

WP2

Austria

Short Country Report

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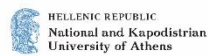
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Executive summary

This report belongs to a collection of 20 short country reports on the History of Nuclear Energy and Society (HoNESt, project Ref.662268). The reports tackle the complex sociotechnical system around nuclear energy. Nuclear developments, notably nuclear energy, are closely intertwined with social, economic, environmental, political and cultural spheres. Nuclear energy is also a globalized system involving transnational transfers of knowledge, materials, technologies, people and products including electrical power, medical elements, toxic wastes and other environmental hazards, materials, capacities and knowledge that must be carefully safeguarded. Nuclear energy is a complex social and technological phenomenon that influences societies but is also shaped by societies.

The short country reports are designed to assemble information and research results on the history of the relations between nuclear energy and society about all the different country cases in an accessible manner, and to document the findings with references.

The purpose of the country reports is threefold, addressing three different audiences:

1. to provide basic elements of narrative and analysis for further historical research by HoNESt researchers;
2. to provide information, context and background for further analysis for HoNESt's social science researchers;
3. to provide accessible information on nuclear-societal relations in the various countries for the purposes of outreach and communication with stakeholders (civil society, industry, associations, policy makers, journalists).

This report focuses on the history of the relations between nuclear energy and society in Austria. The main findings are:

Austria planned to construct three nuclear power stations from the 1970s onwards. Austria had a long tradition of radioactivity and nuclear research dating back to the beginnings of the 20th century, and transnational knowledge transfer was crucial for Austria's plans. The transfer started in the 1950s with the United States' Atoms for Peace program. Industry and utilities,

academia, and government struggled for the leadership in the process of implementation of this knowledge. Industry and government collaborated leading to the founding of the Austrian Research Centre for the Peaceful use of Nuclear Energy in Seibersdorf. Austrian universities received their own TRIGA reactor from the USA, located in Vienna. The Seibersdorf institute took a leading role together with industry as consultant during the construction of the NPP in Zwentendorf from 1971 onwards. At the beginning of that decade local anti-nuclear protest groups emerged which remained ignored before forming a broad national movement. These increasingly public concerns led the Austrian Chancellor Bruno Kreisky to call for a referendum in mid-1978, which resulted in stopping the power plant at Zwentendorf before it went critical.

1. Historical Context (narrative)

1.1. Introduction to the historical context

Austria is better known for its hydropower and “green” energy production after 1945 than for the implementation of nuclear energy. For instance, the completion of the large-scale project of the Alpine hydropower plant in Kaprun in 1955 against the objections of the Allied Forces after World War II became one of the founding myths of the second Austrian Republic. The construction of the hydropower plant started shortly after the Nazis had seized power in Austria but could not be finished before the end of WWII and was then resumed after its conclusion. Likewise, many Austrian physicists were engaged in the first Austrian attempt to establish nuclear energy after the annexation by Germany in the German nuclear weapons project (*Uranverein*) after 1941. This Austrian-German cooperation and therefore the whole program failed with the defeat of the German Reich and its allies of the Axis Powers in 1945. After the war Austria was divided like Germany into four occupation zones. Despite this, the idea of generating energy from nuclear fission was still present in Austria’s post-war politics. However, lack of sufficient funds prevented the development of a national nuclear energy program. This situation changed after the launch of Atoms for Peace with Eisenhower’s famous speech in December 1953. Immediately after Austria regained its national sovereignty in March 1955, the Austrian Council of Ministers decided to build a research reactor with American support. But it took another seven years until the research reactor finally went into operation. This corresponds to Austria’s second attempt to implement nuclear energy, specifically, nuclear energy research. In the course of this attempt, three research reactors were brought into service with the aim of developing a nuclear energy production program in Austria. This third attempt resulted in the decision of the Austrian government under Chancellor Bruno Kreisky in 1971 to build a nuclear power plant near Zwentendorf in Upper Austria. However, this plant never went into operation. After its completion in 1978 the Austrian population voted against the start-up of the plant in a referendum with a small majority (50.47%). As a result, this third attempt to implement nuclear energy in Austria failed, and even today, the image of a “nuclear free” country is central to Austria’s identity.

1.2. Contextual narrative

1.2.1. The beginning of the Austrian program

In contrast with the dominant German role in the Uranverein, the Austrian contribution has attracted only little attention. It was Austria's first attempt to acquire nuclear energy. Therefore a brief sketch of the Austrian activities will be given here (Fengler 2014; Fengler and Forstner 2008; Fengler and Sachse 2012).

In Vienna two centres of nuclear research existed, one was located at the 2nd Institute for Physics of Vienna University and the other at the *Institute for Radium Research* of the *Austrian Academy of Science*. The *Radium Institute* was opened in 1910 and became (due to Austria's monopoly on pitchblende, the raw material for radium production) one of the major centres of the international network of the so called "radium-activists". One astonishing feature of the Institute at that time was the high percentage of female staff, which the historian Maria Rentetzi tried to trace back to the social and political milieu of the "Red Vienna" of the 1920s and 1930s (Rentetzi 2004a).

After the *Anschluss* (reconnection) of Austria to Germany in 1938 about a fourth of all Austrian nuclear researchers lost their jobs, principally due to anti-Jewish sanctions, and the number of women, which were employed at the Radium Institute plummeted by half within the course of a year. Two positions for full professors and two for associate professors at the physics departments of University of Vienna were subsequently filled by the appointment of National Socialist-scientists or opportunistic fellow travellers. These individuals assured themselves of the support of the Third Reich, and then proceeded to reorganize nuclear research in Vienna: the 2nd Institute for Physics and parts of the Institute for Radium Research were merged, creating the *Four-Year-Plan Institute for Neutron Research* in 1943 (Reiter 2004a; Reiter 2004b; Reiter 2001a).

Already before the founding of the Four-Year-Plan-Institute the discovery of nuclear fission attracted the interest of Austrian physicists and the German *Uranverein* opened new possibilities for their research, which were embraced by the Austrians. The Austrian research carried out in the *Uranverein* had mainly the character of fundamental research, sometimes

specifying the *Uranmaschine* (uranium nuclear reactor) as the aspired application.¹ Scattering cross sections of neutrons in uranium and the increase of neutrons in fission reactions were a central topic of the investigations. For this analysis spherical symmetric geometries with layers of paraffin and uranium were used in the experiments. Also (n, 2n)-processes in lead were analysed and extrapolated to reactions in uranium.² It can be noted that, later in the post-war era, the same experimental setups and geometries were used, e.g. in the Habilitation of Karl Lintner (Lintner 1949), the assistant of Georg Stetter at that time. However, besides all kinds of fundamental research, building a nuclear reactor was the core aim behind the Austrian nuclear activities as the application for a patent for a reactor from Georg Stetter, the head of the Four-Year-Plan Institute, shows.³ This thesis is supported by a statement at the end of a report about the engagement of the 2nd Physical Institute of the University of Vienna in the German *Uranverein* where the authors claim that, for a continuation of large-scale experiments for the uranium machine, about two tons of uranium metal, one ton of paraffin and possibly 500kg heavy water were needed.⁴

¹ In the course of the American ALSOS mission the reports of the Uranverein were confiscated and transferred to the United States. Today the "G-reports" are disclosed for research in the Archives of the *Deutsches Museum* in Munich and enlighten the Austrian role in the *Uranverein*. Josef Schintlmeister, „Die Aussichten für eine Energieerzeugung durch Kernspaltung des 1,8 cm Alphastrahlers,“ Bericht vom 26.2.1942, Archiv des Deutschen Museums München, Museumsinsel 1, 80538 München, und Willibald Jentschke und Karl Kaindl, „Vorläufige Mitteilung über die Abhängigkeit der Größe der Resonanzabsorption bei verschiedenen Temperaturen,“ Bericht vom 5. September 1944. Archiv des Deutschen Museums, München, sowie „Bericht über die Tätigkeit des II. Physikalischen Institutes der Wiener Universität und des Institutes für Radiumforschung der Wiener Akademie der Wissenschaften.“ Bericht vom Juli 1945, Archiv des Deutschen Museums, München.

² Georg Stetter und Karl Lintner, „Schnelle Neutronen in Uran (I). Der Zuwachs durch den Spaltprozess und der Abfall durch unelastische Streuung“, „Schnelle Neutronen in Uran (II): Genaue Bestimmung des unelastischen Streuquerschnittes und der Neutronenzahl bei „schneller“ Spaltung“, „Schnelle Neutronen in Uran (III.): Streuveruche,“ Berichte vom September 1942, sowie Georg Stetter und Karl Kaindl „Schnelle Neutronen in Uran (VI): Der (n,2n)-Prozess in Blei und die Deutung der Vermehrung schneller Neutronen in Uran,“ nicht datiert, vermutlich Ende 1942. Alle Archiv des Deutschen Museums, München.

³ Patent application of Georg Stetter at the Reichspatentamt 14. Juni 1939, Nachlass Georg Stetter, Sondersammlung der Österreichischen Zentralbibliothek für Physik, Boltzmann-gasse 5, A-1090 Wien. After the war Stetter made demands because of his patent application, however they were denied in the lawsuit. See also Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 55, Fiche 812.

⁴ G-Report 345, p. 23. Archiv des Deutschen Museums, Museumsinsel 1, 80538 München.

At the end of WWII large parts of the equipment and staff were transferred to the Western zones of the Allied-occupied Austria to protect them from bombings and, presumably, from the Soviet troops. The reasons for the failure of this program are the same as for in Germany (Walker 1989; Walker 2007): in comparison to other war projects the priority level on the nuclear energy program was low and at the end of the war the lack of resources led to important delays. For example in November 1940 the Austrian Academy of Science decided to build a neutron generator for the Radium Institute. The generator was ordered in 1941 with a delivery period of 36 months. In June 1942 a new priority level was granted and the delivery time was reduced to 22 months. Delivery problems from German suppliers delayed the project again and again. Finally the City of Vienna refused the building license for the necessary modification of the Institute building and at the end of 1944 a new place for the generator had to be found. In March 1945 a gym in Krems, a city about 60km to the west of Vienna, was chosen as the new location for the neutron generator. However, the Liberation by the Allied forces ended all plans installing the generator and stopped other parts of Austria's first attempt to develop nuclear energy⁵.

Another often overlooked chapter of Austria's nuclear history concerns the production of heavy water. In 1950 Colonel Goussot, a member of the French forces in Tyrol, asked the theoretical physicist Ferdinand Cap from Innsbruck University for his expertise concerning the production of heavy water in Tyrol during the war. In his report Cap described an "apparatus" for the production of heavy water on the basis of electrolytic separation similar to the method of Norsk-Hydro A.G. in Norway. Furthermore he mentioned test plants for the production of heavy water in Tyrol that were built during the war. From the report it seems that these test plants never reached the level of a large scale production. However, as Prof. Cap, who provided the report to the author, stated that all production facilities were destroyed by the French forces and no further evidence for the existence of the production of heavy water in Tyrol could be found.⁶

1.2.2. Liberation, Reorganization and Reconstruction

⁵ Correspondence of Gustav Ortner with the Helmholtz-Gesellschaft, Düsseldorf, the C.H.F. Müller AG, Hamburg, and the Reichsamt für Wirtschaftsaufbau in Berlin (1940–1945), Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 32, Fiche 444-447.

⁶ Bericht von Ferdinand Cap für Colonel Goussot über eine Anlage zur Produktion von schwerem Wasser in Tirol, 24. November 1950. Kopie im Archiv des Autors, freundlich überlassen von Prof. Dr. Ferdinand Cap. Interview mit Ferdinand Cap conducted by the author, Innsbruck, August 3, 2007. Archive of the author.

