



Humber Zero

Planning for a low carbon future in the Humber

HUMBER ZERO

Discussion outline

1. Humber Zero
2. Strategic Fit
3. What does Humber Zero deliver
4. Contribution to UK Net Zero by 2050
5. Knowledge sharing
6. Project delivery
7. Summary

1. Humber Zero

Immediate, large-scale industrial decarbonisation



- ❖ **World class partners removing up to 8MT/CO₂ per annum by mid 2020s**
- ❖ **Rapid and cost-effective decarbonisation the Humber Refinery**
 - Europe's only supplier of graphite coke for EV batteries and consumer goods
 - Developing new low carbon liquid fuels, including sustainable aviation fuels
- ❖ **1200 MW of low carbon power at VPI Immingham**
 - Providing power and steam to industry and grid
 - Flexibility and stability services to National Grid
- ❖ **Post combustion and hydrogen hybrid which retains optionality for UK consumers**
 - Both green and blue hydrogen combined with baseload CCS
 - Innovate UK already funding Gigastack with Phillips 66/ITM/Orsted
- ❖ **Port of Immingham providing transport and low carbon product export market**
- ❖ **Creates 2,500 jobs during construction, 200 permanent jobs, safeguards 20,000 direct and indirect jobs in local industry**



The University
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nationalgrid
ventures

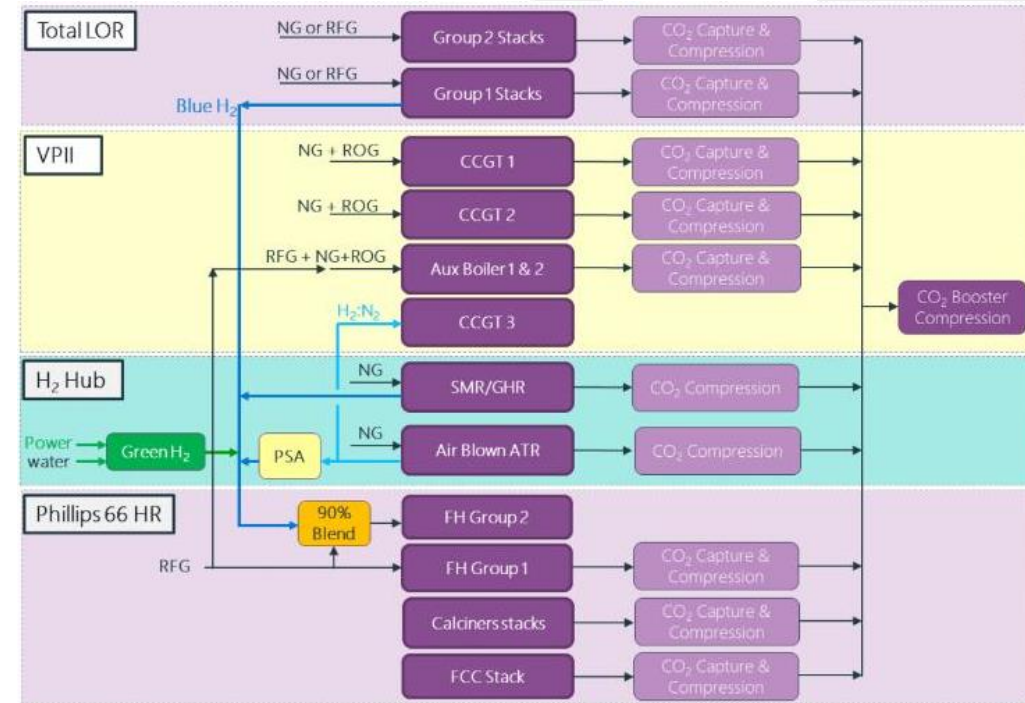
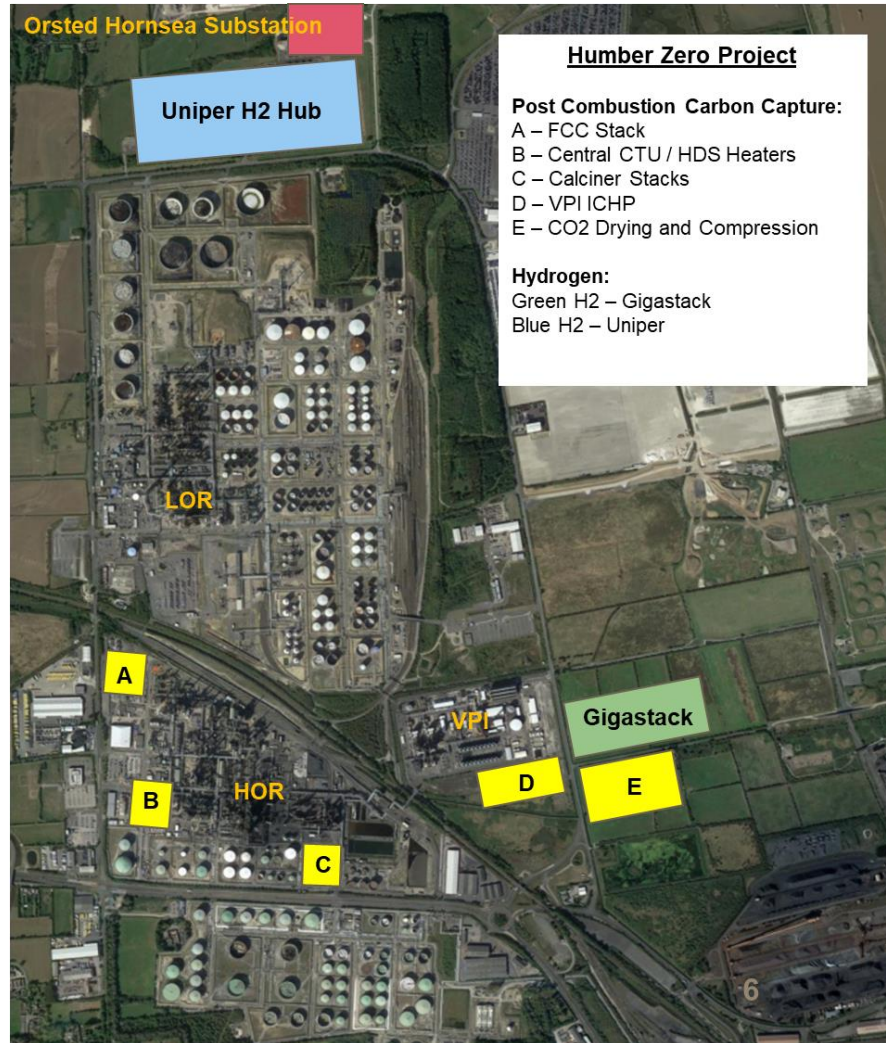


