2025 IERE-TPC Taipei Net-Zero Workshop
May 26–29, 2025

Development status of ammonia combustion technology for thermal power generation facilities

***Hiroshi NOMURA[1)], Ryo NAKAZAWA[2)], Ryo HANAOKA[3)]**
[1)]Assistant Manager, Basic Design Gr., Life Cycle Management Dept., IHI
[2)]Manager, Basic Design Gr., Life Cycle Management Dept., IHI
[3)]Manager, Business Development & Sales Dept., IHI

Keywords: *Ammonia, NOx, Low-Carbon Technologies, Demonstration test, Coal*

Abstract

In the effort to reduce greenhouse gas emissions toward net-zero and support sustainable development, ammonia, which does not emit CO_2 during combustion, has emerged as a promising Carbon-free alternative fuel for thermal power generation. However, challenges such as poor combustibility and NOx emissions must be addressed to ensure stable and efficient operation. IHI has been developing ammonia combustion technologies and conducted ammonia 20% firing demonstration test at Hekinan Power Station Unit 4 in collaboration with JERA from April to June 2024.

This demonstration was conducted with support from the New Energy and Industrial Technology Development Organization (NEDO), a national research and development agency. The modifications for the demonstration test were limited to a minimal scope, such as installing ammonia nozzles and ammonia piping to the existing infrastructure, without altering the main boiler, auxiliary equipment, or environmental facilities. The additional installation of ammonia receiving and storage facilities, as well as ammonia vaporization and supply equipment, is necessary. It was confirmed that ammonia could be fired at 20% energy ratio on a higher heating value basis while maintaining combustion performance and plant operability equivalent to single coal firing through this test. Key parameters such as NOx emissions and unburned carbon in fly ash were equivalent or less than that under single coal firing, demonstrating the potential for ammonia as a viable fuel alternative. Environmental benefits were also observed, with reductions of approximately 20% in CO_2 and SOx emissions, and N_2O emissions remaining below quantification limits. Due to the implementation of adequate safety measures for ammonia, the demonstration test was carried out without any accidents or incidents.

The success of this demonstration has significant implications for large-scale CO_2 reduction, suggesting that ammonia integration can be rapidly and cost-effectively implemented. IHI continues to support clients in adopting ammonia and is advancing the development of higher-ratio ammonia firing and single ammonia firing burners. These advancements provide diverse solutions to meet evolving energy needs and contribute to the global transition to low-carbon energy.