The efforts that were made after the Liberation by the Allied forces in 1945 can be described best as “back to 1938” before the *Anschluss* – not to mention that there was an authoritarian state with political repression in Austria from 1934 onwards. These efforts regarded personnel changes in the course of “denazification” and changes in the structure and organization of research. One of the first tasks was the dissolution of the Four-Year-Plan Institute for Neutron research and the restoration of the former organization of the university and academy institutes. In the course of the “denazification”, former members of the National Socialist party were removed from the institutes, among them Georg Stetter, the head of the 2nd Institute for Physics and Gustav Ortner, the head of the Radium Institute, who both got their jobs after 1938 because of the anti-Jewish measures of the Nazis. At the same time, some of the forced Austrian emigrants from WWII were invited to come back. Stefan Meyer, the former head of the Radium Institute before 1938, was appointed as director of the institute again, while Berta Karlik became the managing director of the institute (Reiter and Schurawitzki 2005). In 1947 Stefan Meyer retired and Berta Karlik was appointed as new director, which also marked the beginning of a new era for the institute. She had finished her PhD at the University of Vienna in 1928 and started her research at the Radium Institute in 1928/29 and became a graduate assistant in 1933. In the intervening time she studied a year under William Bragg at the Royal Institution in London with the help of a fellowship of the *International Federation of University Women* from November 1930 to December 1931. In 1935 she was invited to Sweden for several months to undertake research. After finishing her Habilitation the University of Vienna awarded her the *venia legendi* in 1937. She received several fellowships until she was appointed as lecturer with remuneration (Dozentin mit Diäten) in 1942. She never took part in the research program of the German *Uranverein* and tried to develop her own line of research within the institute. It was not clear at all whether she could continue her work after the Nazis had seized power in Austria. Her request for an extension of her fellowship was denied by the German watchdog for the Viennese University (Kurator der wissenschaftlichen Hochschulen in Wien) with the argument, that there were no chances for females in academia. Thanks to an intervention of the Director of the institute Gustav Ortner, it was made possible for her to stay at the Radium Institute with regular benefits. In a report of the NS-Dozentenführer (Leader of the NS organization for university lecturers) she is described as non-politicised. All in all it seems that she tried to find

her own scientific way without attracting any political attention – neither positive nor negative for the NS-government.⁷ Her unobtrusive behaviour during the NS-era made her post-war career possible.

In contrast to the situation in Germany, there seemed to have been no formal restrictions for nuclear research in Austria after the Liberation in 1945. Moreover the Allied and, in the first instance, the American troops supported the Austrian scientists in the reorganization of their research facilities especially in safe transport of the radium standard compounds and instruments, that were stored in the Western zones of Austria at the end of the war.⁸ Contemporary witnesses, like Karl Lintner, who was the assistant of Stetter during the war, do not remember any restrictions for nuclear research, e.g. Lintner finished his Habilitation thesis in 1949 on the interaction of fast neutrons with the heaviest stable nuclei (Hg, Tl, Bi and Pb) (Lintner 1949). His post-war research was mainly based on the work that was carried out in the German Uranverein.⁹ Prof. Cap does not recall restrictions either.¹⁰ The testimonials of the contemporary witnesses are supported by the documents found in the Archive of the Austrian Academy of Science. For example in 1947 Berta Karlik asked the German contractor of the above mentioned neutron generator to fulfil their commitments and deliver the generator. However, this request was denied due to the restrictions for nuclear research in Germany and some parts of the equipment had already been disassembled and confiscated by the Allied forces.¹¹ In 1966 Karlik offered 400kg of pure uranium nitrate for sale, which was owned by the Radium Institute since the war and was at that time supplied by the Germans for the extraction

⁷ Archiv der Universität Wien, Postgasse 9, A-1010 Wien, Personalakte Berta Karlik, Aktnr. 2152.

⁸ Adrienne Janisch: Wie das Radium nach Wien zurückkam. Ein 10-Tonnen-Lastkraftwagen war zum Transport von zwei Gramm nötig (Radio Wien, 18. Mai 1946), Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 8, Fiche 138. See also the correspondence between Berta Karlik and the allied forces, Karton 55, Fiche 812.

⁹ Interview with Karl Lintner conducted by the author, Vienna June 9, 2007.

¹⁰ Interview with Ferdinand Cap, conducted by the author, Innsbruck, August 3, 2007.

¹¹ Letter from Hans Suess to Berta Karlik April 20th 1947, and letter from C.H.F. Müller Aktiengesellschaft to Berta Karlik June 8, 1949, Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 32, Fiche 448.

of uranium isotopes.¹² Considering all these aspects it seems plausible that there were no legal restrictions for nuclear research in Austria after the war.

While the reconstruction of the Radium Institute was still in progress the re-appointed Director Stefan Meyer started to reactivate his old networks from the pre-war era. The Radium Institute in Vienna was, in addition to Paris, the second depository of a primary radium standard and Stefan Meyer was elected as secretary of the International Radium Standard Committee after its foundation in 1910 and later as its president (Reiter 2001b, 113–14). Whereas networks are based on mutual confidence and trust in the competence, professional skills, methods and reliability of each member, measurements and a publication of a member of the German Physikalische-Technische Reichsanstalt in Berlin seemed to challenge the exactness of the Austrian radium standard and the competence of the members of the Radium Institute.¹³ Therefore Meyer's first task was to restore the reliability and credibility of the Institute as keeper of the second radium standard. In the course of this project he hired two PhD students asking them to probe the exactness of the Viennese radium standards. In the end the exactness was proved and the credibility of the Radium Institute was re-established (Meyer 1945; Kremenak 1948). The success of Meyer's, as well as Karlik's, endeavours can be recognized in the appointment of the Radium Institute as Austrian distribution centre for radioactive isotopes, which controlled the import and distribution of radioactive material in Austria from Harwell (UK) since 1949 and from the US since 1952 (Karlik 1950).

Nevertheless, cold winters, lack of resources and funds created delays in this regular business at the Institute until the end of the 1940s. This situation led to reduce the chances of establishing a new nuclear energy program in any foreseeable future. This issue was also illustrated by a speech on international research in nuclear physics given by the experimental physicist Fritz Regler from the Technical University of Vienna before the Industrialists' Federation in 1949. Regler emphasized in the new possibilities of nuclear physics and its

¹² Letter from Berta Karlik to the Austro-Merck G.m.b.H., October 7, 1966. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 50, Fiche 722.

¹³ Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 31, Fiche 427-428. See also the correspondence between Stefan Meyer and Gustav Ortner, Karton 17, Fiche 271.

application, e.g. in the non-destructive examination of materials. However, implementing a nuclear energy program seemed to him unrealistic because of the amount of necessary investments (Lackner 2000; Regler 1949).

1.2.3. Atoms for Peace in Austria

The peaceful use of atomic energy was one of the central ideas in the 1950s characterized by a public discourse and opinion dominated by a positive view over technology and progress at that time (Lackner 2000). However, it required an external incentive to translate these ideas into real opportunities for a small country like Austria. This ignition spark was given by the US President Eisenhower's famous "Atoms for Peace" speech before the UN General Assembly in December 1953 (Krige 2008; Krige 2006; Krige 2010; Hewlett and Holl 1989).

Eisenhower's envisioned program had to face the practical difficulties raised during discussions with engineers. Already before Eisenhower's speech, the Austrian Electro-Technical Society (Elektrotechnischer Verein Österreichs, EVÖ) had initiated a series of lectures on nuclear physics in 1953 and 1954. From those, it seemed that the establishment of a study group had already been planned at that time but practical aspects, like the transfer from the Society to another building, and probably the absence of a concrete perspective for such a group, delayed the constitution of the group. Nevertheless, in December 1954, a formal study group was finally founded with members of the Technical University, among them Heinrich Sequenz the former president of the TU until 1945, and members of the University, like Georg Stetter, the former head of the Four-Year-Plan Institute for Neutron, the physicists from Vienna University Hans Thirring, Erich Schmid, Karl Lintner, and of course Berta Karlik, the head of the Radium Institute, who had been a co-organizer of the first meeting, and Ministerialrat Alexander Koci as the government representative.¹⁴

Only five days after the constitution of the study group at the EVÖ the first government meeting on international cooperation for the peaceful use of atomic energy took place with participants of several ministries, except military or defence, but with only one representative of academia,

¹⁴ Sitzungsbericht über die Gründung einer „Studiengruppe Atomenergie im EVÖ“ am 16.12.1954 vom 10.01.1955, Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 51, Fiche 750.

namely Berta Karlik from the Radium Institute. No representative of the Austrian industry was invited. In this meeting it was decided to establish an advisory expert commission for the peaceful use of atomic energy, which was assigned to evaluate the possibilities and costs of a research reactor made in cooperation with the USA. Electricity production from nuclear energy was also discussed. However, at that time it seemed to be only a future possibility to complement other forms of electricity production.¹⁵ After a meeting of the Council of Ministers in January 1955 and several other inter-ministerial discussions, the Minister of Education sent out a circular letter to all Austrian Universities in February 1955, in which he asked expert reports on a research reactor and on the possibility for energy production from nuclear fission.¹⁶

Another month later the universities had named the delegates for the commission and it was founded with subcommittees for experimental and theoretical nuclear physics, the application for nuclear energy in physics, chemistry, medicine, biology and one for the technical aspects of a nuclear energy reactor. This time all the delegates came from the universities except the one for the technical application and therefore one may imagine strong debates and opinion between the different institutions over the progress and vision of the project. Berta Karlik was assigned to conceptualize all the necessary memoranda, which underlined her central role again.¹⁷ At that time still no representative of industry or the utilities was present.

In her report concerning the expediency of a construction of a nuclear reactor in Austria, Karlik expounded the different types of nuclear reactors, their purposes, and the costs involved. Furthermore, she gave a short analysis of the situation in other European states like France, Norway, the Netherlands, Sweden, Switzerland, Italy, West Germany, and Belgium. However, Great Britain and the United States were explicitly excluded from this analysis because of the engagement of the military in their nuclear research programs. Karlik pointed out that all these

¹⁵ Archiv der Republik, Österreichisches Staatsarchiv, Nottendorfer Gasse 2, A-1030 Wien, Bestand BMU Atom, Zahl 157.959-INT/54.

¹⁶ Rundschreiben des Bundesministeriums für Unterricht an die Rektorate der österreichischen Universitäten und Hochschulen vom 11. Februar 1955, Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 829.

¹⁷ Correspondence between the Ministry for Education and the University of Vienna, February and March 1955, Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 829.

European states installed or aspired to only research reactors and the financial situation in Austria would only allow the construction of a research reactor. However, she considered the financial requirements too high for the Ministry of Education even in the case of a research reactor. Therefore, she recommended an alliance of all concerned ministries, academia and industry. Besides she pointed out to another problem concerning the lack of qualified personnel for operating a reactor. For this reason she recommended again the construction of a research reactor, where specialists could be trained in light of a possible future assignment in a nuclear power plant.¹⁸

The lack of qualified personnel was one of the main problems for the implementation of the project. Therefore, the Ministry of Education initiated a search for Austrian nuclear physicists abroad. Among them one of the central figures of Austrian nuclear research was eager to come back. Gustav Ortner, the former director of the Radium Institute from 1939-1945, was suggested by Karlik as coordinator of the project.¹⁹ Ortner had held since 1950 a position as professor for experimental physics in Cairo and was in regular correspondence with Karlik even to the point of exchanging of material samples, which Karlik had sent to Ortner in Cairo.²⁰ Concerned about the possibility of missing this opportunity Ortner wrote a very gentle letter to the Ministry abstaining from any salary claims and Karlik on the other hand refused a request of the Ministry to name a second candidate.²¹ Ortner, who finally got selected for the position of project coordinator, was sent to the US for training courses on the technique of nuclear reactors and

18 Gutachten über die Zweckmäßigkeit der Errichtung eines Reaktors in Österreich, verfasst von Berta Karlik im April 1955, Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 49, Fiche 706.