CHRYSAOR



1. Humber Zero

Overall configuration



- Post combustion capture of heaters and stacks flue gases
- Amine based licensed technology
- Shared compression into third party pipeline
- Hydrogen refuelling of geographically remote heaters
- Green hydrogen allows earlier deployment

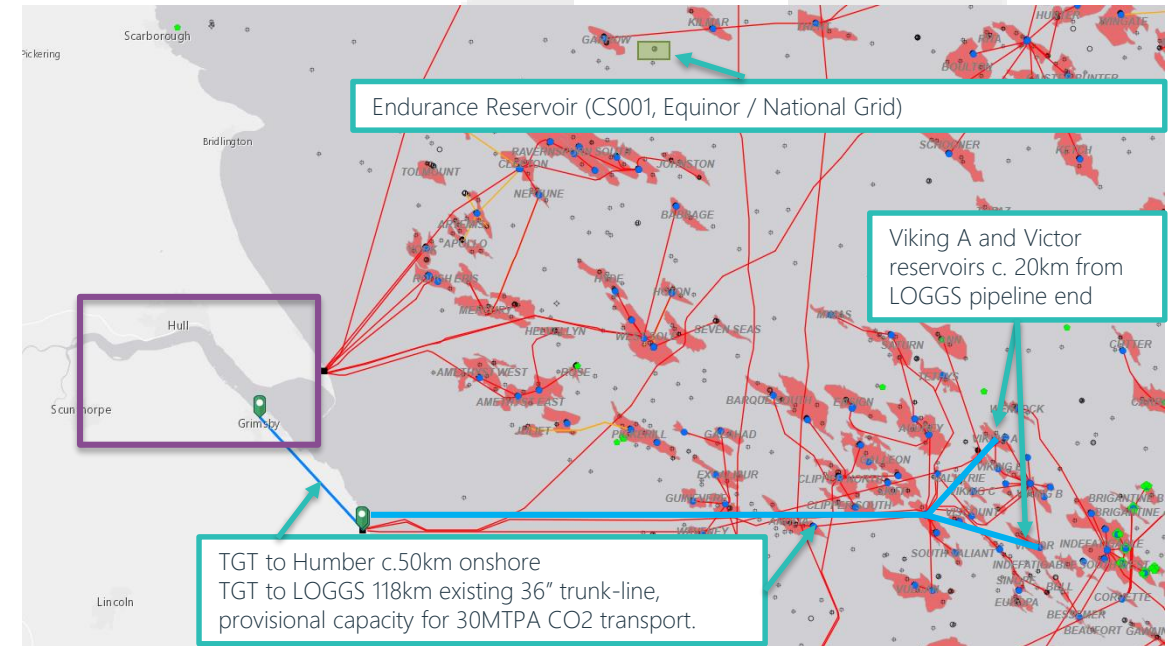
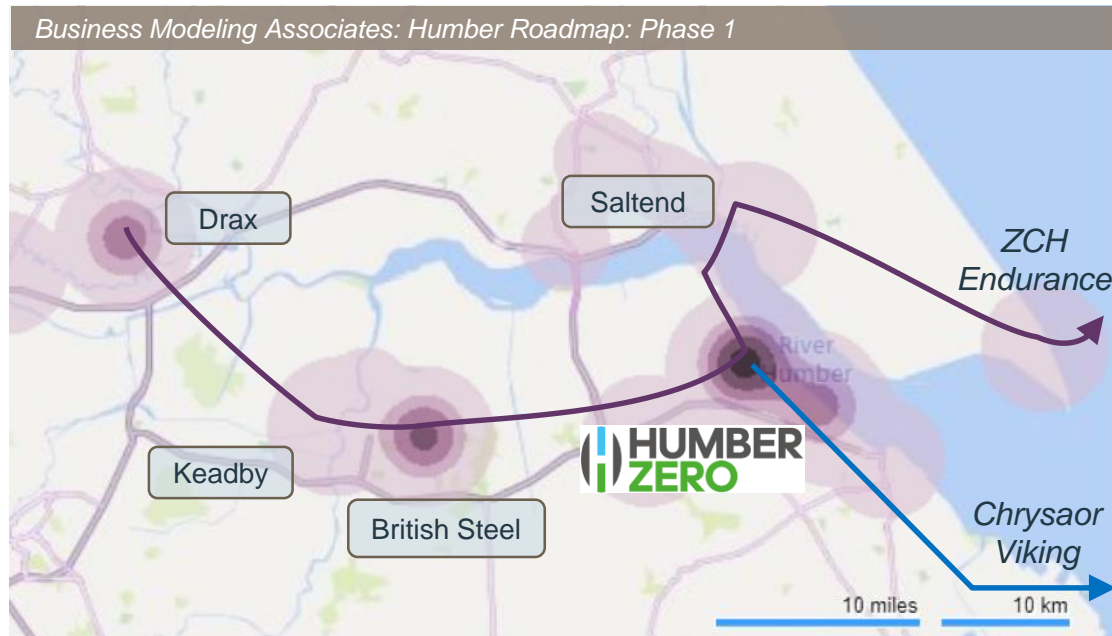
1. Humber Zero

Technical pathways

	Humber Zero projects within Immingham Industrial Cluster	Strategic Fit
1	50 MWth Green Hydrogen production	Hydrogen Supply Programme (Gigastack) - Ongoing Industrial Strategy Challenge Fund (Green H2 for Humber) Low Carbon Hydrogen Fund
2	Post combustion CO ₂ capture to CCGT1, CCGT2, 50% of the maximum flue gas flow from Aux Boilers 1&2 at VP11, CO ₂ pipeline and booster compression.	Industrial Strategy Challenge Fund
3	Post combustion CO ₂ capture and LP compression units applied to FCC stack, Group 1 Fired Heaters Stacks, Calciner Stacks (including SCR & FGD) at P66 Humber Refinery	
4	Conversion of grouped fired heaters to run on 90%+ H ₂ . 138 MWth Blue SMR hydrogen unit.	Industrial Energy Transformation Fund Low Carbon Hydrogen Fund
5	767 MWth Blue ATR hydrogen unit, conversion of CCGT3 at VP11 to fire full hydrogen/nitrogen mix, CO ₂ pipeline and CO ₂ booster compression	Low Carbon Hydrogen Fund

