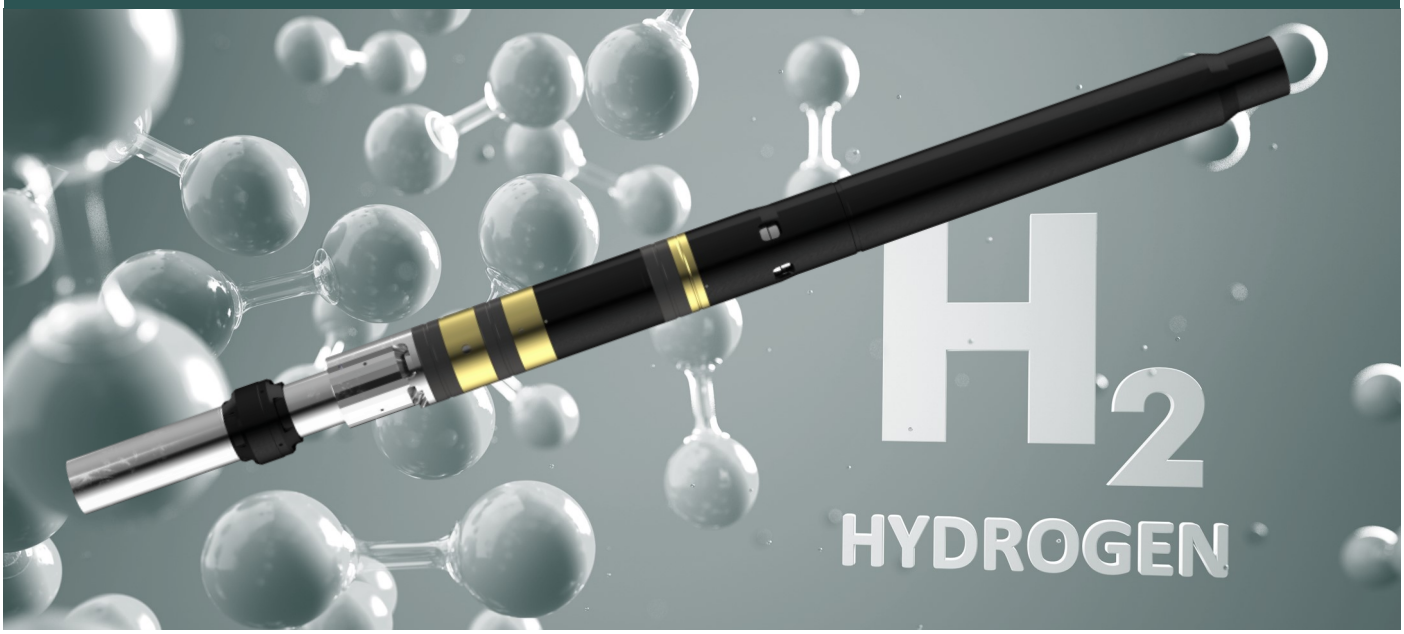
Innovation Case Study

DTI Develops Annular Safety Valve for Hydrogen Storage Wells



HYDROGEN IS A VIABLE ALTERNATIVE TO FOSSIL FUEL AS A SOURCE OF POWER AND HEAT, BEING ABUNDANT, NONTOXIC AND RENEWABLE. THE MOST ENVIRONMENTALLY FRIENDLY TYPE OF HYDROGEN IS GREEN HYDROGEN, WHICH IS PRODUCED USING RENEWABLE SOURCES OF ELECTRICITY.

The World Energy Council's 'Innovation Insights Briefing' (July 2021) states that green hydrogen could supply up to 25% of the world's energy needs by 2050 and according to IRENA's 'World Energy Transitions Outlook 2022', if we are to reach net zero ambitions by 2050, and hydrogen contributes to 10% of that target, we need to produce 614 megatonnes.