19 Letter from Berta Karlik to the Bundesministerium für Unterricht, April 28, 1955. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 829.

20 Correspondence between Berta Karlik and Gustav Ortner, Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 46, Fiche 665.

21 Letter to the Bundesministerium für Unterricht, April 28, 1955. Letter from Berta Karlik to the Bundesministerium für Unterricht, May 4, 1955 and Letter from Gustav Ortner to Berta Karlik, May 17, 1955. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 829.

was belatedly nominated as Austrian expert for the atomic energy conference in Geneva in August 1955.²²

The Austrian Council of Ministers, the highest decision-making body of the second republic, accepted the suggestions of the expert committee based on Karlik's recommendations shortly after Austria regained its full sovereignty in March 1955 and made the decision to build a research reactor, most probably with American support. One has to remember that these developments happened during the Cold War and Austria, which was occupied by the Allies until then, regained its sovereignty only for political neutrality. As a matter of fact, Austria also received offers for building a nuclear reactor from the Soviet Union. However, although these offers were notified and forwarded to the scientists, they remained without responses, probably as a result of the conditions for the aspired integration of Austria into the Western bloc.²³ Karlik recommended the American technology for the comprehensive offer of training, supply of fuel elements and disposal of nuclear waste.²⁴ However, already in December 1954, in an inter-ministerial meeting only the American option was discussed even before the scientific advisory group was formed and the scientists were interviewed.²⁵ This indicates that the scientists may have been asked to follow the political orientation of their government.

Berta Karlik was from the beginning the central figure in the whole organization of the project and, around her, the Radium Institute and the members of the university. The Technical University only seemed to play the role of supporting actor in this project. This development led to the foundation of a separate study group at the Technical University in December 1955 to

²² Letter from Berta Karlik to the Bundesministerium für Unterricht, Juli 16, 1955. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 830.

²³ Letters from the Bundesministerium für Unterricht to Berta Karlik, June 21 and July 5, 1955. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 830.

²⁴ Letter from Berta Karlik to H. Küpper, November 10, 1955. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 830.

²⁵ Letter from Bundeskanzleramt – Auswärtige Angelegenheiten to Bundesministerium für Unterricht, December 6, 1954. Archiv der Republik, Österreichisches Staatsarchiv, Nottendorfer Gasse 2, A-1030 Wien, Bestand BMU Atom, ZI. 157.605-INT/54

articulate the interests of the university on the prospects of new research resources.²⁶ These interests were clearly formulated half a year later in a letter of this study group to the Ministry of Education, where the author Sequenz stated the importance of engineers for the new developments in nuclear energy and that a new institute equipped with a research reactor should not be assigned only to the Viennese University but that the Technical University should benefit at least from the same equipment.²⁷ This latent conflict created a phase of tensions in the 1960s over the question of the access to the new resources.

However, before this internal conflict broke up, Austrian scientists demonstrated unity to the rest of the world at the *First International Conference on the Peaceful Uses of Atomic Energy* in Geneva in 1955. In the preparation for the conference, the Ministry of Foreign Affairs asked for a memorandum “that shows the world, that Austria is using for many years atomic energy for peaceful purposes and is one of the leading nations in that area.”²⁸ In comparison to the debates about Austria’s accession to CERN it seems like scientists were successful with their reasoning, as it was now taken over by the politicians. Berta Karlik was asked again to prepare a report. Most of the report discussed the use of radioactive isotopes in all kind of fields: from medical to scientific and industrial applications. The last section focused on the plans concerning a reactor, where she stated:

Austria is considering the building of a research reactor as a joint project of science and industry and is engaged in preparations. It is expected that within a period of one year it will be possible to clear the major problems as there are the juridical form of cooperation of partners in the project, the financial problem, the coordination of the research

²⁶ Sitzungsprotokoll vom 19.12.1955, Archiv der Technischen Universität Wien, Karlsplatz 13, A-1040 Wien, R.Z. 2787/55, p. 31.

²⁷ Letter from Heinrich Sequenz to the Bundesministerium für Unterricht, July 6, 1956. Archiv der Technischen Universität Wien, Karlsplatz 13, A-1040 Wien, R.Z. 2787/55, p. 32-33.

²⁸ „Der Welt soll gezeigt werden, dass Österreich seit Jahren Atomenergie für friedliche Zwecke verwendet und auf diesem Gebiet zu den führenden europäischen Nationen gehört.“ (English translation from the author), Bundeskanzleramt für Auswärtige Angelegenheiten to Institut für Radiumforschung, January 27, 1955. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 50, Fiche 727.

programs as well as the reactor type, a time schedule, etc. – The construction of a power reactor is not considered advisable at the moment.²⁹

The conference was a catalyst on Austrian developments, but not in the way it was hoped for by the scientists. In parallel to the academic study groups an alliance between energy utilities, industry and politicians had been formed. This alliance led to the founding of the *Österreichische Studiengesellschaft für Atomenergie GmbH* (Austrian Society for Atomic-Energy Studies Ltd.) on May 15, 1956. The Society held a capital stock of 6 Mio öS (Million Schillings) with 51% from the state and 49% from the industry. The alliance was made up of more than 80 companies, although in the board of management of the society only one scientist (Gustav Ortner) was present. However, scientists were invited to participate in the newly founded research groups, e.g. on biology, medicine, safety issues, research and power reactors, metallurgy, physics, chemistry, legal questions etc.³⁰ In June 1956 a contract concerning the cooperation for the civilian uses of atomic energy was signed between the United States and Austria and it was decided to construct a reactor centre with an ASTRA swimming-pool reactor in Seibersdorf near Vienna. 40% of the required 102 Mio öS investment were covered by the European Recovery Program fund and 9 Mio öS were directly subsidized by the American Atomic Energy Commission (Müller 1977, 83–87; Lackner 2000, 209–12).

In the course of planning, the scientists' views were heard but they had the weakest position in the struggle for financial and personnel resources and in the question of who would define the areas of future research. Finally the close cooperation between academia and industry failed in May 1957 when the decision was made that the new reactor centre should no longer be coordinated by a university's institute.³¹ On their side, however, the universities enforced their claims for the construction of their own research reactor project, which was finally approved at

²⁹ Draft of a memorandum, Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 55/56, Fiche 825.

³⁰ Bundesministerium für Unterricht to Berta Karlik, August 23, 1956. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 832.

³¹ Bundesministerium für Unterricht an die Rektorate aller wissenschaftlichen Hochschulen. May 24, 1957. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 832.

the end of August 1957³² and led to the foundation of the *Atomic Institute of the Austrian Universities* in 1959, which received a TRIGA MARK II reactor supplied by General Dynamics for \$258.625 US called "Austria 30".³³ The location of the Atomic Institute and the research reactor of the Austrian universities was heavily debated in the public spheres, because the scientists' first choice was a flak tower, an above-ground bunker built during the NS era in the Augarten, a central pleasure ground in Vienna. The proposal sparked massive public protest, and it was relocated to the Prater, which is a green area on the periphery of the city.³⁴ The new institute was formally attached to the Technical University for administration but the rules of procedure determined that the new Atomic Institute should be opened for research to members of all Austrian universities.³⁵ Nevertheless, the two directors, Gustav Ortner and Fritz Regler who were nominated in March 1961 when the construction was still in progress, came from the Technical University.³⁶ The discussions about the rules of procedures, especially about the access to the new research and teaching resources, led to strong debates between the Technical University and the other universities up to the point where the University of Vienna asked its Faculty of Law for legal support. This fight resulted however in having the Atomic Institute incorporated into the Technical University at the beginning of the 21st century.³⁷

³² Bundesministerium für Unterricht an die Rektorate aller wissenschaftlichen Hochschulen und das Dekanat der Katholisch-theologischen Fakultät in Salzburg, August 30, 1957. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 833

³³ Vertrag zwischen dem Bundesministerium für Unterricht und der General Dynamics Cooperation. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 834/835.

³⁴ Gedächtnisprotokoll über die Sitzung des Aktionskomitees für Atomenergie, Dienstag 1. April 1958 im kleinen Sitzungssaal des Bundesministeriums für Unterricht, verfasst von Fritz Regler, April 2, 1958. Archiv der Technischen Universität Wien, Karlsplatz 13, A-1040 Wien, R.Z. 1250/58, p. 70.

³⁵ Entwurf eines Erlasses des Bundesministeriums für Unterricht betreffend der Zuordnung des Atominstinuts, February 2, 1959, Erlass des Ministeriums vom February 20, 1959. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 834.

³⁶ Protokoll der 5. Sitzung der Atomkommission der österreichischen Hochschulen am 11. März 1961 um 10:00 Uhr im großen Sitzungssaal der Technischen Hochschule Wien. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 836.

³⁷ Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 836/837/838, darin insbesondere: Gutachten des Dekans der Rechts- und staatswissenschaftlichen Fakultät der Universität Wien vom 27. März 1962, Fiche 838.

Finally, three research reactors went into operation: The ASTRA reactor of the industry dominated *Studiengesellschaft* at Seibersdorf in 1960, the TRIGA MARK II of the Austrian universities at the Prater in Vienna in 1962, and a small sub-critical reactor of the technical universities in Graz in 1963. The latter was financed by the federal state Styria and the local industry and was developed independently from the main negotiations in Vienna.

1.2.4. The Nuclear Power Plant in Zwentendorf

Energy production in Austria was until the late 1980s a government monopoly. Besides the central *Verbund* Corporation (Österreichische Elektrizitätswirtschafts-Aktiengesellschaft, Austrian Industry Electricity Stock Corporation) which was controlled by the federal government there was one electricity provider in every state that was controlled by the particular federal state government. When the research reactors were constructed and started up at the beginning of the 1960s electrical energy production from nuclear fission was still a dream of the future as the necessary investments seemed too high for a profitable energy production in comparison to hydropower and fossil-fuelled thermal power plants. Even a predicted doubling of the energy consumption in Austria in the decade from the mid-fifties to the mid-sixties was not enough to make nuclear energy a profitable endeavour. Nevertheless, as early as 1960 the *Verbund* Corporation asked for a report about possible locations for a nuclear power plant (Schaller 1997, 112–14). However, even though the predictions concerning the consumption of electricity were relatively accurate, the main problem remained that hydropower could not cover the increasing consumption and therefore there was no other choice than increasing the share of electricity production from fossil fuels (Lackner 2000, 216f).

By the end of the 1960s the electricity companies started together with the conservative government an initiative for nuclear energy production in Austria. In October 1967 the Ministry of Transport and State-owned Companies (Bundesministerium für Verkehr und verstaatlichte Betriebe) arranged a hearing concerning atomic energy in Austria with explicit reference to electricity production from nuclear fission. The positions in the electricity companies were heterogeneous at that time, especially about when a nuclear plant might be necessary; in particular contrast to the conservative government that forced a quick start on the beginning of construction (Forstner 2016b).

One of the results of the experts' hearing was the foundation of the *Kernkraftwerksplanungsges. m.b.H* (Nuclear Power Plant Planning Corporation Ltd.) in April 1968 and later, after the location was chosen, a construction company named after the area Tullnerfeld the *Gemeinschaftskraftwerk Tullnerfeld Ges. m.b.H.* (Corporation Power Plant Tullnerfeld Ltd) was founded. Problems in the demarcation of the responsibilities of the two companies led to the decision that the latter was in authority for the concrete planning of the plant in Zwentendorf while the former was to plan all future Austrian nuclear power plants. The central *Verbund* held 50% of each corporation; the other 50% were divided among the seven federal state companies. Quarrels between these companies considerably delayed the start of construction. Three years later the Austrian government under Chancellor Kreisky made the planning and building decision in March 1971 and a consortium of the Austrian *Siemens Ges. m.b.H.*, the Austrian Elin Union AG and the German Kraftwerk Union AG was chosen to build the plant. Their offer for a turnkey boiling water reactor of the consortium was not considered the best (the government thought that the Swedish ASEA made the best offer) but it was regarded as a chance for the Austrian industry to prove their abilities in the construction of nuclear power plants and, more broadly, it may also be seen as a part of the Keynesian economic policy in place at that time in the Kreisky era (Forstner 2016b; Lackner 2000, 219f).