2. Strategic Fit

CO₂ Transportation & storage

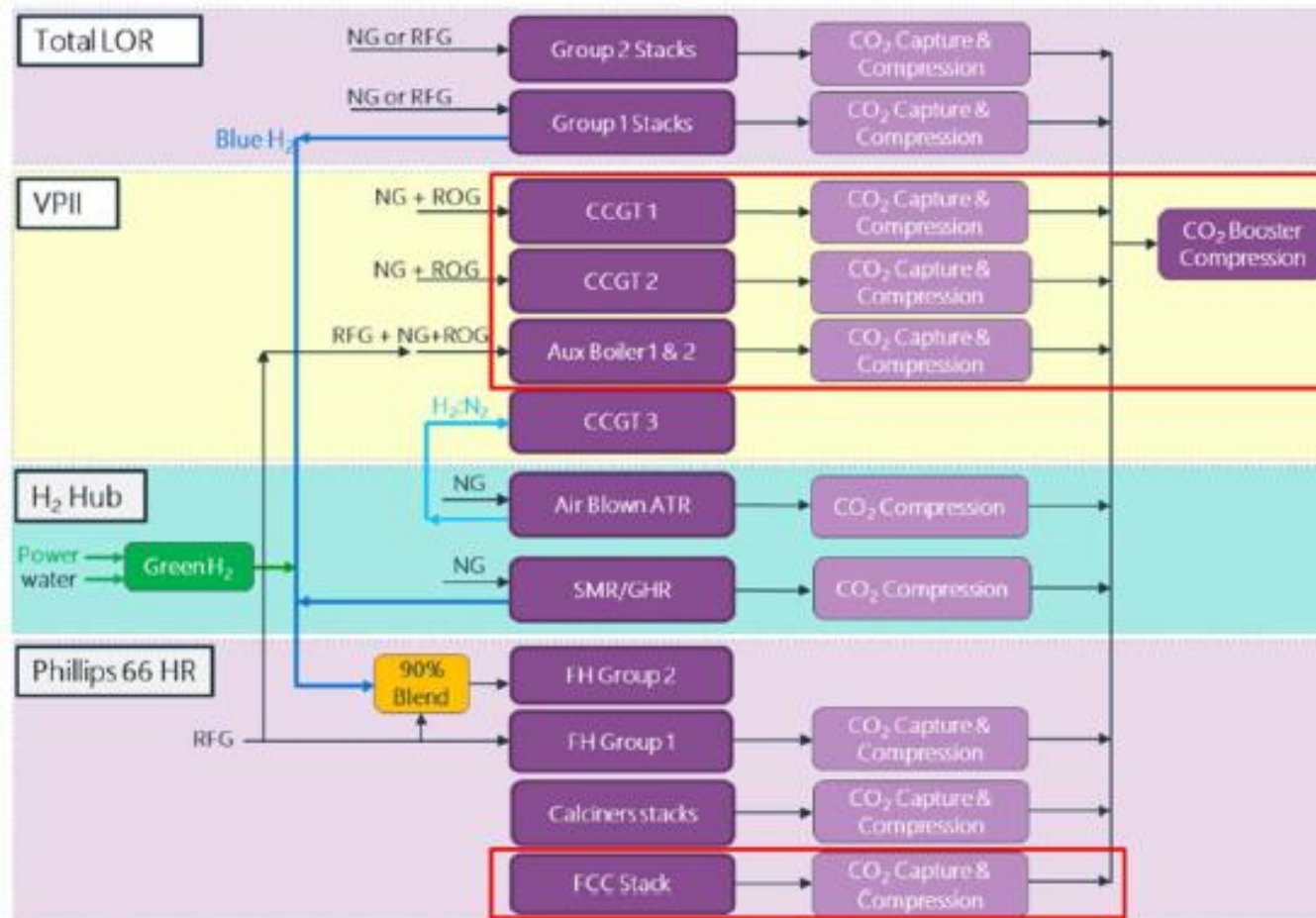


Multiple nearby T&S options available to Humber Zero:
Endurance (Equinor/NGV) and Viking, Victor and V field (Chrysaor) storage options available.