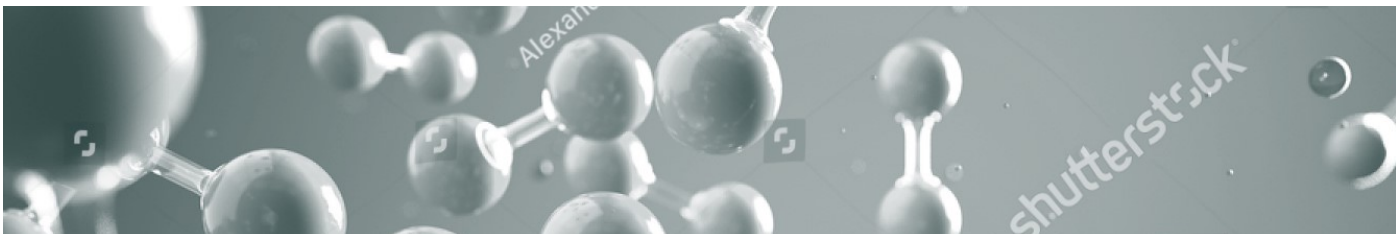
Currently, hydrogen production accounts for a negligible amount of the energy mix, so the challenge is significant. Higher demand and production necessitate increased capacity, so one option is to utilise underground salt caverns for the storage and supply of this mass-produced hydrogen.

PROJECT

In France, a major European project is underway to demonstrate the viability of salt caverns for large-scale green hydrogen storage. Several salt caverns exist at this site, with some previously used to store natural gas.

The old well infrastructure is to be replaced with completions that are more suitable for hydrogen. As the H_2 is stored under pressure, including appropriate downhole safety equipment is critical.

Based on DTI's track record of innovation, the company was asked to develop an annulus control safety valve, which could be installed in a test well at the new facility within 12 months. An annular safety valve prevents unplanned gas release via the annulus to the surface.



RESULTS

To meet the specific requirements of this project, including bi-directional sealing and large volume injection and production rates, DTI chose to develop its existing, patented, Slim Pump Safety Valve (SPSV) technology, which has historically been used in oil and gas wells in support of retrofitted, cable-deployed ESPs and jet pumps.

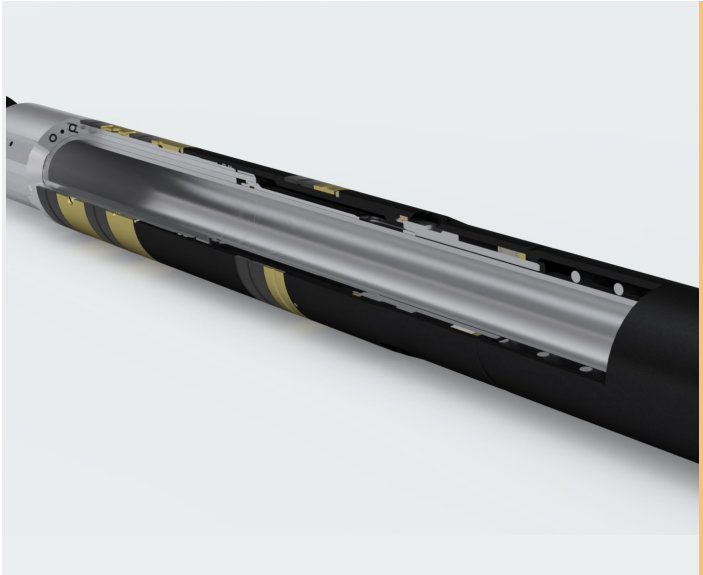
The outcome was a new surface controlled and testable Annular Safety Valve (ASV) with a nipple-deployed system and an integrated control line bypass for tandem deployment and operation of a Tubing Retrievable, Surface Controlled, Sub-Surface Safety Valve (TRSCSSSV).

The ASV also includes a patented pressure-balanced annular poppet valve which ensures leak-tight sealing. It has the ability to open and close in both directions at full working pressure (to 5,000 psi) to allow for both injection and production operations. The ASV also benefits from a large flow area for high volume gas injection and production and provides a well barrier to allow quick reinstatement of other downhole safety valves in the event of failure.

Within just twelve months, the ASV was designed, developed, independently qualified and successfully installed in a well at the pilot facility, ready for the trial injection and storage of hydrogen.

Cross-Sector Applications

The ASV can be used in both hydrogen and natural gas storage wells plus traditional gas lift and gas producer wells.



FEATURES AND BENEFITS

- A patented design allows bi-directional sealing at full working pressure.
- Well pressure or surface test pressure boosts the valve shut.
- Nipple profile is deployed and landed on nipple No-Go.
- Control line bypass to allow one nipple to operate both the ASV and a TRSCSSSV.
- Metal to metal valve seat and poppet design for reliability.
- Includes hybrid high-performance elastomer and non-elastomeric packing seals for reliability.
- A large annular flow area facilitates fast, high-volume, injection and production operations.

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