

Engineers' Relay: An Ongoing Passing and Receiving of the Technology Baton

— Development and Popularization of Coal Gasification Technology, an Alternative Energy

Coal gasification technology converts coal into a syngas with low emissions of CO₂ and other air pollutants for use in power generation and production of chemical products. MHI's integrated coal gasification combined cycle (IGCC^{*1}) demonstration plant^{*2} achieved 2,000 hours of continuous operation, and MHI has successfully developed the world's only gasification technology that can accommodate both air-blown and oxygen-blown agents^{*3}. The 25 years of unstinting effort by its engineers have yielded huge rewards. This May, MHI was awarded a contract to perform the front-end engineering and design (FEED) services for the gasification and power island of the Hydrogen Energy California (HECA) project^{*4}. This marks a new step on the road to the company's long-held dream of commercializing IGCC. In this issue, MHI focuses on the passion of engineers like Yasunari Shibata and Takashi Iwahashi who embrace a mission to develop new energies for the future and promote their adoption worldwide.

Photo left : Takashi Iwahashi, Senior Engineer, IGCC Process Engineering Group, Power Systems Project Engineering Department, Power Systems Project Management Division, Engineering Headquarters
Photo right : Yasunari Shibata, Manager, IGCC Team, Boiler Engineering Section, Boiler Engineering Department, Power Systems

Drawn to Development by the Potential of Gasification

In 2008, MHI's IGCC demonstration plant achieved 2,000 hours of continuous operation, its reliability verified to prepare for commercialization. Shibata, who was in charge of design during this test phase, has had a passionate interest in coal gasification technology since before he joined the company. "I majored in information engineering, but while still in school I started to think that I wanted to be more involved in energy technology, a fundamental aspect of daily life. While I was researching related theses, I came across one that had been written by an MHI employee, and I decided I also wanted to contribute to the development of IGCC. I felt so strongly that, even at my job interview, I told MHI that this was what I wanted to do."

Iwahashi also joined the company with a passion for this technology. Today, as engineering manager for the front-end engineering design on the HECA Project in preparation for implementation, he probes the plant design requirements of the customer, coordinates with the relevant parties both in-house and externally, and pulls the technology together. Iwahashi aspired to create new markets through technology development, and then he learned about MHI's coal gasification technology at an academic conference. He says he was eager to popularize this advanced technology — the first in Japan — as quickly as possible, and contribute to the resolution of global energy and environmental issues.

Today, Shibata and Iwahashi are both working at the forefront of commercializing IGCC technology.

Steady Effort Opened the Way

MHI began developing coal gasification technology in 1983, but the path was far from smooth. Shibata joined the company in 1997 around the time deregulation of the power industry was being debated, and conditions for investment in development were not

favorable. "The demonstration plant project hit a snag, and the whole company felt on edge. We felt that if we were to lose our customers' trust at that point, we wouldn't be able to continue development. Under the circumstances, we couldn't afford mistakes, and the thoughts that my predecessors had about the development were so focused they were almost palpable. At work, and even after work, we often talked about how, given that Japan is a resource-poor country, it's up to us to make IGCC a reality." Through all this, MHI never stopped development work, and a gasifier was built in-house. "I looked at my predecessors, and at how they believed in themselves and put ideas into action. That was when I learned what it means to have a passion for *monodzukuri*, for manufacturing." According to Shibata, his experiences at that time helped him grow into a true developer.

With continuation of the project still uncertain, Shibata and his colleagues conducted verification in-house on the assumption that a demonstration plant would go ahead, and they achieved solid results. Their efforts paid off, and the IGCC demonstration plant project began. However, the test brought daily pressure for Shibata. "I stayed at the site from the trial operation stage onwards; I was covered in coal and sweat, black from head to toe as I inspected and analyzed various potential scenarios. I kept working even in my dreams. And even though we had planned so carefully, when we ran a test, we would find issues. The design, R&D, trial operation and construction supervisors all came together and resolved those issues so we could keep moving forward." Finally, they set that fantastic record: 2,000 hours of continuous operation. At the time, Shibata says, he and all the people who had worked so long and hard together were overjoyed. They were on the road to commercialization achieved through 25 years of sustained efforts and labor by Shibata and the rest of the "challengers."

Now that commercialization is finally a realistic possibility, Iwahashi is in charge of the first step, the HECA Project. "This project can surely expect to attract widespread attention and lead to popularization, and

*1: In this highly efficient combined cycle power generation system, coal is gasified for the first power generation cycle, which is performed using a gas turbine; the exhaust heat from that process is then used to run a steam turbine for the second cycle.

*2: Delivered to Clean Coal Power R&D (CCP) in Nakoso, Iwaki City, Fukushima Prefecture. MHI did more than simply supply the gasifier and other major IGCC equipment: it coordinated all aspects of the plant's creation under a full turnkey contract. The company was also in charge of various verification operations after completion.

*3: In coal gasification, MHI's technology allows both air and oxygen to serve as the gasification agent.

*4: A project to provide a combined cycle power generation plant that includes an IGCC plant to gasify coal and generate power, a plant to manufacture fertilizer from coal gas, and an enhanced oil recovery (EOR) facility that uses the CO₂ recovered from coal gas. It could be one of the world's first commercial-scale IGCC power generation plants with 90% or greater carbon capture and storage (CCS) function.

Enthusiastic People

Planned HECA Project in Bakersfield, California, U.S.

that's why I feel a sense of mission — that we must make it a success." Iwahashi is tackling the project with enthusiasm, and every day he emphasizes the value of free and open communication. "IGCC is composed of numerous systems, and there is a wide range of fields involved, so in order for everyone involved to carry out their duties toward the same goal, we must have unity of purpose. To achieve it, we consider it very important to interact closely with our customers and partners, to communicate face-to-face in order to align our mutual vectors toward plant completion. So even when issues crop up, sales, design, manufacturing, construction, R&D and the rest can all come together and promptly deal with them." As technology advances with each new day, and other companies follow, Iwahashi is looking forward to the project's success.

Opening Up a Limitless Future with Gasification Technology

Now that their efforts have borne fruit and commercialization is just around the corner, Iwahashi pictures a future in which coal gasification technology is increasingly adopted. "Today, renewable energy is getting all the attention, but thermal power generation is vital for a stable power supply. Coal deposits are abundant and the price is stable, but coal produces more CO₂ emissions than other fuels. Coal gasification technology is the way to resolve this issue: it generates power more efficiently than conventional thermal power generation, and uses coal cleanly while keeping CO₂ emissions down. Also, we can manufacture chemical products such as fertilizers and fuel as we generate power. Being in charge of an important technology that will support everyday life in the future — at the forefront of a business in the global spotlight — is more than any engineer could hope for."

"I believe gasification technology can contribute to the resolution of food supply issues as well," adds Shibata. "Energy from livestock manure can be gasified to create fertilizer, and the CO₂ recovered during the process can be used to promote photosynthesis in crops. I want to have a hand in the creation of that sort of sustainable society. At this point it's still just theory, but in the future I'd like us to be able to provide various technologies as a set, and resolve with one stroke various problems faced by Japan and countries around the world." His dreams know no bounds.

Through steady, concerted efforts, engineers like Shibata and Iwahashi have developed technology once thought impossible. They will continue working to broaden the potential of coal gasification technology, passing the baton on to tomorrow.



Project team members at MHI's demonstration plant elated at the record achievement

The history of this 25-year challenge can be read in detail on the MHI website: >>> "A Story of Innovating Challengers – Coal Gasification Technology – Create new energies to safeguard the future"