

An Essay on Power Electronics

Toshimasa Jinzenji

Corporate Advisor

I took the first step of my career some 40 years ago as a design engineer of mercury arc rectifier control equipment, one of the predecessors of today's power electronics. The mercury arc rectifiers use the principle of converting electric power by switching, and are thus different from other electric machines using the principle of Faraday's law. The mercury arc rectifiers were used to convert alternating current to direct current in the electric railways and electrochemical industries. The pumpless mercury arc rectifiers were then developed requiring no vacuum pumps, and it was the time to replace the rotating machines with the mercury arc rectifiers in rolling mills, paper machines, and winders in mining and electric trains. The thyristor was developed several years later, and this extended the use of power electronics to encompass office machines, computers, medical equipment and others.

There were few professionals at that time, so individual engineers had to cover all related technical matters. In addition, the few engineers in charge of a specific product often had to support all application fields of the product such as steel-mill, paper-mill, electric railway and electric power utility, because the demand for mercury arc rectifiers and thyristors was still low. Power electronics engineers extended the application of power electronics equipment greatly in these industries. As power electronics developed, the associated technology became in charge of respective industry sectors. However, such diversification made it difficult to see the wood for the trees.

At that time, we took advantage of the as-yet undeveloped, non-specialized structure to train engineers as professionals having a broad insight and good balance, without restriction to one specialized field. Each industry has its own philosophy and conventions. Our non-specialization enabled us to remain free of a blinkered attitude, and this greatly helped when we transferred power electronic technologies to other application fields, and merged various technologies such as power conversion equipment and circuit breakers, into single products.

The engineers of the manufacturer and those of the customer have a mutual relationship. Customers come in all different types, from those who are the first to use anything new, to the conservative ones who are afraid to take risks. Our mission was to give customers' engineers a good understanding of power electronics, and text books as well as manuals are an important medium for training experts. I fondly recall a translation of the famous book "The Principle of Inverter Circuits" by Prof. R. G. Hoft, published in Japanese by Corona Publishing Co.,Ltd.

Power electronics has a huge future ahead of it, as the source of innovation in the field of electric power. The rapid rise and fall of the mercury arc rectifier reveals that as engineers, we must not remain cloistered in our own specialty, but rather must cultivate a broad knowledge and vision.

SANYO DENKI

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