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# Accelerating Underground Hydrogen Storage with $CO_2$ Storage Experience. Developing a Hydrogen Storage Demonstration at the Otway International Test Centre.

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**Abstract**

Underground hydrogen storage (UHS) is recommended as a cost-effective solution to provide large volume hydrogen ($H_2$) supply security. Porous geological storage resources are an ideal UHS option to address this, providing a vast range of geographically favourable storage locations and ample capacity and the low cost required for the projected growth in the global hydrogen economy.

The technical readiness for industries to undertake UHS in porous rock, however, is low, with the need to address scientific questions around how stored hydrogen interacts with subsurface rocks and fluids, and how this impacts the storage efficiency. While $H_2$ storage has taken place in salt caverns, for underground methanation or as part of a mixed gas, no field demonstration of pure $H_2$ injection and withdrawal for addressing $H_2$ supply and energy security has taken place in porous reservoirs. The development of UHS technologies, fortunately can be rapidly achieved through the innovation of existing $CO_2$ and natural gas storage know-how, processes and infrastructure. Much work is being undertaken within research organisations renowned for their $CO_2$ storage technology, and this conversion of existing knowledge to UHS is progressing rapidly.

A commercially relevant demonstration of UHS is the next step in the development of UHS technology, providing the knowledge and confidence for future large investment into commercial scale UHS. CO2CRC, in partnership with CSIRO, is undertaking the development phase for a field-scale demonstration of porous UHS. CO2CRC's Otway International Test Centre's (OITC) state-of-the art storage and monitoring facilities and the partnership's advanced geological and reservoir engineering knowledge makes it the ideal option for cost effectively and rapidly maturing UHS technology through field demonstration. This demonstration will form a proxy for commercial scale UHS operations, including safe storage and handling protocols and provide a platform for technology development in UHS.

The conceptual plan for this UHS demonstration is to undertake the receival of $H_2$, compress and inject it, via a purpose drilled $H_2$ well, into an already comprehensively characterised depleted reservoir target ~2 km below the

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surface. Advanced monitoring systems would confirm the containment of the $H_2$ and appraise the subsurface $H_2$ processes. Stored $H_2$ will then be extracted, and the performance of this extraction assessed in terms of recovery rate, recovery volume and $H_2$ purity. Pre-existing gases in the depleted fields will be utilised to maintain pressure and assist recovery in a manner than minimises gas mixing. Several cycles of $H_2$ injection and withdrawal will likely take place to assess the performance of the reservoir itself as a temporary storage system. The facility itself and resulting data will be accessible to the research community and industry to collaborate in the demonstration, trial specific technologies and as a training and education vehicle.

This commercially relevant venture will use $CO_2$ storage expertise and CCS research facilities to form a world leading demonstration of $H_2$ injection and withdrawal within a depleted reservoir. The demonstration will provide a proof-of-concept of large-scale safe porous geological storage of $H_2$ as a solution for managing $H_2$ supply challenges at scale and demonstrating it as a vital infrastructure requirement for a safe and holistic Hydrogen economy.

*Keywords:* Hydrogen; Underground; Storage; Porous; Demonstration; Otway