Using Redundant Infrastructure and Depleted Reservoirs in the North Sea to Transition to a Hydrogen Economy in the United Kingdom

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Abstract

The Paris Agreement has spurred the need for energy transition with its goals of dealing with greenhouse-gas-emissions to keep the increase in global average temperature to below 2°C above pre-industrial levels and limiting the rise to 1.5°C to reduce the risks and effects of climate change. Under the terms of the Agreement, each country must plan and report on the contribution it undertakes to mitigate global warming. The North Sea may have a key role to play in the UK's energy transition with potential synergies and interdependencies between the existing oil and gas and the evolving renewable sectors, especially the stellar growth in offshore wind farms around the country. One interesting scenario is the potential use of redundant offshore pipelines, platforms, wells and depleted petroleum reservoirs in the UKCS for the production, transport and buffer storage of hydrogen, which might help the development of a hydrogen economy in the UK. The paper considers the transition from being less dependent on offshore oil and gas to becoming more reliant on renewable energy sources over the next 30 years. Trends in oil and gas fields nearing abandonment and their proximity to existing and planned offshore wind farms are highlighted, as there might be an option to generate green hydrogen via the electrolysis of seawater on platforms earmarked for decommissioning and redundant pipelines might provide storage (line packing for peak shaving) and for transport of hydrogen to shore. Another consideration is the conversion of depleted gas fields and their export lines to shore into CCS sites, so that the CO2, which is a by-

product of the land-based steam-methane reforming (SMR) process used to create hydrogen from natural gas, can be transported offshore and stored underground. Onshore salt caverns can provide non-contaminating storage of hydrogen from SMR, which can subsequently be used for power generation and would reduce the CAPEX needed to build new clean power station capacity. It is estimated that a single hydrogen filled salt cavern could meet the peak and fluctuating energy demands of a whole city. The paper considers the commercial and technical practicalities of the above options and suggests what may and may not be possible in how the North Sea could help the UK's transition into a hydrogen-based economy.

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