A new approach for making CCS profitable, without subsidies

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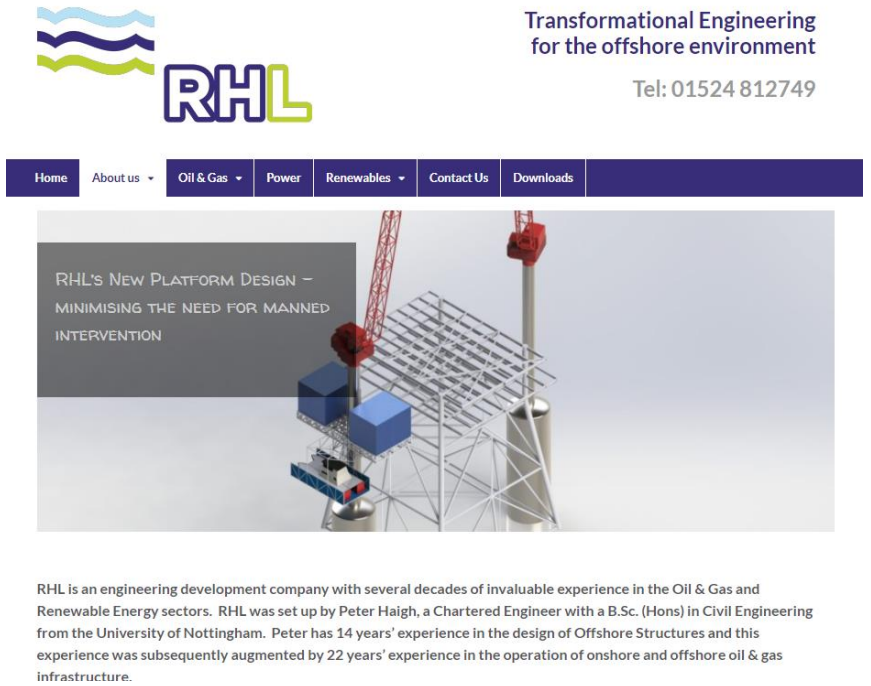

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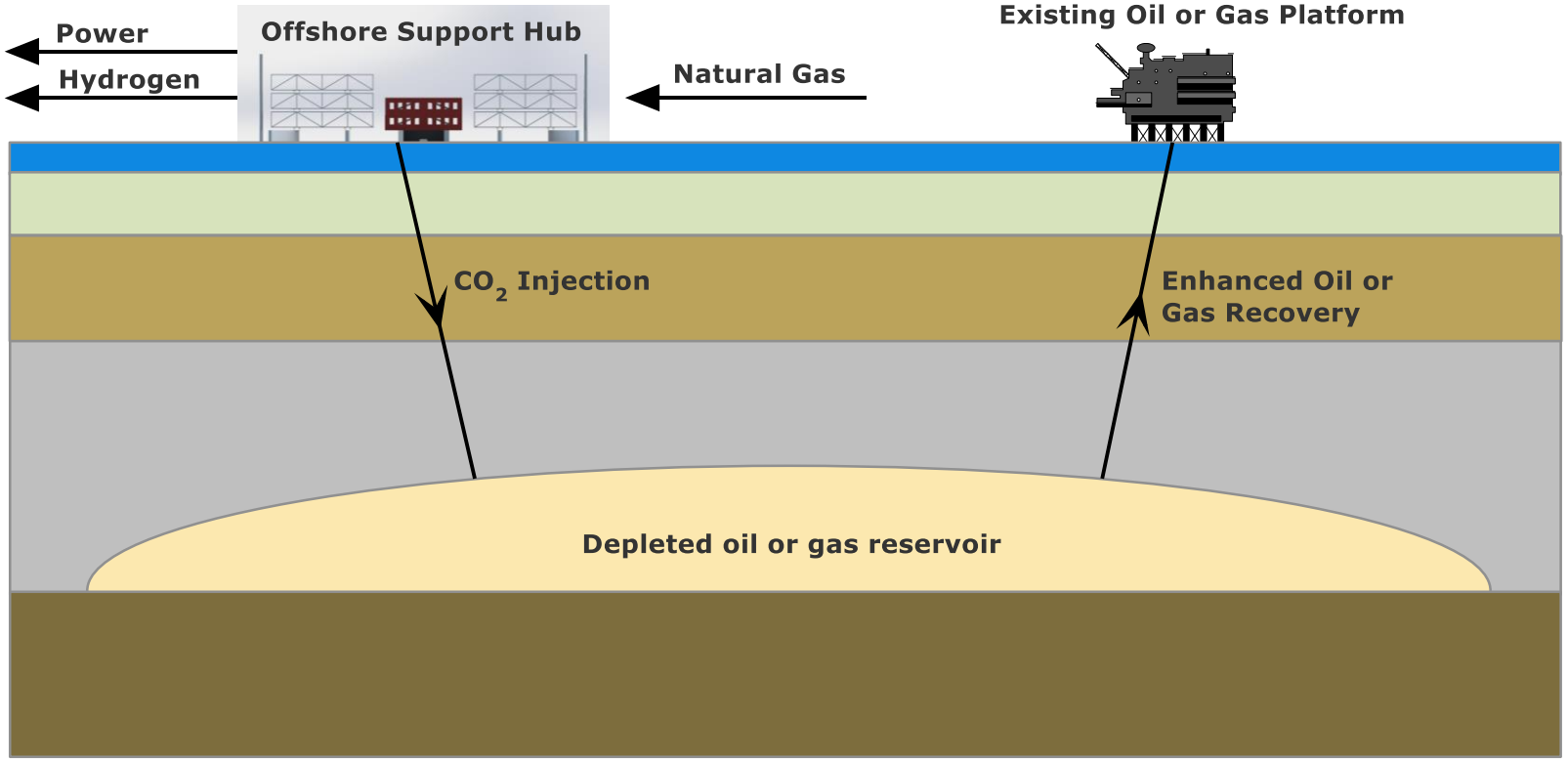
Alternative CCS Approach