After several hearings the building permission was granted and construction started in March 1972 and in 1976 two further nuclear power plants were planned for 1990. Just after the Swedish Social Democrats lost their majority at the national parliament elections in 1976 probably because of their atomic policy, a public discussion process was initiated and supporters as well as opponents were heard. The start-up of the plant in Zwentendorf was delayed several times and finally Kreisky initiated a referendum about the launch, promising to resign should the referendum fail. The referendum resulted in 50.47% of votes against the start-up coming from opponents to nuclear power as well as probably also conservatives supporting the technology but hoping to get rid of Kreisky, hence voting against Zwentendorf NPP for political reasons. However this strategy failed altogether. Kreisky quickly reacted and about one month after the referendum the Parliament passed without any dissentient vote the *Atomsperrgesetz*, a law that forbade the use of nuclear fission in Austria for energy production. A two-thirds majority rule in parliament and another referendum protected the law from being

easily revoked. Nevertheless, nuclear research was excluded from this ban. Following the Three Mile Island accident in the USA in 1979, as well as several failed attempts to withdraw the *Atomsperrgesetz*, the Austrian plans to establish nuclear energy were finally cancelled. In 1986, the Chernobyl accident in Ukraine helped the anti-nuclear movement to receive more and more public attention and acceptance, although the accident had no direct effect on the Austrian decision (Forstner 2016b).

This development led to a new law, now part of the Austrian Constitution:³⁸ The *Bundesverfassungsgesetz für ein atomfreies Österreich* (Constitutional law for an Austria free of nuclear tasks) determined that in Austria:

- Nuclear weapons cannot be produced, tested, stored or transported;
- Nuclear power plants cannot be constructed anymore and those that are already built cannot start operation;
- Transport and storage of compounds for nuclear fission are forbidden, except those for peaceful uses although not those for energy production;
- The Republic of Austria is liable for any injuries due to accidents with radioactive compounds or has to enforce the claims from foreign causers;
- The Federal Government is responsible for the implementation of the law.

Today it seems evident that there is no intention for further developing nuclear power in Austria in any foreseeable future. After a legislative initiative of the Social Democrats failed in 1985 it was decided to use the Zwentendorf power plant in the best way possible. In the further course the power plant was transformed into a stock of spare parts for West German plants of the same type and used as a training area for nuclear engineers. Today's criticism focuses on the high cost (14 billion öS) for such a training plant paid for by the Austrian taxpayers. Anecdotally, the power plant was also used for a film setting with the Swedish actor Dolph Lundgren,

³⁸ Bundesgesetzblatt für die Republik Österreich, ausgegeben am 13. August 1999, 149. Bundesverfassungsgesetz für ein atomfreies Österreich, eingesehen unter <http://www.salzburg.gv.at/1999a149.pdf> am 26.03.2009.

although the production company ran out of money and the film was never finished.³⁹ This makes an interesting parallel with the actual fate of the nuclear power plant.

1.3. Presentation of main actors

Academia

Academia had a long tradition in radioactivity and nuclear research. The Institute for Radium Research was founded in 1910 and was the first Institute of this kind. It was financed by the Austrian Academy of Science and the University of Vienna. Until the Institute was split up in the 1970s there was a close cooperation between the Institute and Vienna University.

In the early discussion until 1956 academia was the driving force for the construction of a nuclear reactor in Austria. All committees were manned by scientists from academia, especially the Radium Institute, the University of Vienna, and the Technical University of Vienna. Other Austrian universities were engaged in the discussion, but played only a minor role. The central figure of the whole discussion was Berta Karlik. She served as director of the Radium Institute, and was the first woman at Vienna University who got a full professorship. She drafted all the memoranda and reports for the conference in Geneva, as well as a feasibility study on a nuclear reactor in Austria in 1955. Academia lost their central position in 1955 when industry and the Austrian utilities entered the discussion treating directly with the government. In the course of the construction of Austria's first NPP academia took only a minor role.

Industry and utilities

Before 1955, early interest in the nuclear technology concerned very few companies, including Waagner-Biro (steel, machine building industry), the Osterreichischen Stickstoffwerken AG (chemistry), Elin AG/ ELIN-UNION AG (electrical engineering), and the Simmering-Graz-Pauker AG (machine building, motor, and electrical engineering). A meeting at the central Austrian utilities (Verbundgesellschaft) led to a union of the industrial interests, and to the founding of the Österreichische Studiengesellschaft für Atomenergie m.bes.H. In this corporation Austrian utilities took a leading role, as well as the above mentioned companies. However, Austrian

³⁹ Tageszeitung *Die Presse* vom 13. Oktober 2008.

government kept a slight majority (50.48%) of the corporation's share. It is the industry that convinced the government to develop nuclear energy production at the end of the 1960s.

Government

The Austrian government welcomed the US offer in the context of the Atoms for Peace program. Soviet offers circulated among the main actors, but no further discussion followed. The conservative government in the 1960s was in favour of nuclear energy as well as the Social Democratic party in the 1970s. However, in the 1960s the conservative government was forced by the industry to complete the development plans in order to effectively start designing and building NPPs.

When the anti-nuclear movement became stronger in the mid-1970s the conservative party started questioning the security of the Zwentendorf NPP. At that time the social democratic party also changed their public policy and initiated a public information campaign. In 1978 it was impossible to find a consensus between the conservative party and the social democratic party concerning the start-up of the Zwentendorf NPP. This led Chancellor Bruno Kreisky to initiate a referendum resulting in a slight majority against the start-up. Several attempts were made to revoke the result of the referendum. Finally, after a last attempt by the Social Democrat and Chancellor, Fred Sinowatz, failed in 1985, all further plans for implementing nuclear power in Austria were definitely abandoned.

The Public

In the 1950s the Austrian government successfully established a positive view of nuclear energy in the public supported by the United States and their manifold information services. This positive view held up until the construction of the Zwentendorf NPP. At the beginning of the construction there were only local protests and opposition by conservative and right-wing groups of the early ecology movement which was strongly influenced by German eugenics (*Rassenhygiene*). This changed after Maoist groups of students entered the field in 1975, and the anti-nuclear movement began to broaden. Finally, it extended across all social classes and social groups which became divided around this question.



2. Showcase: The Austrian Anti-Nuclear Movement

While the anti-nuclear movement in Germany has already been well studied, the Austrian movement has not attracted the same attention.

In the early years, there was only sporadic and local criticism of nuclear power, which was ignored on the whole. For this form of criticism, a memorandum of the Lower Austrian Chamber of Physicians from 1969 serves as illustration. This is the first sign of protest against the construction of the nuclear power station at Zwentendorf. After Zwentendorf had been set as the site for the nuclear power station, Rudolf Drobil, representing the Lower Austrian Medical Association, together with the biologist Gertrud Pleskot, from the University of Vienna, attended Andreas Maurer's surgery and tried to dissuade the Lower-Austrian state governor from constructing the nuclear power station because of potential health hazards. As they failed in their face-to-face negotiation, they made the memorandum public (Straubinger 2009, 211f).

In this memorandum, they demanded not only the participation of nuclear physicists and nuclear engineers in the design of the power plant but also the involvement of those qualified to judge the health and environmental impacts of radiation such as doctors and biologists. The authors of the memorandum stressed that any kind of high-energy radiation is detrimental to the human body and its cells regardless of the size of the dose. In particular, they pointed out the risk of damage to the genome through ionizing radiation. As examples of the victims of such radiation, they listed the first scientists who worked with X-rays or radioactive materials; they also cited the victims of radioactive radiation due the atomic bombs dropped on Nagasaki and Hiroshima. The authors of the memorandum cautioned that even after the most accurate surveys about the potential dangers, and the little consideration they had been given, potential risks will always exist. For instance, even if the probability of an earthquake occurring was *thought* to be extremely low, it could not be ruled out entirely. Moreover, the authors argued that radioactivity discharged into the environment would accumulate over time in organisms. As evidence, they quoted figures from measurements at the Hanford site in the USA (see US's short country report). In addition, the authors questioned the viability of a nuclear power station and highlighted the opportunities for expanding hydropower in Austria. After considering all of these

factors, the authors concluded that it was not worth taking the risk of building a nuclear power station.⁴⁰

This memorandum attracted as little attention as the first early protests of the *Bund für Volksgesundheit* (Union for Public Health), in which Richard and Walther Soyka were the main protagonists. After the death of Richard Soyka, his son Walther took over the management of the *Bund für Volksgesundheit*, which derived from the eugenic/racial-hygiene movement. It was founded in 1926, dissolved after the Occupation and Annexation of Austria by Nazi Germany and was founded again in 1946. The main topics preoccupying the *Bund* in the post-war period were diet, alcohol and nicotine abuse. With plans for an Atomic Institute in Austrian higher education, health effects from radioactivity became one of the *Bund's* concerns. In the early phase of protest against Zwentendorf, the *Bund* demanded a referendum against contamination from nuclear reactors (1969) and organised two marches in 1970 as protest actions, in which protestors starting from different places converged on Zwentendorf. Headed by Walther Soyka, a society for biological safety (*Gesellschaft für biologische Sicherheit*) was also founded in 1970, whose goal was to oppose to nuclear energy.⁴¹ In March 1972, Walther Soyka, equipped with hundreds of powers of attorney from residents who lived close to the site of the planned nuclear power station, attempted to participate in the hearing for the licensing procedure at the parish hall in Zwentendorf. Since local residents did not have a stakeholder status according to the Radiation Protection Act, Soyka was finally ousted by the police from the parish hall after the protest. In 1972, Soyka became a co-worker at the University of Bremen and moved in circles on the edge of the right-wing spectrum (Geden 1996, 116) until his candidacy as an independent for the Nazi party *Deutsche Volksunion* in the German federal elections for the *Bundestag* (German parliament) in 1998 (Hertel 1998, 26).

The *Bund für Volksgesundheit* collaborated intensively with the *Weltbund zum Schutz des Lebens* (World Union for Protection of Life), which was also conservative tending to “ethnonationalistic”. German and Austrian sections of the latter were established in 1960 by Günther Schwab, and the environmental historian John Straubinger concludes in his analysis of

⁴¹ Hermann Soyka, The „Bund für Volksgesundheit“, 2007, http://www.academia.edu/6641682/Der_Bund_fuer_Volksgesundheit, consulted on 14/03/2007

Schwab's work that he indeed had a considerable propinquity to National-Socialist ideology but was the first to warn about the dangers of nuclear power in Germany and Austria in his work (Geden 1996, 105–7; Straubinger 2009, 65–75). His book *Morgen holt dich der Teufel. Neues, Verschwiegendes und Verbotenes von der friedlichen" Atomkernspaltung*, which appeared in 1968 in Germany and Austria, played an important role in this respect (Schwab 1968). In his book, Schwab provided in the form of a dialogue some facts and arguments for the opponents of nuclear power. Thus, for example, Peter Weish, a former employee at the Research Centre Seibersdorf and later head of the anti-nuclear movement in Vienna, recalled in an interview the important role the book played in his own opposition to nuclear energy.⁴² However, the initial protests did not manage to achieve a widespread attraction within the population.

