**Speech at the Energiforsk Annual Nuclear Conference Dinner**
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First of all I would like to thank the Swedish Nuclear Society for the award. It is probably the finest price a reactor physicist can get in Sweden, and I feel deeply honoured. I was asked to give a speech in English, and I intend to give you some glimpses of my professional life, more fully described in my book *Blågul atom*, published two years ago in Swedish.

It all started in 1947-48 with my exam work in technical physics at the Royal Institute of Technology in Stockholm. My supervisor was Sigvard Eklund. He then headed a section for nuclear physics at the Research Institute for National Defense. We were located at IVA's research station at Drottning Kristinas väg in Stockholm, or DKV as we said. My task was to study a nuclear reaction with equipment that had been used by Lise Meitner, who was then with us at DKV. When my exam was passed, I was employed by Eklund. In the summer of 1950 his section was incorporated in AB Atomenergi. Atomenergi was founded in 1947 as a partly state-owned company. In the beginning it had two main tasks: to extract uranium from Swedish shales and to build a research reactor.

On July 13, 1954 I participated in the startup of the reactor. It was built in a rock cavern below and adjacent to DKV. The prototype was CP-3 at Argonne in the USA. Our reactor had rods of natural uranium metal from France as fuel and heavy water from Norway as moderator. The power was initiallly 300 kW of heat. No heat exchanger was needed, nor any external neutron source, since the neutrons from the spontaneous fissions in uranium were sufficient to start the nuclear chain reactions. In the control room, my colleague Nils-Göran Sjöstrand and I were eagerly calculating with the help of a half-automatic hand calculator – this was before the computer age. We plotted the results in a diagram, showing how criticality was approached, as the heavy water was filled up. The whole process was quite undramatic. At 7 pm our CEO Harry Brynielsson could call the media and report that the first Swedish reactor had started. In analogy with the current names of research reactors at that time, such as GLEEP in England, ZEEP in Canada and JEEP in Norway, I suggested the name SLEEP for Swedish Low Energy Experimental Pile. But this was not accepted by Eklund.

Already in 1953, my boss Gunnar Holte and I made preliminary calculations on the next reactor after R1. We studied a 10 MW heavy water reactor, similar to the Canadian NRX, for research, isotope production and materials testing. But Atomenergi decided to buy an American 30 MW light water reactor. The R2 reactor was installed in 1960 at the newly built research station in Studsvik at the Baltic, south of Stockholm. R2 was in use until 2005. After R2, several research reactors were installed at Studsvik, such as R0, a critical facility for

heavy water reactors, KRITZ, a critical high temperature facility for light water reactors, and FRO, a fast zero-energy reactor.

In the Autumn of 1955 we succeeded in reqruiting my fellow-student Ingvar Carlvik to our group of reactor physicists at DKV. He was a very able mathematician. We sat together for whole days, one of us writing on the blackboard and the other taking notes. We developed calculational methods for pressurized heavy water moderated and cooled power reactors, fuelled by rod bundles of natural uranium oxide. The methods were used in the design of the first Swedish commercial reactor. It was erected in a rock cavern at Ågesta, in the southern part of Stockholm. The reactor went critical in July 1963, almost on the day nine years after R1, and operated successfully from 1964 to 1974, delivering heat to a suburb and electricity to the grid.

In 1958 Atomenergi started to study the next commercial reactor after Ågesta. It became known as Marviken after the planned location at the Baltic south of Stockholm. In the beginning, Marviken was an enlarged Ågesta, i.e. a pressurized heavy water reactor with natural uranium fuel for electricity generation and fuel exchange during operation. However, in 1962 our lead reactor engineer Peter Margen presented a study of a boiling heavy water reactor with natural coolant circulation. Furthermore, the possibility of testing nuclear superheat was suggested. The study was modestly called BASHFUL for Boiling And Super-Heat FULlscale. The State power board Vattenfall approved of the proposal, and in the Spring of 1963 the Swedish parliament decided in favour of going ahead with the project.

During the 60s the reactor physics calculational methods were further improved under the guidance of Ingvar Carlvik. Technically, Marviken was a rather complex design with two types of fuel elements, one for boiling and one for superheating. The fuel was low-enriched uranium with different degrees of enrichment for the boiling and superheating elements. Unfortunately, we never got to know how our calculations agreed with reality, since the Marviken project was abandoned in 1970 in a nearly complete state. However, already in December the same year the first Swedish light water boiling reactor, O1, went critical at Oskarshamn. The reactor was designed and built by ASEA Atom.

After the shutdown of Marviken, I was appointed to lead the reactor department at Studsvik. I held this position until 1978, when I became a senior consulant. In 1979 the first reactor core melt accident occurred at Three Mile Island. I spent some time trying to understand the accident and wrote a book, entitled *Light Water Reactor Safety,* published in 1989 by the British firm Pergamon Press.

After my retirement in 1988, I started a consulting firm in nuclear safety and wind energy. For fifteen years, from 1978 to 1993, I was the secretary of the International Energy Agency's expert committee for research and development

of wind energy. The IEA is the energy agency of the OECD countries and has its secretariat in Paris. During my time, the number of participating countries in the wind energy program increased from nine to fifteen. Today more than 20 countries are members. Since the meetings were held twice a year, alternately in the participating countries and often included study visits, I got to see some windy places all over the world and experience the breakthrough of wind power.

In retrospect, I am glad for having participated in the development of a nearly fossile-free system for electricity generation in Sweden, based on water, nuclear and wind energy. At the same time I can regret what I think was the unnecessary shutdown of the two Barsebäck reactors in 1999 and 2005, as well as the plans for premature shutdown of two reactors at Ringhals. The first one was in fact closed down only a couple of weeks ago. All the better then is the increasing global insight that nuclear power can and will play an important future role for handling the climate change. We are looking forward with confidence.