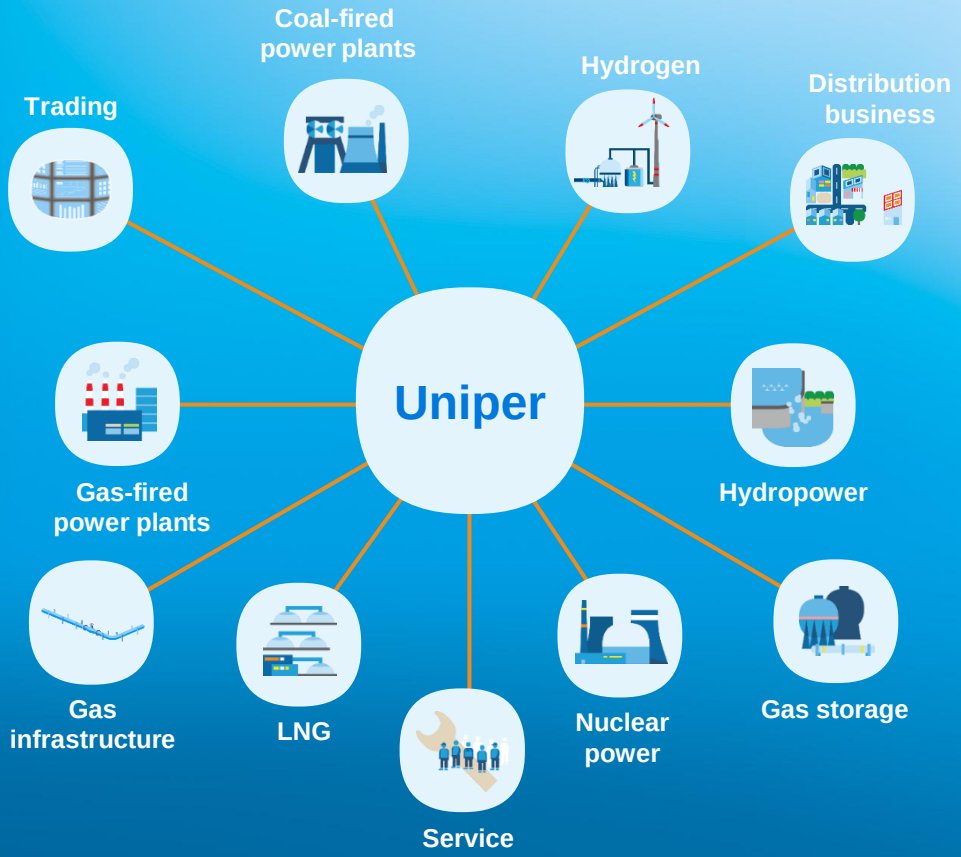
12,000 employees
in over 40 countries.

MDAX
MSCI Germany

50.97 billion euros in
sales (2020)

998 million euros
Adj. EBIT (2020)

~ 35 GW
generation capacity



Uniper supports market development of all types of hydrogen that help to reduce carbon emissions

Project Air (Perstop)
Green H_2 for chemical *>25MW*

Barsebäck
Green H_2 for industry

Flotta Hydrogen Hub
Green H_2

Power-To-Gas Hamburg
Green H_2 – *1.5 MW*

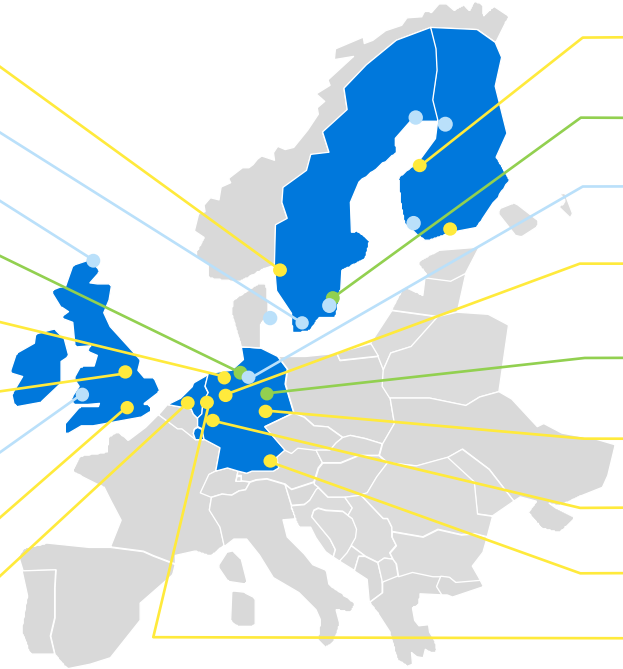
Wilhelmshaven
Green H_2 for steel, *>400MW*
Ammonia imports