In the federal state Upper Austria and in its capital Linz, resistance against a planned second nuclear power station in Stein/St. Pantaleon stirred early. This protest led finally to the broadening of the anti-nuclear movement across the whole country. The resistance there was instigated by the *Naturschutzbund* (Environmental Protection Group) and the *Weltbund zum Schutz des Lebens*, later joined by the Maoist-oriented *Kommunistische Bund Linz* (Communist Confederation Linz). The latter was the driving force in the working group Nuclear Energy Linz and was popular especially among students. The Upper Austrian anti-nuclear movement spanned the entire political spectrum from the left to the right. Due to its heterogeneity disagreements often occurred concerning the most affective forms of action to achieve the shared goals. A decisive step towards the unification of the movement was taken in the sidelines of a lecture given by Karl Richard Bechert, a nuclear power station opponent and nuclear physicist from Germany. Functionaries of the Austrian *Naturschutzbund*, Upper Austrian activists and the Viennese group surrounding Peter Weish and Bernhard Löttsch formed a network. Furthermore, the Upper Austrian nuclear power station opponents united in the *Bürgerinitiative gegen Atomgefahren* (Civil Initiative against Nuclear Hazards) (Straubinger 2009, 211f).

The Austrian anti-nuclear campaign gained additional impetus from events in Germany. As the construction of the Württemberg nuclear power plant in Wyhl began in February 1975, demonstrators successfully occupied the building site for nine months. A panel discussion in

⁴² Interview with Peter Weish, conducted by the author on 16th February 2016.

Linz in April 1975, with more than 3,500 participants, represented the first high point in the development of the Austrian anti-nuclear campaign. Both the Minister of Trade Staribacher and Chancellor Kreisky took part in the event. Discussion was turbulent, and it was broadcast on TV to all of the federal states of Austria. Nuclear energy was no longer a local issue; it was now a concern of the entire federal territory. In almost all cities and universities, working groups and action groups were formed that made it their business to inform people about the dangers of nuclear energy (Bayer 2014, 173).

Federal Government came under increasing pressure by this development, and in October 1975 federal elections for the parliament were imminent. On 1st April 1975, the Minister of Trade Staribacher announced a provisional construction freeze on the proposed nuclear plant (AKW) at Stein/St. Pantaleon for economic reasons. In April 1976, the Federal Government initiated an information campaign in 10 Austrian cities, in which experts discussed various aspects of nuclear energy and faced questions from the general public. Both supporters and opponents of nuclear energy were represented among the experts. Through this campaign, a strong course of confrontation like in the Federal Republic of Germany was to be avoided. However, the nationwide unification of the different anti-nuclear groups was one of the consequences of the Chancellor's nationwide initiative. In May 1976, the representatives of the various groups met and formed an umbrella organization the Initiative Österreichischer Atomkraftwerksgegner (Initiative of Austrian Nuclear Power Opponents). Their goal was to prevent the Zwentendorf nuclear power station from being commissioned (Straubinger 2009, 211f).

The result of the September 1976 elections in Sweden probably also influenced the turnaround in the politics of the Austrian Federal Government. The Swedish Social Democrats under the leadership of Olof Palme lost the election partly because of its nuclear policy. (See Sweden's Short Country Report) The events in Sweden were reported in detail in the *Arbeiterzeitung*, the daily newspaper of the SPÖ.⁴³ Kreisky declared, two days after the elections in Sweden, that the construction of nuclear power station Stein/ St. Pantaleon be frozen until the question of disposal of nuclear waste had been cleared.⁴⁴

⁴³ See, for example, *Arbeiterzeitung* from 21st September 1976.

⁴⁴ *Arbeiterzeitung* from 22nd September 1976.

The information campaign of the Federal Government was launched in October 1976 and ended ultimately in a fiasco for the Government. The events in autumn of 1976 and spring of 1977 were clearly dominated by the anti-nuclear activists. Thus the IAEA recorded in its files:⁴⁵

“9 December 1976, Salzburg: ‘Judging the Risks at Nuclear Power Stations.’ This turned into a festival for professional demonstrators, using speaking choruses. The main scientific opponents, Dr. Bernhard Lötsch and Dr. Peter Weihs [sic] from Vienna’s Boltzmann Institut für Umweltwissenschaften received ovations.

...

27 January 1977, Vienna: ‘Effects on Society and Control of Operation of Nuclear Plants.’ This was the biggest demonstration of anti-nuclear groups in Austria, about 1000 persons attended, 90% of them anti-nuclear. No discussion was possible, only opposition groups made their demands known and elected their chairman. After this, official organizers asked themselves if the campaign should be continued in this climate.”

Some of the events proceeded more quietly; however, overall, it can clearly be said that the Federal Government’s campaign was a failure. During 1977, there were several nationwide actions and demonstrations, and the situation for the government worsened progressively (Bayer 2014, 173).

As it had become obvious in the spring of 1978 that a common parliamentary resolution between ÖVP and SPÖ for commissioning the Zwentendorf nuclear power station was not going to be achieved, the SPÖ leadership decided to seek a decision in a referendum. During the preparation for this referendum, the working group *NEIN zu Zwentendorf* (No to Zwentendorf), with the geologist Alexander Tollmann at its head, was founded from the conservative parts of the anti-nuclear movement. Eventually, they just managed to assert themselves in the referendum thanks in part to the lack of mobilization in the supporters of the SPÖ (Forstner 2016b).

⁴⁵ Nuclear controversy in Austria, 1976-77, IAEA Archives, Vienna, Box 15521.

3. Events

Critical view to the selection process of the five events

Reasons for choosing the events:

- *Eisenhower's Atoms for Peace speech* was chosen because it was the initial spark for post-war Austria's nuclear energy program. The speech and the Atoms for Peace program had a great effect on several countries of the western hemisphere and might therefore be suitable for a transnational comparison.
- *Conference in Geneva 1955* was also a transnational event. The effects of the conference on Austria and its nuclear program may also be part of a transnational comparison.
- *The Austrian plebiscite in November 1978* marks the failure of the Austrian nuclear energy program. The date is crucial for Austria and cannot be neglected. The analysis shows that the Socialist Party failed to mobilize its supporters for the referendum.
- *A ship's christening* shows how local traditions of protest and civil resistance later developed as anti-nuclear protests. These protests started against the Swiss NPP in Rütli next to the Austrian border, and later focused on the Austrian NPP.
- *The IAEA and the Austrian events* shows how local/national events influenced the policy of a transnational organization. In this case the Austrian referendum led to a public acceptance program of the IAEA.

3.1. Event 1: Eisenhower's 'Atoms for Peace' Speech

It seems that the American *Atoms for Peace Program* was Austria's only chance after the war to acquire nuclear energy. However, there were also offers from the Soviet Union for the construction of research reactors. In this early period scientists took the leading role and it seems that that followed the political needs of Austria's integration with the West. Political neutrality played no role in Austria's first steps into nuclear energy production. US President Eisenhower's famous "Atoms for Peace" speech before the UN General Assembly in December 1953 gave the ignition spark for Austria's nuclear energy program after WWII. (Forstner 2016b).

Eisenhower's envisioned program had to face the practical difficulties raised during the discussions with engineers. Already before Eisenhower's speech, the Austrian Electro-Technical Society (Elektrotechnischer Verein Österreichs, EVÖ) had initiated a series of lectures on nuclear physics in 1953 and 1954. From those, it seemed that the set-up of a study group had already been planned at that time but practical aspects, like the transfer from the society to another building, and probably the absence of a concrete perspective for such a group, delayed the constitution of the group. Nevertheless, in December 1954, a formal study group was finally founded with members of the Technical University (TU), among them Heinrich Sequenz the former president of the TU until 1945, and members of the University, like Georg Stetter, the former head of the Four-Year-Plan Institute for neutron physics, the physicists from Vienna University Hans Thirring, Erich Schmid, Karl Lintner, and of course Berta Karlik, the head of the Radium Institute, who had been a co-organizer of the first meeting, and Ministerialrat Alexander Koci as the government representative.⁴⁶

Only five days after the constitution of the study group at the EVÖ the first government meeting on international cooperation for the peaceful use of atomic energy took place with participants of several ministries except military or defence, but with only one representative of academia, namely Berta Karlik the head of the Institute for Radium Research. In this meeting it was decided to establish an advisory expert commission for the peaceful use of atomic energy, which was assigned to evaluate the possibilities and expenses of a research reactor in cooperation with the USA. Also electricity production by nuclear energy was discussed, but at that time it seemed to be only a future possibility to complement other forms of electricity production.⁴⁷ After a meeting of the Council of Ministers in January 1955 and several other inter-ministerial discussions, the Minister of Education sent out a circular letter to all Austrian

⁴⁶ Sitzungsbericht über die Gründung einer „Studiengruppe Atomenergie im EVÖ“ am 16.12.1954 vom 10.01.1955, Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 51, Fiche 750.

⁴⁷ Archiv der Republik, Österreichisches Staatsarchiv, Nottendorfer Gasse 2, A-1030 Wien, Bestand BMU Atom, Zahl 157.959-INT/54.

Universities in February 1955, in which he asked expert reports on a research reactor and on the possibility for energy production from nuclear fission.⁴⁸

Another month later the universities had named the delegates for the commission and it was founded with subcommittees for experimental and theoretical nuclear physics, the application for nuclear energy in physics, chemistry, medicine, biology and one for the technical aspects of a nuclear energy reactor. This time all the delegates came from the university except the one for the technical application and therefore one may imagine strong debates and opinion between the different institutions over the progress and vision of the project. Berta Karlik was assigned to conceptualize all the necessary memoranda, what underlined her central role again.⁴⁹

In her report concerning the expediency of a construction of a nuclear reactor in Austria Karlik expounded the different types of nuclear reactors, their purposes, and the costs involved. Furthermore, she gave a short analysis of the situation in other European states like France, Norway, the Netherlands, Sweden, Switzerland, Italy, West Germany, and Belgium. However, Great Britain and the United States were explicitly excluded from this analysis because of the engagement of the military in their nuclear research programs. Karlik pointed out that all these European states installed or aspired to only research reactors and the financial situation in Austria would only allow the construction of a research reactor. However, she considered the financial requirements too high for the Ministry of Education even in the case of a research reactor. Therefore, she recommended an alliance of all concerned ministries, academia and industry. Besides she pointed out to another problem concerning the lack of qualified personnel for operating a reactor. For this reason, she recommended again the construction of a research

⁴⁸ Rundschreiben des Bundesministeriums für Unterricht an die Rektorate der österreichischen Universitäten und Hochschulen vom 11. Februar 1955, Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 829.

⁴⁹ Correspondence between the Ministry for Education and the University of Vienna, February and March 1955, Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 829.

reactor, where specialists could be trained in light of a possible future assignment in a nuclear power plant.⁵⁰

The lack of qualified personnel was one of the main problems for the implementation of the project. Therefore, the Ministry of Education initiated a search for Austrian nuclear physicists abroad. Among them one of the central figures of Austrian nuclear research was eager to come back. Gustav Ortner, the former director of the Radium Institute from 1939-1945, was suggested by Karlik as coordinator of the project.⁵¹ Ortner held since 1950 a position as professor for experimental physics in Cairo and was in regular correspondence with Karlik up to the point of exchange of material samples, which Karlik had sent to Ortner in Cairo.⁵² Concerned about the possibility of missing this opportunity Ortner wrote a very gentle letter to the Ministry abstaining from any salary claims and Karlik on the other hand refused a request of the Ministry to name a second candidate.⁵³ Ortner, who finally got selected for the position of project coordinator, was sent to the US for training courses on the technique of nuclear reactors and was belatedly nominated as Austrian expert for the atomic energy conference in Geneva in August 1955.⁵⁴

The Austrian Council of Ministers, the highest decision-making body of the second republic, accepted the suggestions of the expert committee based on Karlik's recommendations shortly after Austria regained its full sovereignty in March 1955 and made the decision to build a research reactor, most probably with American support. One has to remember that these developments happened during the Cold War and Austria, that was occupied by the Allied until

⁵⁰ Gutachten über die Zweckmäßigkeit der Errichtung eines Reaktors in Österreich, verfasst von Berta Karlik im April 1955, Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 49, Fiche 706.

