# BOOK REVIEWS

**Selection of books for review is based on the editor's opinions regarding possible reader interest and on the availability of the book to the editor. Occasional selections may include books on topics somewhat peripheral to the subject matter ordinarily considered acceptable.**

## Nuclear Energy in Germany

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| *Authors* | Karl Winnacker and Karl Wirtz |
| *Publisher* | American Nuclear Society (1979) |
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| *Reviewer* | Joseph R. Dietrich |

There is an interesting story about Otto Hahn that illustrates why we need this book. The place and time were the First International Conference on the Peaceful Uses of Atomic Energy, in Geneva, in 1955. The centerpiece of the U.S. exhibit was an operating research reactor of the "swimming pool" type. "One day an old gentleman appeared in the control room of this reactor and asked the American on duty: 'Can I play with your beautiful reactor, please?' 'Sure,' said the operator, 'but do you understand anything of these matters?' 'I think so,' said Otto Hahn, smiling, 'I discovered nuclear fission.' The American looked at Hahn with incredulous astonishment and then said, 'Sorry, but I can't know everybody who is engaged in the atomic business.' "

The story is quoted from the book. Today we certainly cannot know everybody who is engaged in the atomic business, but we should know *of* these giants of nuclear science and technology who made the important contributions to the development of nuclear energy.

Written by Karl Winnacker and Karl Wirtz, who played important parts in many of the events of which they write, *Nuclear Energy in Germany* sets the German story in the context of worldwide development. Those of us who have worked in the field since the early days will find our memories refreshed by the book, and are apt to feel a warm nostalgia as we recall the exciting events in the history of our technology—or perhaps read the name of an old friend or acquaintance. Those who came into the field later, and those who view it from the outside, will find an orderly and penetrating exposition of the nuclear story, from the discovery of nuclear fission—and a bit before—to recent times. There is also a look toward the future in the final chapter, entitled "The Remaining Task."

German contributions were vital to the great early developments in physics that ultimately placed nuclear energy in the hands of Man: Planck's quantum theory, the presage inherent in Einstein's theory of the equivalence of mass and energy, and finally the breakthrough itself: the experiment of Hahn and Strassmann in 1939 that split the uranium atom.

World War II had a profound effect on efforts to put the discovery of Hahn and Strassmann to practical use. The portion of the book that covers the war years in Germany and the early post-war years, a segment of the nuclear history which is treated only sparsely elsewhere, is of special interest. During the war, German scientists struggled to develop a nuclear reactor, but their efforts were frustrated by the lack of resources, lack of scientific vision at high levels of the government, and fragmentation of the effort. Successful neutron multiplication experiments were conducted, but sufficient uranium and low-absorption moderator could never be assembled to approach criticality.

By the end of the war, most of the physical resources for nuclear research and development in Germany had been destroyed or seized, or were outdated. The German State could ill afford to devote financial resources to anything beyond the immediate needs of the nation and its people. International communication in the field of nuclear energy was virtually nonexistent because of secrecy restrictions. The only remaining resources in Germany were the capabilities, the determination, and the dedication of her scientists, some of whom were already well advanced in years. In 1946, when the Kaiser Wilhelm Society for the Promotion of Sciences was revived and renamed the Max Planck Society, Planck was 88 years old. Yet he accepted the chairmanship and brought to the new society the prestige of his distinguished scientific career. He persuaded Otto Hahn, then 67, to take over the management of the society. Hahn was still active ten years later, when he was appointed one of three deputy chairmen of the newly formed German Atomic Commission.

In 1955, two very significant events occurred: In May the Federal Republic of Germany regained its full sovereignty and became free to chart its own course in the field of nuclear development; in August the first International Conference on the Peaceful Uses of Atomic Energy was held in Geneva. The conference grew out of the "Atoms for Peace" initiative of President Eisenhower, first enunciated in December of 1953. The conference witnessed the wholesale declassification, by the "Nuclear Powers," of much formerly secret or restricted information. As further results of the "Atoms for Peace" plan, the U.S. in the autumn of 1954 announced plans for the training of foreign students in reactor technology at U.S. national laboratories, and made available enriched uranium in controlled quantities for reactor work abroad.