Humber Hub
Green + blue H_2 for industry *700MW$_{th}$*

North Wales
Green + blue H_2 for industry and fuel switching, *>200MW$_{th}$*

Project Cavendish
Blue H_2 for fuel switching *>700MW$_{th}$*

Hydrogen to Maasvlakte
Green H_2 for industry *>100MW*



Raahe
Green H_2 for direct reduction of iron (DRI)
~ 500 MW

Oskarshamn
Pink H_2 - *0.7 MW*

Hamburg
Green H_2 for industry

Huntorf (CHESS)
Green H_2 for power, transport, storage
>30MW (→ 300MW)

Power-To-Gas Falkenhagen & Store&Go methanation
Green H_2, *2 MW*

Bad Lauchstädt
Green H_2 for chemical *>30MW*

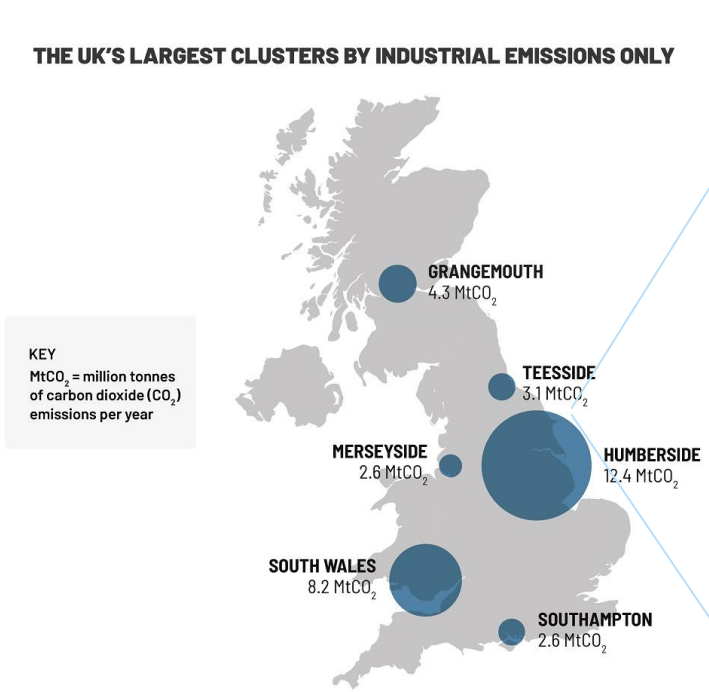
Scholven
Green H_2 based gas turbine

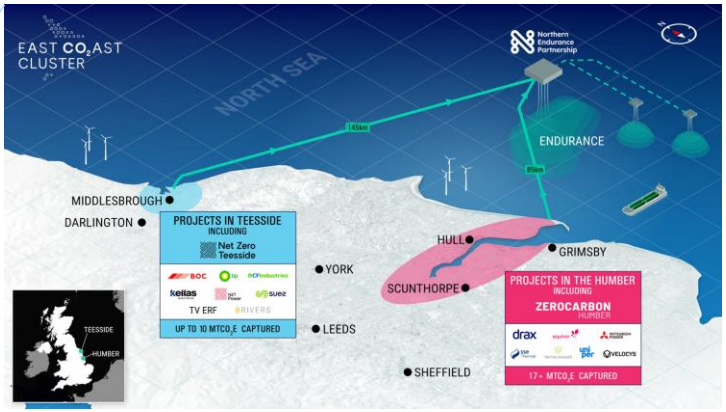
Bierwang
H_2 storage in subsurface porous rock formations