⁵¹ Letter from Berta Karlik to the Bundesministerium für Unterricht, April 28, 1955. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 829.

⁵² Correspondence between Berta Karlik and Gustav Ortner, Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 46, Fiche 665.

⁵³ Letter to the Bundesministerium für Unterricht, April 28, 1955. Letter from Berta Karlik to the Bundesministerium für Unterricht, May 4, 1955 and Letter from Gustav Ortner to Berta Karlik, May 17, 1955. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 829.

⁵⁴ Letter from Berta Karlik to the Bundesministerium für Unterricht, Juli 16, 1955. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 830.

then, regained its sovereignty only for political neutrality. As a matter of fact, Austria also received offers for building a nuclear reactor from the Soviet Union. However, although these offers were notified and forwarded to the scientists, they remained without responses, probably as a result of the conditions for the aspired integration of Austria into the Western bloc.⁵⁵ Karlik recommended the American technology for the comprehensive offer of training, supply of fuel elements and disposal of nuclear waste.⁵⁶ However already in December 1954 in an inter-ministerial meeting only the American option was discussed even before the scientific advisory group was formed and the scientists were auditioned.⁵⁷

3.2. Event 2: The Effects of the Conference in Geneva 1955 on Austria

While in the first months of Austria's planning to establish a nuclear energy program academia took a leading role in the discussions, this changed with the conference in Geneva. During the preparations for the conference an alliance between industry, the Austrian utilities, and parts of the Austrian government was set up. This led to the loss of the hegemonic position of academia within the discourse and the new alliance took over the leading role.

In the course of the preparation of the *First International Conference on the Peaceful Uses of Atomic Energy* in Geneva in August 1955, the Ministry of Foreign Affairs asked for a memorandum "that shows the world, that Austria is using for many years atomic energy for peaceful purposes and is one of the leading nations in that area."⁵⁸ It was again Berta Karlik,

⁵⁵ Letters from the Bundeministerium für Unterricht to Berta Karlik, June 21 and July 5, 1955. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 830.

⁵⁶ Letter from Berta Karlik to H. Küpper, November 10, 1955. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 830.

⁵⁷ Letter from Bundeskanzleramt – Auswärtige Angelegenheiten to Bundesministerium für Unterricht, December 6, 1954. Archiv der Republik, Österreichisches Staatsarchiv, Nottendorfer Gasse 2, A-1030 Wien, Bestand BMU Atom, ZI. 157.605-INT/54.

⁵⁸ „Der Welt soll gezeigt werden, dass Österreich seit Jahren Atomenergie für friedliche Zwecke verwendet und auf diesem Gebiet zu den führenden europäischen Nationen gehört.“ (English translation from the author), Bundeskanzleramt für Auswärtige Angelegenheiten to Institut für Radiumforschung, January 27, 1955. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 50, Fiche 727.

who was asked to compose such a report. Most of the report discusses the use of radioactive isotopes in all kind of fields: from medical over scientific to industrial applications. The last section focuses on the plans concerning a reactor, where she states:

Austria is considering the building of a research reactor as a joint project of science and industry and is engaged in preparations. It is expected that within a period of one year it will be possible to clear the major problems as there are the juridical form of cooperation of partners in the project, the financial problem, the coordination of the research programs as well as the reactor type, a time schedule, etc. – The construction of a power reactor is not considered advisable at the moment.

The conference took was a catalyst for development in Austria, but not in the way as it was hoped for by the scientists. Parallel to the academic study groups an alliance between energy economy, industry and politics had constituted. This alliance led to the founding of the *Österreichische Studiengesellschaft für Atomenergie GmbH* (Austrian Society for Atomic-Energy Studies Ltd.) on May 15, 1956. The society held a capital stock of 6 Mio öS with 51% by the state and 49% by industry, all in all more than 80 companies, but in the board of management of the society only one scientist (Gustav Ortner) was present. However, scientists were invited to participate in the newly founded research groups, e.g. on biology, medicine, safety issues, research and power reactors, metallurgy, physics, chemistry, legal questions etc.⁵⁹ In June 1956 a contract concerning the cooperation for the civil uses of atomic energy was signed between the United States and Austria and it was decided to construct a reactor centre with an ASTRA swimming-pool reactor in Seibersdorf near Vienna. 40% of the necessary investments of 102 Mio öS were covered by the *European Recovery Program* fund, 9 Mio öS subsidized the *American Atomic Energy Commission* directly.⁶⁰

In the course of planning the academic scientists were heard but they had the weakest position in the struggle for financial and personnel resources and in the question of who defined areas of

⁵⁹ Bundesministerium für Unterricht to Berta Karlik, August 23, 1956. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 832.

⁶⁰ Peter Müller, *Atome, Zellen, Isotope: Die Seibersdorf-Story* (Wien 1977), p. 83-87; Helmut Lackner, „Von Seibersdorf bis Zwentendorf. Die "friedliche Nutzung der Atomenergie" als Leitbild der Energiepolitik in Österreich,“ *Blätter für Technikgeschichte* 62 (2000): 209-212.

future research. Finally the close cooperation between academia and industry failed as in May 1957 the decision was made that the new reactor centre should no longer be organized as a university institute.⁶¹ On the other hand the universities enforced their claims on the construction of their own research reactor project, which was approved at the end of August 1957⁶² and led to the foundation of the *Atomic Institute of the Austrian Universities* in 1959, which received a TRIGA MARK II reactor called “Austria 30” supplied by General Dynamics for \$258.625 US.⁶³ The location of the Atomic Institute and the research reactor of the Austrian universities was heavily debated in the public, because the scientists first choice was a flak tower, an above-ground bunker built during the NS era in the Augarten, a central pleasure ground in Vienna. Due to massive public protest it was relocated to the Prater, which is a green area in the periphery.⁶⁴ The new institute was formally attached to the Technical University for administration but the rules of procedure determined that the new Atomic Institute should be open for research to members of all Austrian universities.⁶⁵ Nevertheless, the two directors, that were nominated in March 1961 – the construction was still in progress – came from the Technical University, namely Gustav Ortner and Fritz Regler.⁶⁶ The discussions about the rules of procedures, especially about the access to the new research and teaching resources, led to heavy debates between the TU and the other universities up to the point where the University Vienna asked the

⁶¹ Bundesministerium für Unterricht an die Rektorate aller wissenschaftlichen Hochschulen. May 24, 1957. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 832.

⁶² Bundesministerium für Unterricht an die Rektorate aller wissenschaftlichen Hochschulen und das Dekanat der Katholisch-theologischen Fakultät in Salzburg, August 30, 1957. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 833

⁶³ Vertrag zwischen dem Bundesministerium für Unterricht und der General Dynamics Cooperation. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 834/835.

⁶⁴ Gedächtnisprotokoll über die Sitzung des Aktionskomitees für Atomenergie, Dienstag 1. April 1958 im kleinen Sitzungssaal des Bundesministeriums für Unterricht, verfasst von Fritz Regler, April 2, 1958. Archiv der Technischen Universität Wien, Karlsplatz 13, A-1040 Wien, R.Z. 1250/58, p. 70.

⁶⁵ Entwurf eines Erlasses des Bundesministeriums für Unterricht betreffend der Zuordnung des Atominstinuts, February 2, 1959, Erlass des Ministeriums vom February 20, 1959. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 834.

⁶⁶ Protokoll der 5. Sitzung der Atomkommission der österreichischen Hochschulen am 11. März 1961 um 10:00 Uhr im großen Sitzungssaal der Technischen Hochschule Wien. Archiv der Österreichischen Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 836.

Faculty of Law for legal support. However, in the long run the universities lost and the Atomic Institute was incorporated into the TU at the beginning of the 21st century.⁶⁷

Finally three research reactors went into operation: The ASTRA reactor of the industrial dominated *Studiengesellschaft* at Seibersdorf in 1960, the TRIGA MARK II of the Austrian universities at the Prater in Vienna in 1962, and a small sub-critical reactor of the Technical universities in Graz in 1963. The latter was financed by the federal state Styria and local industry and developed silently apart from the main negotiations in Vienna (Forstner 2016b).

3.3. Event 3: The Austrian Plebiscite in November 1978

In 1977 nuclear power and the start-up of the NPP Zwentendorf had become a political issue due to the increasing public protests during the years 1976/77. The government passed the decision on nuclear power on to parliament. The Socialists were sure they would come to a mutual agreement with the major opposition party the People's Party because the latter's most influential groups were clearly in favour of nuclear power. A report on nuclear energy was submitted to parliament by the government.

In the course of the parliament hearings the People's Party reconsidered its position, and declared themselves pro nuclear power, but against the start-up of Zwentendorf for security reasons. Therefore, Chancellor Kreisky decided not to ask the parliament for the final decision and instead announced a referendum in June about the start-up.

The plebiscite took place on November 5, 1978. Only 64.1% of the eligible voters took part in the plebiscite, of which 50.47% were against the introduction. The results in each one of the federal states show that those in the in the western federal states were least in favour of the plant being switched on.

⁶⁷ Akademie der Wissenschaft, Ignaz-Seipl-Platz 2, A-1010 Wien, Bestand Institut für Radiumforschung, Karton 56, Fiche 836/837/838, darin insbesondere: Gutachten des Dekans der Rechts- und staatswissenschaftlichen Fakultät der Universität Wien vom 27. März 1962, Fiche 838.

Federal State	Yes in %	No in%
Burgenland	59,8	40,2
Carinthia	54,1	45,9
Lower Austria	50,9	49,1
Upper Austria	47,2	52,8
Salzburg	43,3	56,7
Styria	52,8	47,2
Tyrol	34,2	65,8
Vorarlberg	15,6	84,4
Vienna	55,4	44,4
Whole	49,5	50,5

The SPÖ had not succeeded in mobilizing its followers. This argument is supported by the low participation of voters. Whilst turnout in the referendum was 64.1%, turnout in the 1971, 1975 and 1979 national parliament elections was solidly between 91% and 92%.⁶⁸ The anti-nuclear tradition in the most western state Vorarlberg will be discussed in event #4 “A ship’s christening.”

Kreisky reacted quickly and a month after the referendum the parliament passed without any dissenting vote the *Atomsperrgesetz*, a law that forbade the use of nuclear fission in Austria for energy production which could only be altered by a two-thirds majority in parliament and another referendum. Nevertheless, research was excluded from this ban.⁶⁹

The enriched uranium and the fuel elements were sold to the US. Much of the planning cooperation was liquidated from 1979 onwards. Finally, the planning cooperation for Zwentendorf the *Gemeinschaftskraftwerk Tullnerfeld GmbH* was liquidated in 1985 after the Socialist Chancellor Fred Sinowatz failed to revoke the *Atomsperrgesetz* in parliament. Austria’s final No to nuclear energy was therefore clearly before the Chernobyl accident.⁷⁰

⁶⁸Bundesministerium für Inneres, Nationalratswahlen, historischer Rückblick, http://www.bmi.gv.at/cms/BMI_wahlen/nationalrat/NRW_History.aspx, 25. Mai 2016.

⁶⁹ Bundesgesetzblatt für die Republik Österreich, Jahrgang 1978, ausgegeben am 29. Dezember 1978, 232. Stück.

⁷⁰ Österreich Journal, Alle Parteien gegen Atomkraft, Nr. 94, 1. April 2011, S. 1-11.

