

Energy Cork Lunchtime Briefing 26th November 2020

Green Hydrogen - Demand



Agenda

- Strategies stimulating demand for Hydrogen
- Hydrogen at Scale
- Hydrogen for Consumers







• Strategies stimulating demand for Hydrogen







Strategic Focus On Hydrogen

The IEA and EU recognise that Hydrogen can be used as a feedstock, a fuel or an energy carrier with storage capabilities, with many possible applications which would reduce greenhouse gas emissions across industry, transport, power and buildings sectors.





European Union 2020 – Hydrogen Strategy
The production of clean hydrogen needs to be increased by creating a sustainable industrial value chain.
We should boost the demand for clean hydrogen coming from industrial applications and mobility technologies.
Clean hydrogen needs a supportive framework, well-functioning markets and clear rules, as well as dedicated infrastructure and a logistical network.
Promoting research and innovation in clean hydrogen technologies is crucial.
Europe we will secure cooperation opportunities with neighbouring countries and regions of the EU and work to establish a global hydrogen market.
The European Clean Hydrogen Alliance will help build up a robust pipeline of investments.



The EU Strategy for increasing demand for Hydrogen

The path towards a European hydrogen eco-system step by step :



- It will be based on life-cycle carbon emissions, anchored in existing climate and energy legislation
- Operated in line with the EU taxonomy for sustainable investments. \bullet



Short and medium term

- Identify other forms of low-carbon hydrogen
- reduce emissions from existing hydrogen production
- support the development of a viable market at a significant scale.

Long term

- decarbonise our European economy
- promote clean hydrogen
- develop clean, renewable hydrogen
- produced using mainly wind and solar energy
- compatible with the EU's climate neutrality goals

Introduction of a comprehensive terminology and certification, to define renewable and other forms of hydrogen.



UK Strategy for increasing demand for Hydrogen

UK Government Hydrogen Strategy- November 2020

Hydrogen Production

- 1GW of hydrogen production capacity by 2025
- 5GW by 2025
- £240 million Net Zero Hydrogen Fund
- Both hydrogen from renewable electricity and hydrogen with CCS to be supported
- A full Hydrogen Strategy to be published in 2021

Hydrogen in Homes

- 20% blending of hydrogen in gas distribution grid by 2023
- Neighbourhood trials of 100% hydrogen by 2023
- a large village hydrogen trial to begin in 2025
- possible hydrogen pilot town before 2030 \bullet

The UK government notes the choice remains open as to whether ultimately they pursue hydrogen heating, an electrified heating system, or a mixture of both, whilst they continue to pilot the options.





CCS 10 million tonnes of CO2 capture per year by 2030 investment of up to £1 billion to support the establishment of CCS in two industrial clusters by the mid-2020s, and four by 2030 Revenue mechanism for industrial carbon capture will be brought forward in 2021, with CCS business models finalised in 2022. **Places & Finance** Industrial Super-Places - where renewables, CCS and hydrogen congregate will be supported. £1 billion Net Zero Innovation Portal focusing on priority areas such as

- Hydrogen, direct air capture, advanced CCUS,
 - bioenergy, and industrial fuel switching.



• Hydrogen at Scale







Hydrogen at Scale in Ireland

Potential for Blue Hydrogen to make an impact on the Hydrogen market in Ireland

- Hydrogen from natural gas through steam methane reforming (SMR).
- Consumed at scale in industrial clusters
 - Whitegate & Aghada CCGT's Oil Refinery \checkmark
 - Shannon Estuary \mathbf{V}
 - Dublin CCGT's \checkmark
- Provides Dispatchable power through CCGT's
 - Supported by Carbon Capture Storage (CCS)









Green Hydrogen produced at scale could support expanded demand across:

- Transportation cars, trucks, buses
- Industry steam / heat demands
- Domestic home heating and cooking

2050 Net Zero targets could be achieved with strategic inclusion of Green Hydrogen in the fuel mix

This would align with current EU strategy for Clean Hydrogen



Green Hydrogen as a source of RES-E

Definition of RES-E: Refers to the electricity generated from clean energy sources such as photovoltaic, hydro, tidal/wave, wind, geothermal, and renewable biomass.