GETH2 (Epe)
H_2 storage in subsurface salt caverns

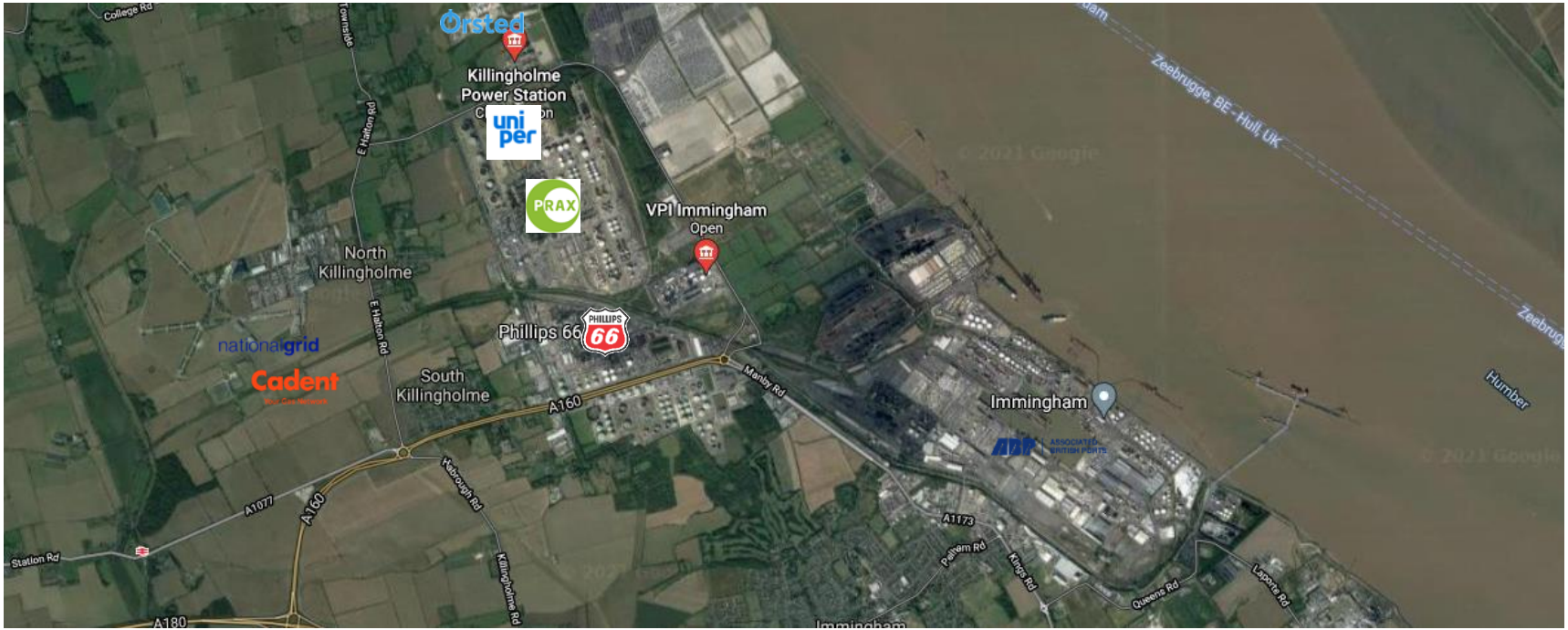
Project idea Project in design Project completed