Event 4: A Ship's Christening, November 1964 (basis for anti-nuclear protests in Western Austria against the Swiss NPP Rütli)

In the table above is shown that Austria's most Western state Vorarlberg voted at 84.4% against the start-up of the Zwentendorf NPP. This is by far the highest rejection rate of all Austrian federal states. In comparison to other Austrian states Vorarlberg had the longest tradition of civil protests, including against nuclear power in Switzerland.

Since 1971, massive protests by the *Naturschutzbund* (Environmental Protection Group) with the support of the *Weltbund zum Schutz des Lebens* began here against Rütli, the Swiss nuclear power station close to the border. However, the inhabitants of Vorarlberg could look back on a tradition of protest before the demonstrations against the Swiss nuclear power station. The so-called Fußach Ship Christening in 1964 was written in the consciousness of the population of Vorarlberg as an act of civil resistance. On 21st November 1964, an angry group of approximately 20,000 local inhabitants prevented the christening of a ship of the Lake Constance fleet with the name "Karl Renner", the first SPÖ Federal President in Austria since 1945. The Lake Constance fleet was subordinate to the Austrian federal railway, which was in turn assigned to the Department of Transportation under Minister Otto Probst. As the Ministry of Transport made the planned name known, anger stirred in the Vorarlberg population against "Viennese centralism". The anger was additionally fuelled by the *Vorarlberger Nachrichten*, the local leading media. After the abolition of the monarchy, christening ships after personalities was waived for less controversial names. The state government of Vorarlberg decided not to send any representative to the ship's christening in protest; instead, the 20,000-strong group of Vorarlberg inhabitants gathered in the harbour of the community Fußach and conducted an emergency christening of the ship in which they gave it the name "Vorarlberg". In the collective consciousness of Vorarlberg, the Fußach Ship Christening is still considered today as an example of successful protest against Viennese centralism.⁷¹

Between 1972 and 1975, up to 20,000 Vorarlberg inhabitants marched in the so-called Anti-Rütli Marches across the border to Switzerland. These actions were supported in turn by the *Vorarlberger Nachrichten*, which also played a major role in the later resistance against the

⁷¹ Interview with Hildegard Breiner, conducted by the author on 29th June 2012 in Bregenz.

Zwentendorf nuclear power station. Protest went so far in Vorarlberg that even the state representatives of the Vorarlberg SPÖ called for a “no” to Zwentendorf contrary to the guidelines of the federal party. The high “no” vote, 84%, of voters in Vorarlberg in the referendum on Zwentendorf cannot be understood as a simple “no” to the Chancellor Kreisky; its roots have to be seen instead in a long-standing tradition of civil resistance and protest against nuclear power in Austria's western-most federal state.⁷²

Event 5: The IAEA and the Austrian Events

The International Atomic Energy Agency in Vienna began to pay a close attention to the Austrian debates from 1977. It did not limit its interest to the activities of the opponents to nuclear power, but also recorded the activities of advocates in their files. These files include a detailed description of the various groups, their main representatives and the central arguments on which they based their views. After the announcement of the referendum, the depth of detail in the observations increased again. In addition, observations were extended, probably from March 1978, to all democratic countries of the Western world, and all activities associated with "nuclear controversy" were recorded in the files.

The IAEA did not actively intervene in the Austrian nuclear debate. The Swedish IAEA Director General Sigvard Eklund thus made almost no public statement on Zwentendorf. Public statements such as those in a television interview for the Austrian news programme *Zeit im Bild* on 21st September 1978 remained the exception. However, the Agency did make information available to those who advocated for nuclear power plans. It supplied the Austrian utilities with information three months before the referendum and also gave daily newspapers and the ORF information about the disposal of radioactive waste.⁷³

In addition, the IAEA initiated a traveling exhibition on its 20th anniversary, which showed a map of nuclear power stations in the countries bordering Austria and discussed disposal and safety issues. After the exhibition in the Kärntnerstraße was destroyed in its first night, 24th October 1977, it was moved for the months of November and December 1977 to Vienna's city hall. In

⁷² Interview with Hildegard Breiner, conducted by the author on 29th June 2012 in Bregenz.

⁷³ Information output in connection with Austrian referendum as known to OPI [Office for Public Information], IAEA Archives, Box 15521

May 1978, it was exhibited at three other locations in Lower Austria. The IAEA also showed information films on nuclear energy. These films aimed to stimulate a positive attitude toward nuclear energy and were in accordance with the mission of IAEA to promote the peaceful use of nuclear energy.⁷⁴

On 23rd November 1978, the IAEA hosted an information event for the Austrian referendum. Altogether 21 people participated: four from Switzerland, two from the Federal Republic of Germany, three from Sweden and one representative each from France, the Netherlands, Spain and Italy. First, a representative of the Austrian Federal Chancellery spoke on the background of the referendum and to the measures pending to cast the results of the referendum into legislation.⁷⁵

Subsequently, a first error analysis combined with behavioural advice for similar situations was given. These included the following points: It was recommended that in principle no more than 50 people be in the audience for an information session. For discussions sufficient time should be allowed; the presentations should therefore be kept short. It seemed of even greater importance to allow sufficient time for informal discussions. The audience should be taken seriously; questions should be answered with a detailed response and not be avoided. The risks of nuclear energy should be mentioned from the beginning in order to avoid having to admit in the course of the discussion that there are "minor problems" yet to be solved. Grossly simplified presentations should not be given neither should simplistic comparisons between the risks of nuclear energy and the dangers involved, for example, in an hour's skiing or drinking half a bottle of wine. Exclusively people with a broad foundation of knowledge on the subject of energy should be sent to such discussions. In this way, it was hoped that speakers would not be so specialised that they could not answer general questions, which shook an audience's confidence in the expert's knowledge. In addition, efforts should be made in personal

⁷⁴ Information output in connection with Austrian referendum as known to OPI [Office for Public Information], IAEA Archives, Box 15521.

⁷⁵ Information Meeting on Austrian Referendum held on 23rd November 1978, Files from D.G.'s [Director General's] Office - 1978, IAEA Archives, P-156 Box 4.

discussions to find common topics of interest not remotely connected to nuclear energy in order to show that nuclear scientists are also ordinary people with ordinary interests.⁷⁶

The participants to the meetings were grateful for the information as well as the opportunity to exchange experiences over lunch. The importance of the forthcoming Swiss referendum on 18th February 1979 over nuclear power was emphasized. For the French-speaking part of Switzerland, the public relations officer of the French *Commissariat à l'Énergie Atomique* (Atomic Energy Commissariat) offered support, which was well received by the Swiss participants. Likewise, the IAEA's offer of a brochure on radioactive waste disposal was welcomed since this topic touched the core of the Swiss debate. Basically, there was a desire to examine the implications of the Austrian referendum for other countries as well as the question whether the results of the referendum could be used by opponents to nuclear energy for their own purposes. Furthermore, a request was made to the IAEA to either promote the benefits of nuclear energy more actively or set out its advantages compared to alternative sources of energy.⁷⁷

In the short term, the IAEA would not only be present at pro-nuclear events but also in those which deal with energy issues in general. Members of parliament and, if possible, journalists should also be provided with information. For this purpose, other United Nations bodies should be incorporated. Thus, in the long run, UNESCO should be incorporated in order to anchor technical progress in the 20th century (including nuclear energy) in the curricula of secondary schools.⁷⁸

Based on these considerations, a list of twelve points for a public acceptance program was created:⁷⁹

1. Fairy tales and facts on Nuclear Energy including description of accidents
2. Publication of positive assessments on Nuclear Energy from outsiders
3. Increased rebuttals in technical literature (New Scientist etc...)

⁷⁶ (Ibid).

⁷⁷ (Ibid).

⁷⁸ (Ibid).

⁷⁹ (Ibid).

4. Increased reviews of reports (Club of Rome...) and Dissemination
5. Full use of UN media system (radio, press releases, UNCSTD, papers supplement)
6. Efforts to launch secondary school teacher's training on energy matters:
 - a. approach to UNESCO
 - b. to governments: Austria, FRG, Sweden
 - c. summer schools training by IAEA
7. Better presentation of Agency's Annual Report
8. Prepare short factual rebuttal to Austrian "NO" arguments and disseminate
9. Increase information on comparative health costs and Env. aspects of Energy sources
 - a. IAEA/UNEP Panel
 - b. 1980 Agency Symposium
 - c. Include WHO
10. Increased participation by Agency staff in the preparation of information on the results of Agency's technical meetings (140 a year)
11. Increased Agency participation in meetings dealing with energy matters in general — and increased participation of environmentalism Agency meetings
12. Planning for future Agency actions on specific subjects (decommissioning)"

From these twelve points, a concrete plan of action was then developed, which was provided with a special budget of USD 87,155.⁸⁰ The Austrian nuclear programme ended thereby with a similar transnational knowledge transfer to the one it began with, and the Austrian experience was evaluated by the IAEA and was made available to its member states.

⁸⁰ (Ibid).

4. Facts & Figures

The purpose of this section is to give an overview of nuclear power in Austria. This section contains such data as number of reactors, reactors' locations, technical and chronological details of reactors' construction as well as statistics on electricity production, periodization and social connections to nuclear constructions. This data can be used as a supportive material to the following sections of the country report and in order to understand the overall country's situation. Key dates and abbreviations used in this report are presented in the beginning of this section.

4.1. Data summary

- Austria projected three commercial nuclear power plants but had only one never operated nuclear power plant at Zwentendorf. The construction of new plants and start-up of the completed Zwentendorf NPP was abandoned in 1978 after a majority voted against nuclear power in a referendum.
- Austria has three small research reactors, two of them being decommissioned, and the other still being operated.

4.2. Key dates and abbreviations

Key dates:

1910	Opening of the Institute for Radium Research as the first Institute of this kind worldwide
1938	Annexation of Austria to Germany
1940s	Austrian physicists became members of the German Uranverein
1943	Merge of the Institute for Physics and parts of Institute for Radium Research into Four-Year-Plan Institute for Neutron Research under the Third Reich
from 1945	Liquidation of Four-Year-Plan Institute for Neutron Research and bring back university research institutions
1953	US-President Eisenhower's Atoms for Peace speech
1955	Austrian national sovereignty and decision to build a research reactor with American support

- 1955** Foundation of Österreichische Studiengesellschaft für Atomenergie
- 1958** Austria gets CERN membership
- 1958** Federal agreement for building and construction of the first research reactor
- 1959-1965s** Three research reactors starts operation (ASTRA, TRIGA and ARGONAUT)
- 1962** The second research reactor went critical (TRIGA)
- 1965** The third reactor went critical (ARGONAUT)
- 1971** Decision to build a nuclear power plant in Zwentendorf
- 1974** A new company established to build a second nuclear power plant
- 1977** International Conference for a Non-Nuclear Future in Salzburg. In the same year – public protests Zwentendorf site and across Austria. Peaceful protests revealed secret fuel imports to the nuclear site and prevented it.
- 1978** Fuel was transported with the help of police and military helicopters to the Zwentendorf nuclear site.
- 1978** Majority of votes on public referendum against nuclear power (little difference). Zwentendorf reactor never started. Socialists' party issued a law that prohibited use of nuclear power for generation of electricity.
- 1979** Three Mile Islands accident. Austrian society realized wisdom of abandoning the nuclear power
- 1994** Study on decommissioning of the first research reactor (ASTRA)
- 1999** Constitutional law abandoning the use of nuclear power in Austria (BGBL 149)
- 1999** Shut down of the first research reactor (ASTRA)
- 2004** Shut down of the third research reactor (ARGONAUT) and decommissioning of the ASTRA reactor

Abbreviations:

- ASTRA** Adaptierter Schwimmbecken-Typ-Reaktor Austria (Adapted swimming pool-type reactor Austria)
- AMF** American Machine and Foundry, Inc.
- BGBL** Das Bundesgesetzblatt, Federal Law Gazette

BWR	Boiling water reactor
CERN	Conseil européen pour la recherche nucléaire
NPP	Nuclear power plant
TRIGA	Training, Research, Isotopes, General Atomics – nuclear research reactors
GKT	Gemeinschaftskraftwerk Tullnerfeld GmbH

4.3. Map of nuclear power plants

Figure 1 presents the map of nuclear reactors in Austria.



