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J-POWER's experiences in clean hydrogen production

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Abstract

Electric Power Development Co., Ltd. (J-Power) has been conducting coal gasification research since the 1990s and has been accumulating knowledge on the multi-purpose use of coal-derived gas through the EAGLE (2002-2022) and the Osaki CoolGen projects (ongoing). The latter is a semi-commercial scale project based on the former. These projects aimed to demonstrate gasification, CO₂ capture and recovery, and high-efficiency power generation from various coals that had been widely used, such as bituminous and sub-bituminous coals. Large-scale production of hydrogen-rich syngas has already been successfully demonstrated.

In 2015, J-Power participated in the Japan-Australia Hydrogen Energy Supply Chain Demonstration Project (HESC) with the support of the Victorian, Commonwealth and Japanese governments. The goal of HESC was to demonstrate a hydrogen supply chain; gasified Australian brown coal is refined to high-purity hydrogen, which is then liquefied and transported to Japan by dedicated ocean carrier. J-Power was in charge of producing high-purity hydrogen. The brown coal used in this project is widely available throughout the world, but its high moisture content and propensity to self-heating makes it unsuitable for transportation, whereby limiting its use only on-site. Brown coal also emits CO₂ during gasification; capturing and storing the CO₂ is necessary for its massive future application. We have identified the potential for large-scale, stable clean hydrogen production from brown coal in Latrobe Valley, Victoria, which is close to a suitable site for CCS. At HESC we constructed and operated a hydrogen production demonstration plant, and in February 2021 succeeded in producing high-purity (99.999%) hydrogen from brown coal for the first time in the world, demonstrating the potential for creating a new clean fuel. Furthermore, with a view to achieving negative emissions in the future, hydrogen production from a mixture of brown coal and biomass was also successfully achieved. We will work towards commercialisation and development of clean hydrogen production at large-scale with CCS, based upon use the knowledge on gasification characteristics of Australian brown coal obtained through this project.

We would like to express our deepest gratitude to the Victorian, Commonwealth and Japanese Government and all those involved for their long-term support.