- RHL has developed an alternative CCS approach, utilizing pre-combustion, CO_2 capture technology. The facilities are located at an offshore CO_2 storage site and include H_2 production and power generation facilities.
- Initial studies show that this approach can reduce the CCS costs by over 50%, to deliver an economically attractive CCS Project.



Why Offshore?

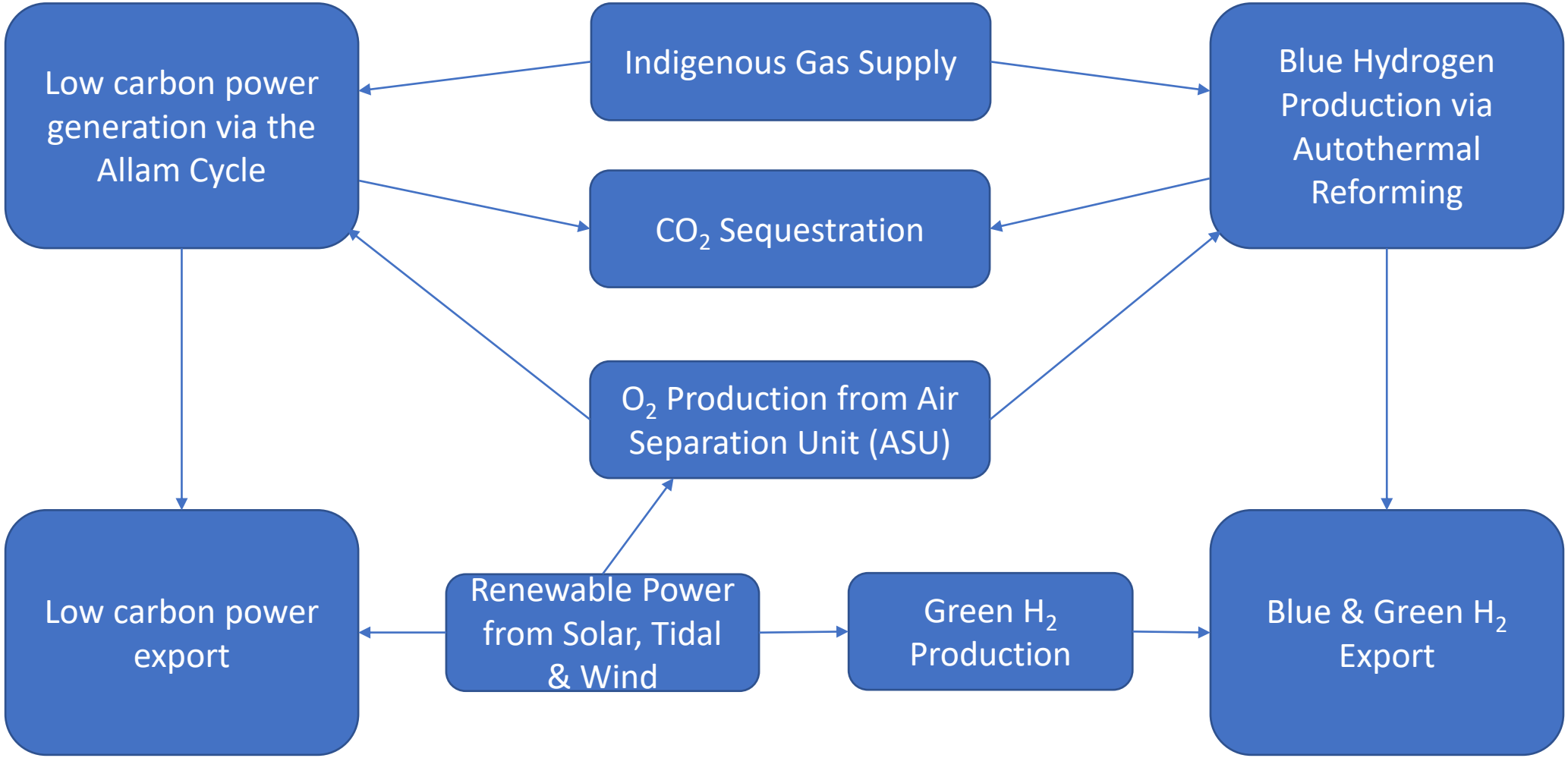
Onshore CCS

- Typical, UK based CCS Projects take the following approach:
  - Retrofitted, post combustion CO_2 capture with high energy input
  - Compression of the captured CO_2 to a super critical fluid, again with high energy input
  - Transportation of the fluid CO_2 to depleted oil or gas reservoirs via onshore & offshore pipelines
  - The CO_2 fluid is then re-gasified to allow efficient injection into the depleted reservoir
  - This approach results in high CAPEX & OPEX which usually delivers a sub-economic business case, without subsidies or high CO_2 taxes
- Previous experience shows that this approach delivers an unattractive business case.