- Humber Zero is the **gateway** to Humber decarbonisation
- Credible route to **at-scale capture** from 2026 (8MTPA CO₂ by 2030);
- Repurposing LOGGS 36" trunkline offers route to **rapid deployment** of CO₂ transport and storage;
- Depleted gas reservoirs with **robust operator-knowledge** of injection, storage and containment potential.

3. What does Humber Zero deliver

Humber Zero – core scope



Core Scope : 3.8 MTPA

Post-combustion carbon capture (PCC) on
GT1, GT2 & Aux Boilers at VPI

+

Post-combustion carbon capture (PCC) on
FCC at HOR Phillips 66

*The Core Scope represents the first logical step by
applying PCC on the FCC unit at HOR - Phillips 66.*

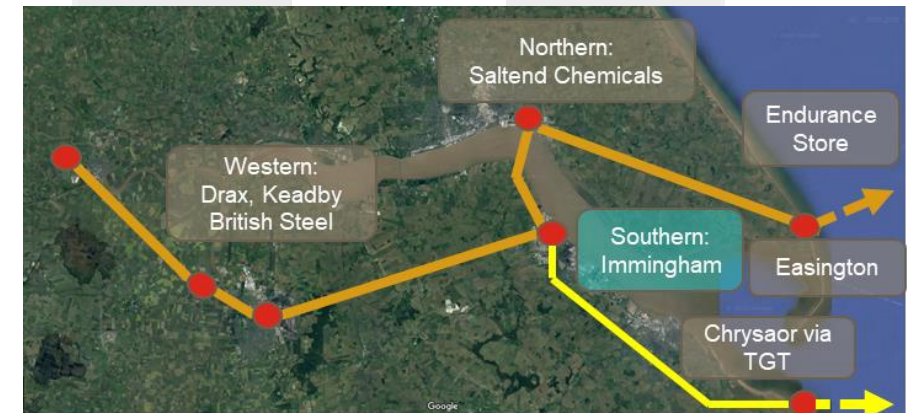
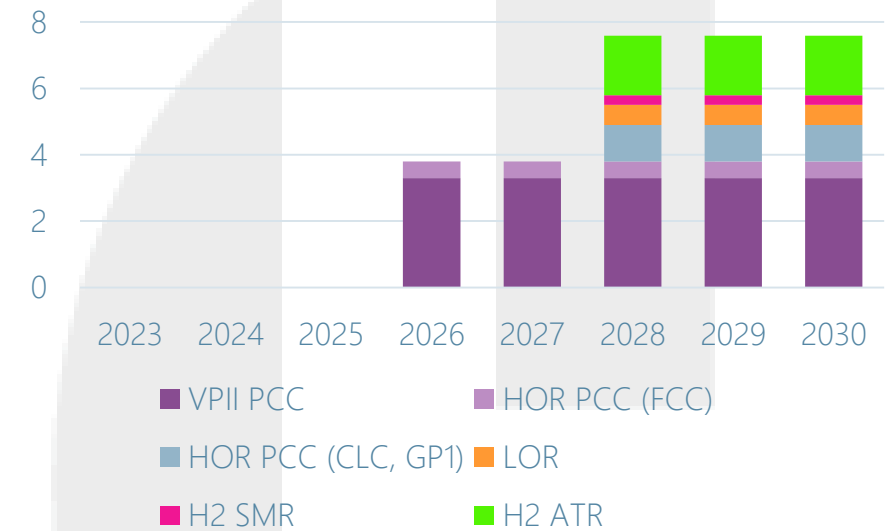
*This unit will treat the most concentrated CO₂ stream
and is the least complex, including consideration of
the pre-treatment steps.*

4. Contribution to UK Net Zero by 2050

Humber Zero a Gateway to decarbonizing Humber Industrial Cluster

- Deployment of multiple technology pathways at scale
 - Post-Combustion Capture, Green and Blue Hydrogen
- Decarbonisation of over 25% of Humber Cluster from Immingham industrial site
- Anchor for multiple offshore CO₂ storage sites under development
 - Endurance (Equinor/National Grid)
 - Viking/Victor and V fields (Chrysaor)
- Connecting Western Humber emitters
- Export / Import potential for CO₂ and low carbon products through ABP Immingham deep water port

Humber Zero CO₂ Volumes
(MTPA)



