

Introduction of CCS Technology to Thermal Power Plants and Construction of a CCS Value Chain

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Abstract

1. Background

Japan has set its 2030 GHG emission reduction target at 46 percent from its 2013 levels, an ambitious target which is aligned with the long-term goal of achieving net-zero by 2050. Carbon dioxide Capture and Storage (CCS) is one of essential technologies for carbon neutrality, and Japan is currently aiming for business scale-up and cost reduction by 2030, with the aim of implementing CCS projects on a full scale to achieve carbon neutrality by 2050.

In 2021, The Kansai Electric Power Co., Inc. (Kansai EPCO) declared "Zero Carbon Vision 2050", aiming for carbon neutrality throughout the entirety of its business activities including power generation by 2050. One of its initiatives is the decarbonization of thermal power plants through CCS.

Challenges exist in the introduction of CCS into thermal power plants. Typically, the capture of CO₂ is easier when it is present in exhaust gas at high pressure and concentration, leading to global commercialization, particularly in facilities such as petrochemical plants. Conversely, the CO₂ from thermal power plants is at low pressure and concentration (atmospheric pressure/[coal] 12-14%, [natural gas] 7-10%). In the combined cycle system, the CO₂ concentration is even lower (atmospheric pressure, 3-4%). Therefore, with current technology, CO₂ capture is extremely costly, posing a significant challenge for commercialization.

2. Commitment to CCS

Since 1990, Kansai EPCO, in collaboration with Mitsubishi Heavy Industries, Ltd., has been dedicated to the research and development of a high-performance amine absorbent (KS-1™) and a CO₂ capture process (KM CDR Process™). As a part of this technological advancement, a test facility was established at the Nanko Power Plant, and more recently, a new form of amine absorbent (KS-21™) has been developed. This is a CO₂ capture technology suitable for thermal power plants using a chemical capture method, and has extremely superior performance compared to others. Additionally, the two companies will install a new test facility at the Himeji No2 Power Plant and begin demonstration tests in FY2025, to develop a CO₂ capture process that can be adapted to the combined cycle system, and even higher performance absorbent.

Furthermore, Kansai EPCO and Cosmo Energy Holdings Co., Ltd.

have been conducting studies toward the construction of a CCS value chain that encompasses the separation and capture of CO₂ emitted from business sites operated by the two companies in Osaka area through to the joint liquefaction and storage, and subsequent shipment of captured CO₂ to storage sites.

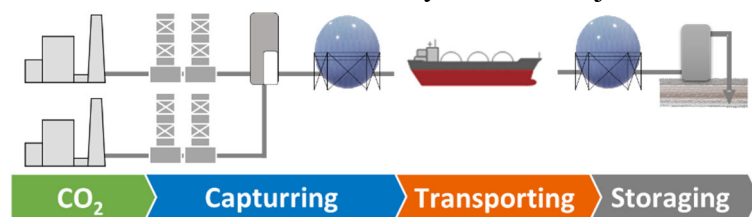


Fig.1 The image of a CCS value chain