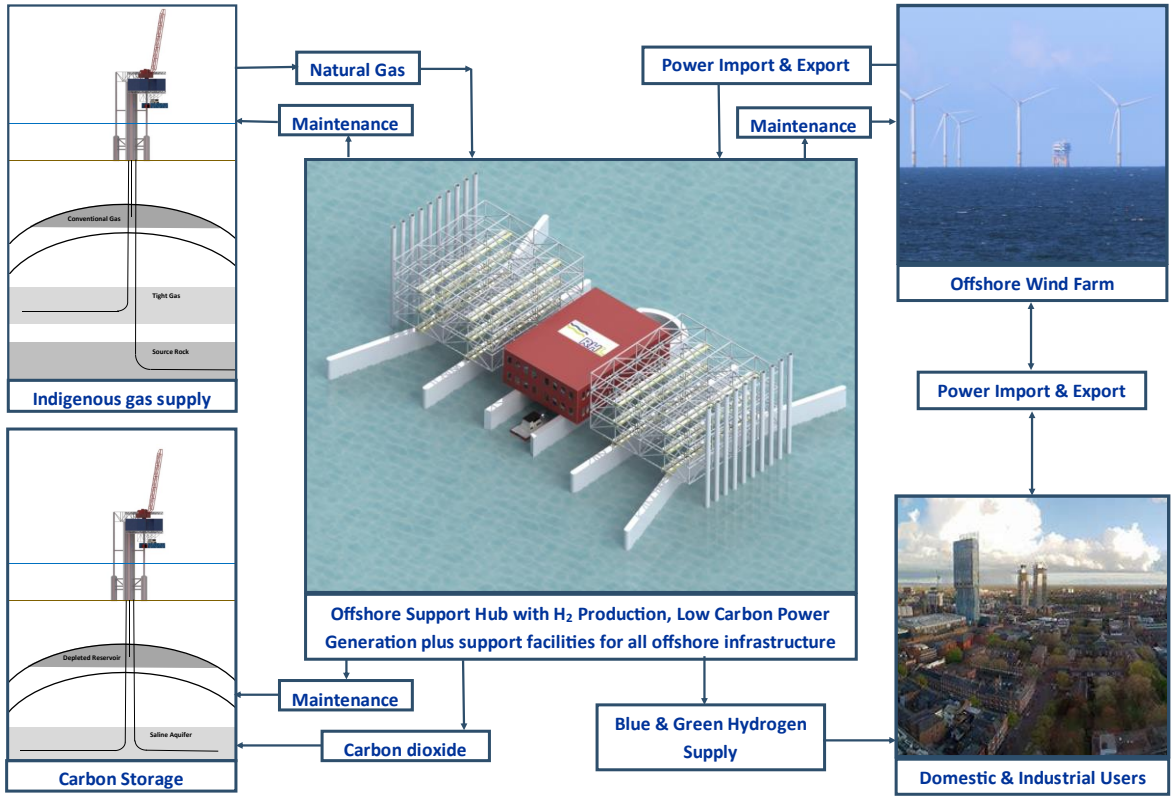
Offshore CCS

- The alternative CCS approach, proposed by RHL, takes the following approach:
  - New, pre-combustion, CO2 capture technology with energy input from dedicated renewables
  - Minimal compression of the captured CO_2 to suit reservoir conditions, with low energy input
  - No requirement for onshore or offshore pipeline infrastructure
  - No requirement for re-gasification
  - Initial cost estimates show that these benefits can reduce the CCS costs by over 50%
- Financial modelling shows that this approach delivers an economically attractive CCS Project.

Process Model



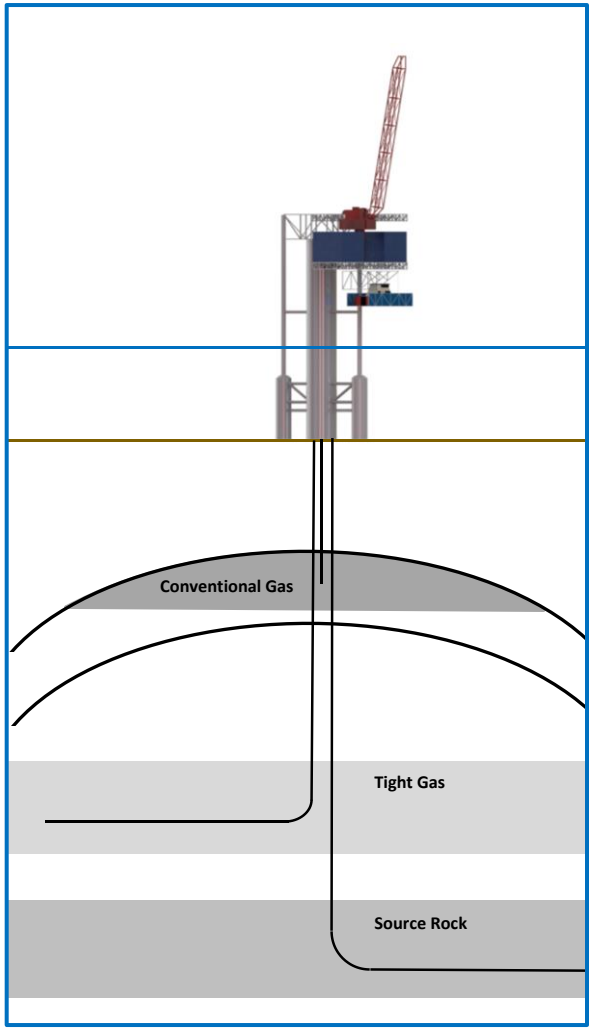
Layout of the Offshore Facilities



- The offshore hub foundation located above a depleted oil or gas reservoir
- Low carbon power generation and H_2 Production facilities are located on this structure
- Facilities are fed by an indigenous supply of natural gas, to deliver blue H_2 plus low carbon power.
- Facilities linked to offshore wind infrastructure for power export and green hydrogen production when the demand for power is low.
- Pre-combustion technology delivers CO_2 emissions, without further processing, for direct injection into the depleted oil or gas reservoir.
- OPEX is minimized by adopting a new operating model supported by a safe dock for all vessel operations.

