Repurposing Existing Oil Reservoirs Towards Net-Zero Hydrogen Production with Carbon Sequestration

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Abstract

Vedra Hydrogen has developed a process to produce net-zero hydrogen at high scale and least cost, using stranded hydrocarbon resources in late-life oil reservoirs. The process can accelerate achievement of national energy self-reliance goals and climate commitments.

Vedra recently completed an extensive feasibility study on a mature reservoir onshore in Europe. Key findings show that hydrogen can be generated from the crude oil under reservoir conditions of temperature, pressure, and high water saturation. These claims have been proven in the laboratory. The demonstration project which has been designed for the specific reservoir will prove this process further under field conditions, using available process plant.

Two key technologies are used in generating net-zero hydrogen within reservoirs from the waste residual oil: In- Situ Oxidation (ISO) of the crude oil and reservoir brine, and Carbon Sequestration (CCS). Both technologies have been used successfully for many years but never for Clear Hydrogen production from mature oil reservoirs in Europe.

The reservoir, containing naturally occurring residual crude oil and brine, is used as a massive reaction chamber and carbon dioxide store. These resources would otherwise be wasted if the reservoir was decommissioned. In addition, the process becomes carbon-negative by storing third parties' carbon dioxide.

Complex geoscience, and dynamic reservoir, models show hydrogen production is sustainable for many years as the reservoir is efficiently swept by converting the waste oil to hydrogen. The existing wells and facilities can be modified for the safe injection of compressed air and production of syngases. New surface facilities will be installed to separate the syngas gases for CO2 storage and high purity hydrogen sales.

Geoscience plays a critical role in initially screening the opportunities and then high-grading and optimizing the field development for hydrogen. Case examples will be shown how this is done most effectively with supporting laboratory and reservoir simulation work.

The process is highly scalable. Vedra's plans de-risk commercialisation by scaling up in logical steps. A short demonstration project leads to initial commercialisation at one site, expanding to multiple well clusters, and finally full-field conversion to hydrogen and CCS operations.

The Vedra Method can be deployed across a multitude of mature onshore oil fields globally. This will develop local circular economies by supplying clean hydrogen to industry while storing harmful CO2 permanently. It will contribute significantly to the energy transition and help meet national decarbonisation goals. The process provides a compelling economic, environmental, and political solution to the international challenges of energy transition.