The road was still uphill, however, for Germany, as her scientists and engineers worked to catch up technologically, and as she struggled to regain her place among nations that had been enemies during the war years. Many international problems had to be resolved, and internal structures had to be set up for the sponsorship and control of nuclear development and for the assurance of public safety. These political and administrative developments are chronicled in *Nuclear Energy in Germany* in a way that sets them in context with both international developments and the progress of technology.

By 1963, eight research reactors were in operation in Germany. A highly significant milestone was the construction, under the direction of Karl Wirtz, of the first reactor of German design and manufacture–FR2–which achieved criticality of March 7, 1961 at Karlsruhe. Natural uranium was chosen as fuel, because of the uncertainty of availability of enriched uranium, and heavy water as moderator. It was a research reactor with a 12-MW(thermal) output, later increased to 40 MW through core modification and a change to enriched uranium fuel.

The FR2 was the forerunner of two successful pressurized heavy water reactors of the vessel type, using natural uranium fuel and producing electric power, both built by Siemens AG. The first of these, the MZFR, completed in September 1965, was also located at Karlsruhe, and produced 50 MW of electric power. The second was an export power plant, located at Atucha, in Argentina. It began operation in 1974 and has operated reliably since then, with an electrical output of 340 MW.

Nuclear power reactors of various types were investigated in Germany, and experimental plants were built for several of the types. However, as the commercial potential of light water reactors (LWRs) became apparent in the U.S., and as U.S. policy for the export of enrichment services was liberalized, Germany swung toward the LWR types, and became the first country other than the U.S. to develop an LWR supply industry. The General Electric boiling water reactor (BWR) technology was imported by Allgemeine Elektricitäts-Gesellschaft (AEG) and Siemens added the Westinghouse pressurized water reactor (PWR) technology to the experience they had gained through their own pressurized heavy water reactor projects. The first sizable boiling water nuclear power plant went into operation at Gundremmingen in 1966 with an electrical output of 240 MW, and the first pressurized light water plant, rated at 283 MW(electric), began operation at Obrigheim in 1968.

Later, the PWR activities of Siemens and the BWR activities of AEG were combined in a nuclear systems supply company, Kraftwerk Union AG, which builds nuclear plants in Germany and for export. Plants built in Germany are among the largest in the world, and have enviable records of reliability and availability. For the future, development and demonstration are proceeding on the fast breeder; and the pebble-bed, high-temperature gas-cooled reactor, an indigenous development, has been demonstrated, and an intermediate-scale prototype [the 300-MW(electric) THTR] is moving toward completion. In the relatively short period since the first Geneva Conference in 1955, Germany has overcome its handicaps and has joined the ranks of the leaders in the nuclear power field.

There is, of course, much more to the story of nuclear energy development, both in detail and in scope, than this review has space to summarize. *Nuclear Energy in Germany* treats all of this, both in fascinating detail and in comprehensive scope. The details are brought alive by a personal flavor heightened by anecdotes about, and quotes from, important figures in the nuclear drama. The scope goes far beyond the mere history of nuclear power plant development, to include considerations ranging from the technical to the institutional and political. Among the related topics considered are the nuclear fuel cycle, basic nuclear research, the uses of radioactive isotopes, nuclear fusion, the synthesis of fuel gases by nuclear energy, government support and regulation of nuclear power, and the Non-Proliferation Treaty. The authors have devoted a chapter to each subject or group of related subjects, with the narrative for each following a more or less chronological pattern. This scheme of organization by subject, rather than according to a single continuous chronology, adds greatly to the coherence of the book.

Although the book covers a wide range of technical subjects, these subjects are explained in terms quite comprehensible to the nontechnical reader. In fact, those not versed in nuclear technology will find the book as interesting for its exposition of the basic facts and principles of that technology as for its historical content.

In this time of troubles for the nuclear industry, the account of the German triumph over adversity in the pursuit of nuclear energy is a heartening story. One is left with the feeling that progress will prevail, despite the unreasoned fears of a new technology that afflict many and despite the reactionaries who would deny the world the proven benefits of abundant energy. *Nuclear Energy in Germany* is a welcome addition to the annals of human achievement.

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