RHL's New Technologies

- RHL have three patents which underpin solutions for delivering this alternative approach.
- Offshore Platform (Patent No. GBEP 3140459) plus Access Solution (Patent No. UK 14731993.3) deliver a low-cost platform for natural gas recovery and CO_2 injection wells.
- Offshore Platform supports a modular drill rig, with the potential to deliver well costs below £10 million per well.
- Estimated cost of offshore Platform with 16 well slots, in 30 metre water depth, is £20 million.
- Seawall Technology (Patent No. GB 2549530) provides a low-cost foundation structure for the offshore hub and dock infrastructure.
- Estimated cost for offshore hub foundation is £200 million, assuming a demonstration project producing 200,000 Nm^3 per hour of blue hydrogen and a 300 MW power generation unit. This cost replaces the land & groundwork costs for two onshore plants.

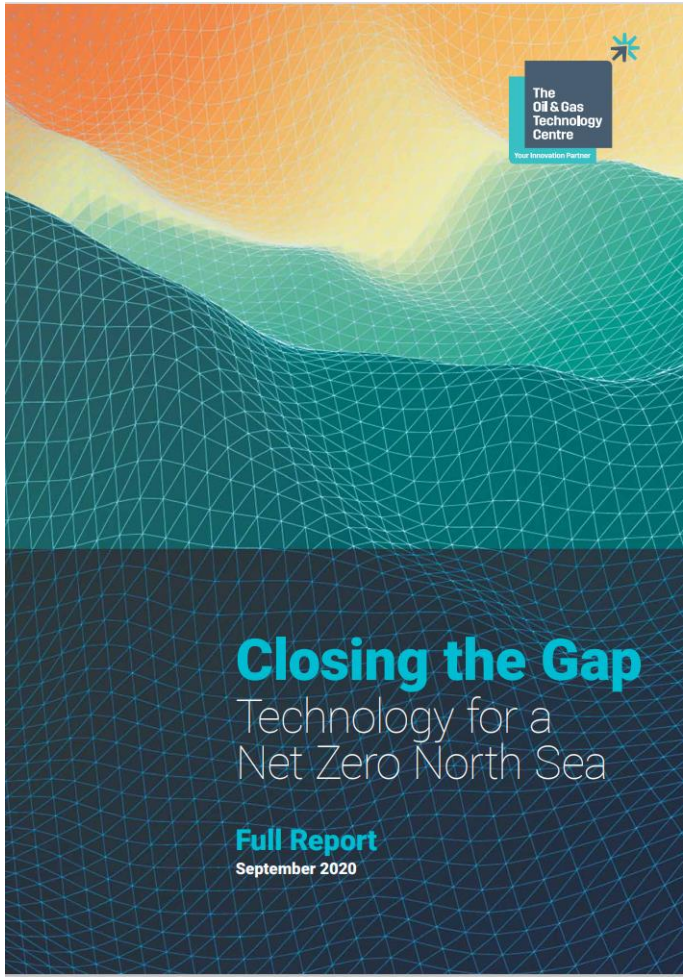


Benefits of this CCS Approach

- Initial studies have shown that this CCS approach supports 4 business types which can deliver attractive revenues, without subsidies:
  - Natural Gas Production @ £0.35 per therm delivers an IRR of 45%
  - Hydrogen Production @ £2.50 per kg delivers an IRR of 40%
  - Power Generation @ £75 per MWh delivers an IRR of 18%
  - Carbon Storage @£30 per tonne of CO_2 delivers an IRR of 31%
- The OGA have shown that indigenous gas supplies have lower carbon intensity than imported gas supplies.
- The combination of power from the offshore hub, plus power from renewable sources, offers a low-cost alternative for the provision of base load operations.
- Currently, industrial users would need to deploy onshore carbon capture and transportation to become carbon neutral. The availability of reliable sources of H_2 and low carbon electricity, at competitive prices, offers these users a potentially lower cost alternative.

Summary

- The work completed by RHL demonstrates that CCS is economically attractive, without subsidies, if an alternative approach is adopted.
- The availability of large volumes of affordable hydrogen will allow industrial users to develop processes which do not emit CO_2.
- The technology required to deliver this approach is commercially available.
- With carbon prices projected to hit €100 per tonne: CCS approach developed by RHL offers offshore operators the opportunity to delay abandonment and become a key part of the solution to achieving net zero CO_2 emissions by 2050.
- The UKCS offers many sites which could be suitable for the deployment of offshore CCS, these need to be developed before key infrastructure is decommissioned.



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