5. Knowledge sharing

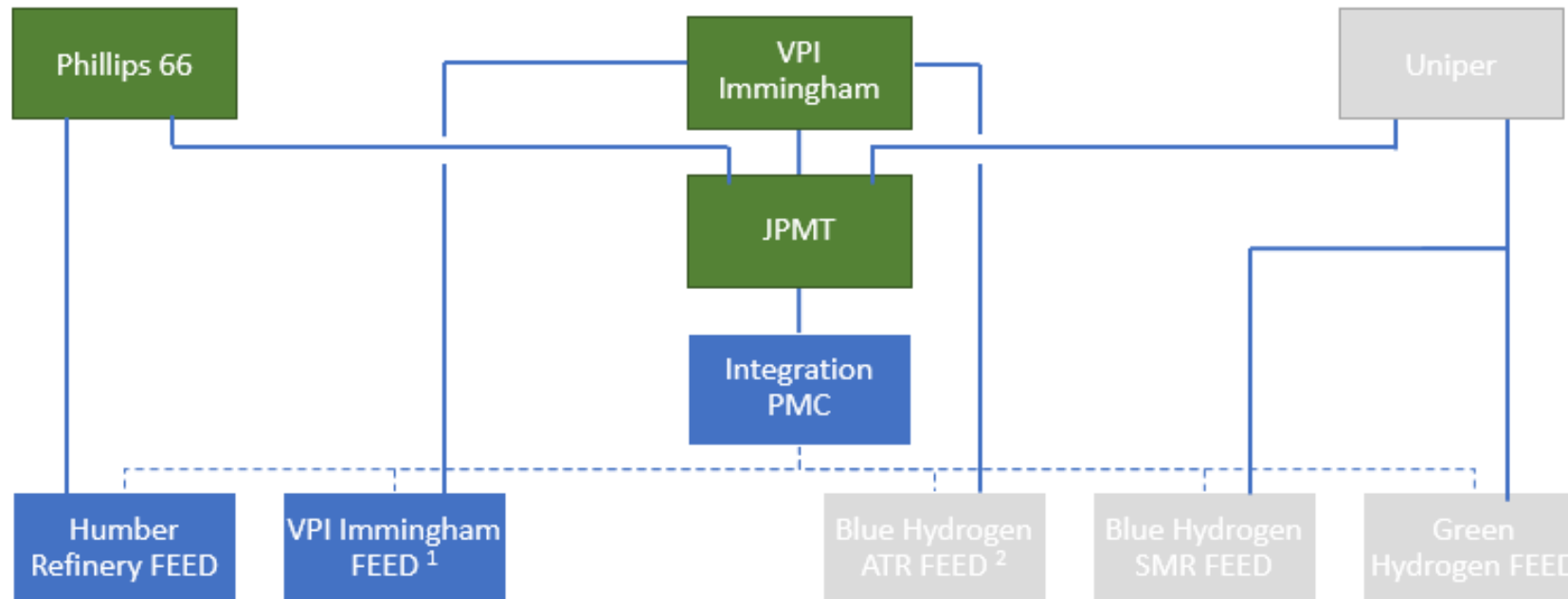
Who? Stakeholders	Why? Benefits	What? Knowledge shared	How? Channels
Humber clusters	<ul style="list-style-type: none"> Optimise use of local infrastructure Ensure better cluster integration 	<ul style="list-style-type: none"> Identify project synergies with other sites and projects in the Humber cluster 	<ul style="list-style-type: none"> Cluster meetings/reports Site visits Collaboration Humber LEP and CATCH on the cluster plan
Other UK clusters	<ul style="list-style-type: none"> Highlight learning and potential opportunities for CCS projects Transform and decarbonise UK industry in the long-term 	<ul style="list-style-type: none"> Knowledge associated with deployment of PCC technologies Key learnings from FEED studies 	<ul style="list-style-type: none"> Data knowledge platform Site visits Cross-cluster / industry meeting and events
IDRIC	<ul style="list-style-type: none"> Allow learnings translation into future research, training and teaching activities, preparing the next generation for a net-zero world. 	<ul style="list-style-type: none"> Key learnings on the types of activities and skills required for projects of this nature 	<ul style="list-style-type: none"> Collaboration with the IDRIC programme Participation in IDRIC events
General public	<ul style="list-style-type: none"> Raise awareness of CCS and decarbonisation of refining, supporting clean growth and ensuring community support 	<ul style="list-style-type: none"> Evidence of the benefits of industrial decarbonisation and the benefits for the local and UK industry including job retention and emission mitigation 	<ul style="list-style-type: none"> Press releases and dissemination events Project website Social media Public consultation
Current/ previous CCS projects	<ul style="list-style-type: none"> Bilateral engagement to share common challenges and capture lessons learned Bring innovation to the Humber Zero project 	<ul style="list-style-type: none"> Understand previous issues, share approach to of Humber Zero and technical and operational questions for discussion/validation. 	<ul style="list-style-type: none"> Targeted engagement Literature review (if available)