Large scale hydrogen deployment will start in industrial clusters

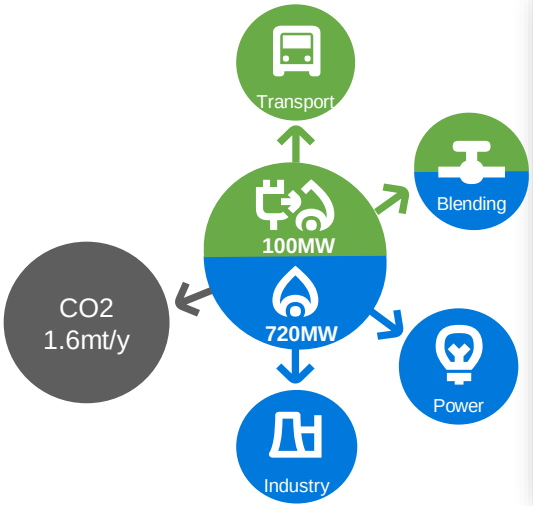


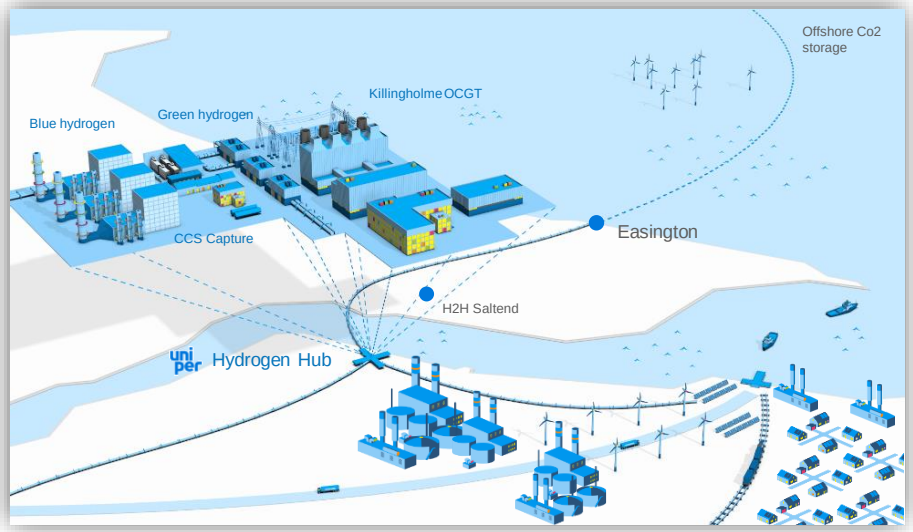


Uniper is focussed on hydrogen supply to South Humber / Immingham industrial area



