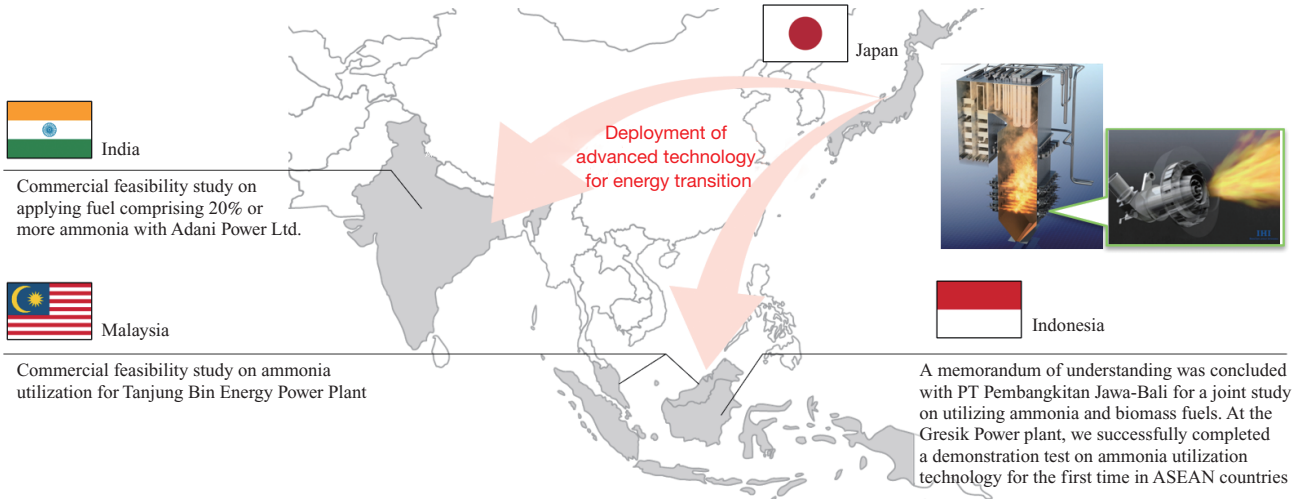
Popularizing Ammonia Combustion Technology from Japan

Initiatives to expand the use of ammonia and application of ammonia utilization technology to existing boilers

IHI's ammonia combustion technology is attracting a lot of attention around the world, and IHI has received many inquiries about applying its ammonia utilization technology to existing thermal power plants mainly in India and Southeast Asian countries. This article introduces the information on IHI's initiatives to promote the use of ammonia outside Japan.



Expansion of ammonia combustion technology

Deployment of ammonia utilization and combustion technology in India and Southeast Asian countries

Ammonia utilization technology for existing thermal power boilers is attracting attention around the world, particularly in India and Southeast Asian countries. Indeed, IHI has received many inquiries about applying the technology to power plants that use boilers introduced by manufacturers other than IHI.

The Indian government aims to achieve zero greenhouse gas emissions by 2070, and is considering the use of hydrogen and ammonia in the country's thermal power plants. India will still need thermal power generation because demand for electric power is likely to increase there, and it is expected that the use of ammonia as a fuel will reduce the CO_2 emissions from thermal power plants. Against this background, in 2022 a commercial feasibility study was conducted on applying ammonia utilization technology to the Mundra Thermal Power Plant, owned by Adani Power Ltd. in India. The Mundra Thermal Power Plant is equipped with an opposed firing boiler introduced by Babcock & Wilcox Beijing Co., Ltd. (China). Opposed firing is a type of combustion that features burners facing each other at the front and back of the furnace. IHI has a long history of designing and remodeling opposed firing boilers. Using the

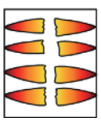
Mundra Thermal Power Plant, Adani Power Ltd.

knowledge gained from the experience, we are striving to apply our ammonia utilization technology to boilers made by other manufacturers and already installed at power plants.

A commercial feasibility study at the Mundra Thermal Power Plant was conducted with a subsidy from the New Energy and Industrial Technology Development Organization (NEDO). In the study, we calculated costs required for introducing ammonia utilization technology into this plant. In order to apply IHI's ammonia utilization technology to existing boilers, including those made by other manufacturers, as in this case, we are planning to provide the technology to the commercially operating equipment at the power plant after conducting a technical evaluation with fuel tests and numerical calculations (pre-demonstration test study).

In Malaysia, the use of ammonia fuel is attracting attention as an effective way to reduce CO_2 emitted from thermal power plants. As in the case of India, in 2022 we conducted a commercial feasibility study on applying ammonia utilization technology to the Tanjung Bin Energy Power Plant. In addition to having an opposed firing boiler, the Tanjung Bin Energy Power Plant is also equipped with a swirl combustion boiler. Swirl combustion is a type of combustion in which a swirling flame is formed in the center of furnace, unlike opposed firing which is IHI's forte. We began studying a policy on ammonia fuel application in collaboration with Steinmüller Engineering GmbH in Germany, which is one of IHI's group companies. The company has an extensive experience of designing and remodeling swirl combustion boilers. There are many swirl combustion boilers being built also in Indonesia and many other countries, and we believe that the market for using ammonia fuel will be enormous if the fuel can be used with them.

Ammonia utilization technology for thermal power boilers is gaining interest also in Indonesia. For this reason, in October 2022 we conducted a demonstration test on technology for using natural gas and a small amount of ammonia at Indonesia's Gresik Power Plant Unit 1. The boiler installed there had been a heavy-oil boiler supplied by IHI that was later remodeled to one fueled by natural gas. For this demonstration test, IHI planned and arranged the ammonia system and provided a combustor. With Indonesian government officials watching, we successfully completed a test of technology that uses a small amount of ammonia. This was the first demonstration test using commercially operating equipment in ASEAN countries, and the results were reported to the world at a G20-related meeting held in Indonesia in November of that year. Indonesia is also considering the application of carbon-free fuels to reduce the amount of CO_2 emitted from thermal power plants while meeting the growing demand for electricity, and the success of this demonstration test with commercially operating equipment is positioned as a first step for that. We will work together with Indonesian power companies and government to actively expand ammonia utilization and combustion technology to reduce CO_2 emissions from the country's thermal power plants.

Method	Opposed firing method	Swirl combustion method
Side view		
Top view		
Burner arrangement	Burners are installed facing each other	Burners are installed to form a swirling flame in the center of boiler

Difference in combustion methods

Images of Gresik Power Plant and the ceremony at the demonstration test

Expanding demand for ammonia fuel and building a supply chain

Currently, the IHI Group is developing technology for all processes related to ammonia fuel, including production, transport, storage, and use. The increase in use of ammonia, as seen in the application of ammonia to thermal power boilers and industrial furnaces, is crucial also for building an ammonia supply chain. By expanding the use of ammonia, we can expect the cost reduction associated with manufacturing and transporting ammonia in the upstream processes by mass-producing it. The IHI Group will work together as one to create a carbon-neutral society by building an ammonia supply chain.