Leverage knowledge across UK clusters

6. Project delivery

Project Governance

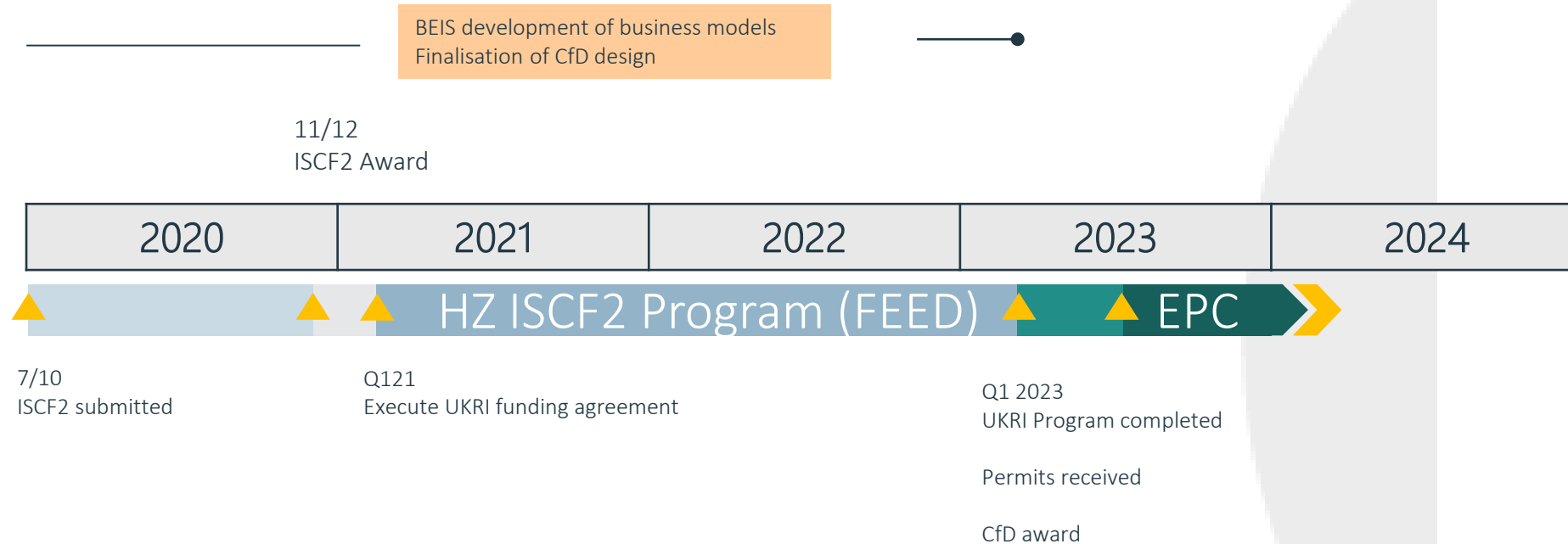
Separate FEEDs with interfaces managed by JPMT and Integration PMC



1. CO₂ Booster Compression Unit design included within VPI Immingham FEED
2. Projects integrated via Joint Project Management Team (JPMT) and Integration PMC

6. Project delivery

Project Funding and Route to Commerciality



- ✓ Business models developed in parallel with phase II ISCF program
- ✓ Project commerciality dependent on business model definition
- ✓ Delivery of technical, commercial, consenting project definition by 2023

7. Humber Zero -Summary

Immediate, large-scale industrial decarbonisation



- World class partners ready to decarbonise Immingham industrial cluster by 2030
- Low-cost deployment pathway enabled by PCC
- Advantaged access to multiple offshore CO₂ stores (Endurance, and Chrysaor V fields)
- Opening gateway to Western Humber emission sources and full decarbonization of Humber cluster by 2040
- Creates 2,500 jobs during construction, 200 permanent jobs, safeguards 20,000 direct and indirect jobs in local industry
- Projects ready to move forward post award