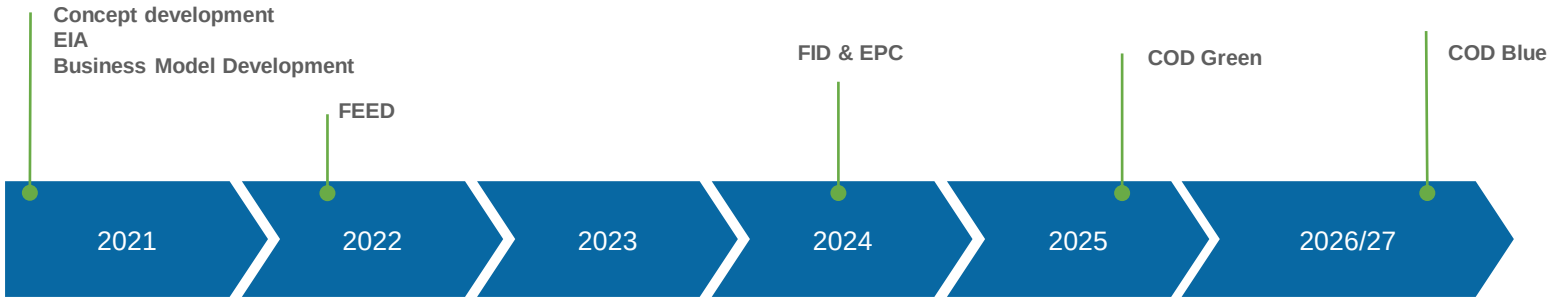
Humber Hub





ZEROCARBON HUMBER

EAST CO_2AST CLUSTER



uniper

Mayflower: port decarbonisation with green hydrogen

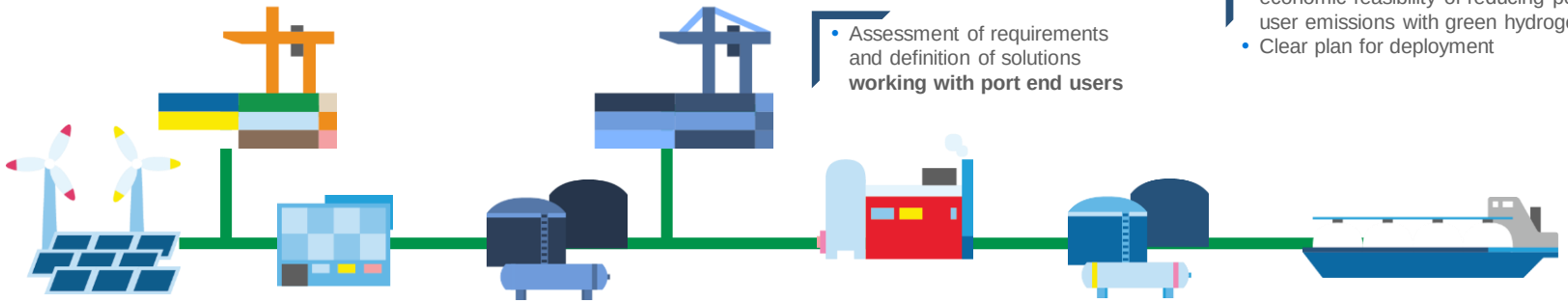
Electrified port equipment

(3) H2 fueled port equipment

- Assessment of requirements and definition of solutions **working with port end users**

Output of Feasibility Study

- Report outlining technical and economic feasibility of reducing port user emissions with green hydrogen
- Clear plan for deployment



Renewable Power Direct or Grid + PPA

- Define plant requirements
- Assessment of connection options
- Green power sourcing

(1) 20MW Electrolysis

- Define plant requirements (water, land)
- Assessment of existing infrastructure
- Permitting strategy
- Define demand profile working with end users

(2) H2 transport & Storage

- Assessment of requirements and definition of solutions

(4) Ammonia synthesis

- Assessment of requirements and definition of solutions **working with port end users and technology suppliers**