Sustainable Energy Input

- Electricity input for electrolysis process
- Using electricity production from sources such as
- On-shore wind \checkmark
- Off-shore wind
- Solar \checkmark
- Hydro
- **Bio-mass**

Sustainable Feedstock

Water

Abundant and sustainable \checkmark

Sustainable Energy Output

- Green Hydrogen
 - Used at source or stored

Sustainable Energy on Demand

- Utilising Green Hydrogen in Gas Turbines
- Transportation
- **Energy Storage**
- Heating







Hydrogen use in CCGT's

- Existing gas turbine plants in CCGT's should be capable of handling up to ~ 5% hydrogen concentration.
- At hydrogen concentrations between 5% and 18% the Gas Turbine fuel systems may need to be analysed for suitability, with potential modifications required.
- Above 18% hydrogen concentrations the controls, fuel and combustion systems may need to be upgraded.
- Gas turbines operating on hydrogen can provide dispatchable power generation
 - Supporting the grid in times of low RES-E output.



Gas Turbines operating on Green Hydrogen can meet future dispatchable generation requirements, contributing to reductions in CO2 emissions.

Note: % concentration are by volume













Hydrogen for Consumers







Residential & Transport Demand for Energy

Heating of buildings and water, and use of heat in industry, accounts for more than half of global energy use. In Europe, heat and hot water account for 79pc of energy use by EU households, the vast majority of which rely on natural gas boilers. Green Hydrogen offers a sustainable alternative that could make use of existing gas infrastructure.



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The technical challenges that come with introducing hydrogen to these markets are well understood and manageable. The real challenge will be to deliver hydrogen solutions that are commercially viable and affordable to consumers.

Heating – "buildings will need to see hydrogen prices that are competitive". IEA 2019. Transport – "prospects for hydrogen fuel cell vehicles depend on cost reductions in fuel cells, storage tanks and the utilisation of fuelling stations." IEA 2019.





	ktoe		
C	702		
iew	68		
Gas	605		
	1059		
t	196		
I	155		

Total Demand is 2,785 ktoe = 32,389,550 MWh.

Natural Gas, Oil, Peat and Coal make up 2,015 ktoe = 23,434,450 MWh

This is close to 72% of total demand.

Typical household in ROI consumes approximately 11,000 kWh of fuel per annum for heating and cooking

Mode Transport	ktoe
Unspecified	506
Fuel Tourism	184
Pipeline	2
Navigation	42
Rail	196
Public Passenger	139
Aviation	1103
LGV	332
HGV	727
Private Car	2063

Total Demand is 5,294 ktoe = 61,569,220 MWh.

Private Car, HGV, LGV and Public Passenger make up 3,261 ktoe = 37,925,430 MWh.

This is close to 62% of total demand.





Finally4 steps for increasing demand for Hydrogen – IEA 2019

Make industrial ports the nerve centres for scaling up of clean hydrogen. The IEA identified that hydrogen could also fuel ships and trucks serving the ports and power other nearby industrial facilities.

Cork Harbour is a good example of an industrial working port with shipping infrastructure, 2 large power stations, an oil refinery and vast chemical/pharmaceutical industry.

Expand hydrogen in transport through fleets, freight and corridors. (2)

Powering high-mileage cars, trucks and buses to carry passengers and goods along popular routes can make fuel-cell vehicles more competitive.

Cork Harbour is a good example of an industrial port with 2 large power stations, oil refinery, oil distribution network, vast chemical/pharmaceutical industry, linked to the main transport and freight corridors.

Build on existing infrastructure, such as millions of kilometres of natural gas (3) pipelines.

Introducing clean hydrogen to replace just 5% of the volume of countries' natural gas supplies would significantly boost demand for hydrogen and drive down costs.

GNI own and operate thousands of kilometres of high and low pressure natural gas lines in Ireland

Green Hydrogen can play a part in Ireland's energy challenges.

Green hydrogen needs to see falling production and utilisation costs, expanded infrastructure and supportive government strategies and policies.



Launch the hydrogen trade's first international shipping routes. (4)

Lessons from the successful growth of the global LNG market can be leveraged. International hydrogen trade needs to start soon if it is to make an impact on the global energy system.

Ireland has a number of strategically placed ports with the potential to handle large volumes of Hydrogen