(5) Bunkering

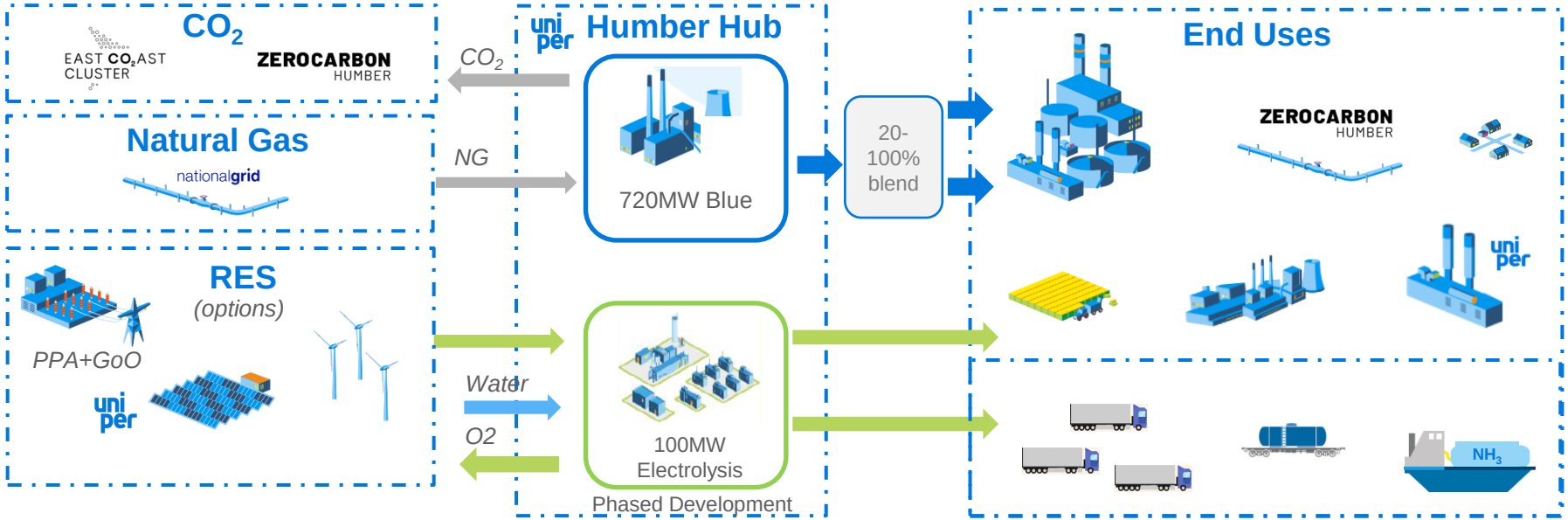
Low carbon shipping fuels

Transition from fossil based to hydrogen based energy in the maritime sector due to
(1) Deployment of an 17.5 MW electrolyser
(2) Creation of hydrogen distribution and storage
(3) Adjustment of port equipment
(4) Deployment of ammonia synthesis
(5) Creation of ammonia bunkering
→ **Provision of clean hydrogen and ammonia**

Developing a transferrable hydrogen supply to ports model, starting with the Port of Immingham

Humber Hub Technical Concept

Humber Hub combine Uniper's interests in the regional collaboration projects Zero Carbon Humber (ZCH) and Project Mayflower (Mayflower), in a phased development of both blue and green hydrogen production facilities at Killingholme power station site.



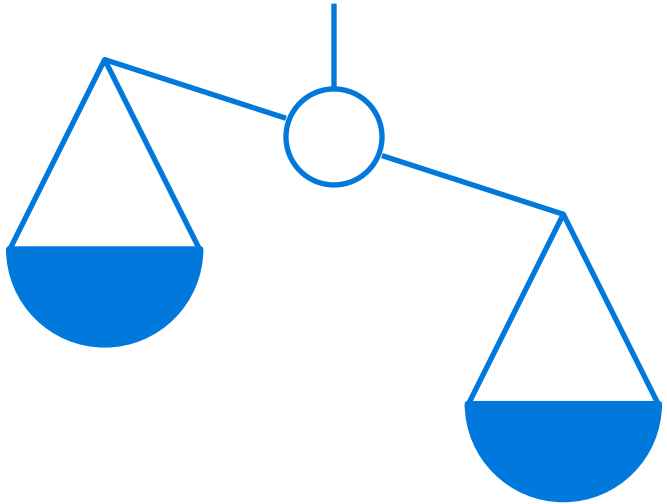
NG – Natural Gas; CO_2 – Carbon Dioxide; RES – Renewable Energy Source; O2 – Oxygen;

Killingholme: all the right ingredients for large scale hydrogen production

Collaboration versus competition in industrial clusters

Funding opportunities

- Targeted, with specific criteria (e.g. ISCF, IETF, Industrial Fuel Switching)
- Promotes and enables partnerships and cooperation
- Resource intensive process



Cluster sequencing

- Competition for initial business model funding and CO2 storage capacity
- Can narrow focus on own decarbonisation initiatives
- Resource intensive process

Managing production and demand risk in an emerging market

- No wholesale market; multiple offtake routes increases project complexity
- Industry; different customer decarbonisation ambitions, requirements and timelines
- Power; co-located production or regional pipeline supply?
- Transport; timing of deployment and hydrogen quality
- Regional hydrogen networks; will they come forward, when and on what terms?
- Gas blending; destination for surplus hydrogen if there is a business model

Project risk as hydrogen and CCS policy develops

- Sufficient incentive to support first mover project in a long term competitive market
- Initial hydrogen production business model accommodates some demand risk
- Visibility of future support to enable follow on projects, future expansion and supply chain growth
- Clarity on how business models interact (e.g. CO2 transport and storage with hydrogen production and future hydrogen network regulation)
- Demand side policy essential to stimulate fuel switching whilst minimising carbon leakage

If you need any further information, please contact us:

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