Figure 1 – Nuclear power plant and research reactors' locations

Zwentendorf nuclear power plant is located on the Danube River only 60 km North-West from Vienna. TRIGA reactor, the only operating of the three research reactors is located in Vienna, Viennise Prater near the Viennese amusement park. The two other research reactors were located in Seibersdorf, about 40 km from Vienna and in the city of Graz in South-East Austria.

4.4. List of reactors and technical and chronological details

The tables below show a summary of the nuclear research reactors and the only commercial reactor in Austria.

Table 1 - List of reactors in Austria

Name	Use	Operator	Supplier	Type	MWe net
Zwentendorf	commercial	GKT	AEG&Siemens	BWR	700
ASTRA, Seibersdorf	research for planning NPP	Austrian Reactor Centre	AMF	MTR	10
TRIGA	university trainings, education	Atominstitut	General Atomics	Mark II	0.25
Argonaut	university trainings, education	The Reactor Institute Graz	Siemens	Argonaut	0.001

Previously Austrian Reactor Centre is now named Austrian Institute of Technology and the Atominstitut is the Atomic Institute in Vienna. The Reactor Institute Graz was located at the University of Technology, Graz.

Table 2 – Key dates of reactors

Name	First talks	Construction began	Operations started	Shutdown	Decommission
Zwentendorf	earlier 1970	1972	never	1978	
ASTRA, Seibersdorf	1955	1958	1960	1999	2004
TRIGA	1955	1960s	1962		
Argonaut	1955	1960s	1965	2004	2004-2005

4.5. Periodization of nuclear development

The nuclear power development has three periods:

1) 1910 – 1950: radioactivity research, several researchers are female. After the Annexation by Germany 1938, the number of woman in research decreased by half and one fourth of all

researchers lost their jobs. During the war Austrian nuclear physicists worked with German Uranium Club on nuclear fission.

2) 1953 – 1970: After Atoms for Peace speech three research reactors were brought to operation with the aim of developing a nuclear energy program in Austria. The main Austrian political parties – the Socialist Party and People's Party – were both pro-nuclear. The Liberal Party was a small opposition party that had critical views against nuclear power.

3) 1970s – present: Building of the first nuclear power plant and referendum upon using the NPP. Rejection of nuclear energy in Austria.

5. References

There are several papers and books that treat radioactivity research and nuclear physics in Austria before WWII, but only very few publications that address the Austrian nuclear energy program.

1. Literature on Austria before 1950

The most comprehensive work is the book of Silke Fengler (Fengler 2014). She analysed the Austrian research until the end of the 1940s including “denazification” and the reorganization of Austrian research. She edited also proceedings together with Carola Sachse, that give a broader view until the 1970s (Fengler and Sachse 2012). There are several papers by Wolfgang L. Reiter on Stefan Meyer (Reiter 2001c), the Nazi-era (Reiter 2004a; Reiter 2001a; Reiter 2004b), and the reorganization after 1945 (Reiter and Schurawitzki 2005). Maria Rentetzi published on the early period of radioactivity research in Vienna (Rentetzi 2005; Rentetzi 2009; Rentetzi 2004b; Rentetzi 2004a) until 1938.

2. Literature on Austria after 1950

Helmut Lackner (Lackner 2000) was the first, who treated the history from Atoms for Peace to the NPP in Zwentendorf. The most comprehensive work on this topic is my Habilitation (Forstner 2016b), which is currently reviewed and will be published in 2017. Several papers by myself already appeared: (Fengler and Forstner 2008; Forstner 2012b; Forstner 2011b; Forstner 2012a; Forstner 2011a; Forstner 2012c; Forstner 2016a).

There were several master theses at the University of Vienna focusing on one or another aspect of the Austrian nuclear program. Most of them are available through the e-library of Vienna University (Premstaller 1997; Zehetgruber 1994; Schmidt 2007; Martinovsky 2012; Bayer 2013; Bayer 2014).

Bayer, Florian. 2013. “Politische Kultur, Nationale Identität Und Atomenergie. Die Österreichische Kernenergiekontroverse von 1978 Bis 1986 Im Lichte Des Nationalrats.” Universität Wien.

———. 2014. “Die Ablehnung Der Kernenergie in Österreich. Ein Anti-Atom-Konsens Als Errungenschaft Einer Sozialen Bewegung?,” 170–187.

- Fengler, Silke. 2014. *Kerne, Kooperation Und Konkurrenz. Kernforschung in Österreich Im Internationalen Kontext (1900-1950)*. Wien, Köln, Weimar.
- Fengler, Silke, and Christian Forstner. 2008. "Austrian Nuclear Research 1900-1960 - A Research Proposal." *Jahrbuch Für Europäische Wissenschaftskultur* 4: 267–76.
- Fengler, Silke, and Carola Sachse. 2012. *Kernforschung in Österreich: Wandlungen Eines Interdisziplinären Forschungsfeldes 1900-1978*. 1. Auflage. Böhlau Wien.
- Forstner, Christian. 2011a. "From International Cooperation to the Failure of a National Program: The Austrian Case." In *A Comparative Study of European Nuclear Energy Programs*, edited by Albert Presas i Puig, 419:27–50. Preprint Des Max Planck Instituts Für Wissenschaftsgeschichte. Berlin.
- . 2011b. "Nuclear Energy Programs in Austria." *Jahrbuch Für Europäische Wissenschaftskultur* 6: 211–231 (im Druck).
- . 2012a. "Neutronenquellen - Von Atomzertrümmerung Zu Zerstörungsfreier Materialprüfung." In *Zur Geschichte von Forschungstechnologien. Generizität - Interstitialität - Transfer*, edited by Klaus Hentschel, 140–60. Diepholz, Stuttgart, Berlin: GNT-Verlag.
- . 2012b. "Zur Geschichte Der Österreichischen Kernenergieprogramme." In *Kernforschung in Österreich: Wandlungen Eines Interdisziplinären Forschungsfeldes 1900-1978*, edited by Silke Fengler and Carola Sachse, 159–80. Wien, Köln, Weimar: Böhlau.
- . 2012c. "Zur Geschichte Der Österreichischen Kernenergieprogramme." In *Kernforschung in Österreich. Wandlungen Eines Interdisziplinären Forschungsfeldes 1900-1978*, edited by Silke Fengler and Carola Sachse, 159–182. Wien.
- . 2016a. "Kernspaltung, Kalter Krieg Und Österreichs Neutralität." In *Österreich Im Kalten Krieg. Neue Forschungen Im Internationalen Kontext*, edited by Maximilian Graf and Agnes Meisinger, 73–96. Göttingen.
- . 2016b. "(Un-)Kontrollierbare Kettenreaktion? Kernphysikalische Wissensströme Und Nukleartechnik Im 20. Jahrhundert." Habilitation, Jena: Friedrich-Schiller-Universität.
- Geden, Oliver. 1996. *Rechte Ökologie. Umweltschutz Zwischen Emanzipation Und Faschismus*. Berlin.
- Hertel, Gerhard. 1998. *Die DVU – Gefahr von Rechtsauß Sen*. München.
- Hewlett, Richard G., and Jack M. Holl. 1989. *Atoms for Peace and War, 1953-1961: Eisenhower and the Atomic Energy Commission*. Berkeley and Los Angeles.
- Karlik, Berta. 1950. "1938-1950." In *Festschrift Des Institutes Für Radiumforschung Anlässlich Seines 40jährigen Bestandes (1910–1950)*, 35–41. Wien.
- Kremenak, Berta. 1948. "Zur Frage Der Genauigkeit Der Radiumstandardpräparate (12. Dez. 1947)." *Acta Physica Austriaca* 2: 299–311.
- Krige, John. 2006. *American Hegemony and the Postwar Reconstruction of Science in Europe*. Cambridge, MA: MIT.

- . 2008. "The Peaceful Atom as Political Weapon: Euratom and American Foreign Policy in the Late 1950s." *Historical Studies in the Natural Sciences* 38: 5–44.
- . 2010. "Building the Arsenal of Knowledge." *Centaurus* 52: 280–96.
- Lackner, Helmut. 2000. "Von Seibersdorf Bis Zwentendorf. Die „friedliche Nutzung Der Atomenergie“ Als Leitbild Der Energiepolitik in Österreich." *Blätter Für Technikgeschichte* 62: 201–26.
- Lintner, Karl. 1949. "Wechselwirkung Schneller Neutronen Mit Den Schwersten Stablen Kernen (Hg, Tl, Bi Und Pb)." Habilitation, Wien: Universität Wien.
- Martinovsky, Julia. 2012. "Repräsentative Demokratie in Österreich Am Beispiel Der Volksabstimmung Über Das Kernkraftwerk Zwentendorf." Universität Wien.
- Meyer, Stefan. 1945. "Über Die Radium-Standard-Präparate (29. Nov./13. Dez. 1945)." *Anzeiger Der Österreichischen Akademie Der Wissenschaften, Math.-Naturwiss. Klasse*, 82: 25–30.
- Müller, Peter. 1977. *Atome, Zellen, Isotope: Die Seibersdorf-Story*. Jugend & Volk.
- Premstaller, Florian. 1997. "Kernenergiepolitik in Österreich Während Der Ära Bruno Kreisky." Diplomarbeit, Universität Wien.
- Regler, Fritz. 1949. "Die Atomforschung Und Ihre Nutzenanwendung in Österreich." *Die Industrie* 2: 49.
- Reiter, Wolfgang L. 2001a. "Die Vertreibung Der Jüdischen Intelligenz: Verdopplung Des Verlustes - 1938/1945." *Internationale Mathematische Nachrichten* 187: 1–20.
- . 2001b. "Stefan Meyer. Pioneer of Radioactivity" 3: 106–127.
- . 2001c. "Stefan Meyer: Pioneer of Radioactivity." *Physics in Perspective* 3: 106–27.
- . 2004a. "Das Jahr 1938 Und Seine Folgen Für Die Naturwissenschaften an Österreichs Universitäten." In *Vertriebene Vernunft*, edited by Friedrich Stadler, II:664–80. Münster.
- . 2004b. "Österreichische Wissenschaftsemigration Am Beispiel Des Instituts Für Radiumforschung Der Österreichischen Akademie Für Wissenschaften." In *Vertriebene Vernunft*, edited by Friedrich Stadler, II:709–29. Münster.
- Reiter, Wolfgang L., and Reinhard Schurawitzki. 2005. "Über Brüche Hinweg Kontinuität. Physik Und Chemie an Der Universität Wien Nach 1945 - Eine Erste Annäherung." In *Zukunft Mit Altlasten: Die Universität Wien 1945-1955*, edited by Margarete Grandner, Gernot Heiss, and Oliver Rathkolb, 236–59. Wien.
- Rentetzi, Maria. 2004a. "Gender, Politics, and Radioactivity Research in Interwar Vienna: The Case of the Institute for Radium Research." *ISIS* 95: 359–93.
- . 2004b. "The City as a Context for Scientific Activity: Creating the Mediziner-Viertel in Fin-de-Siècle Vienna." *Endeavour* 28 (1): 39–44.

———. 2005. "Designing (for) a New Scientific Discipline: The Location and Architecture of the Institut Für Radiumforschung in Early Twentieth-Century Vienna." *British Journal for the History of Science* 38: 275–306.

———. 2009. *Trafficking Materials and Gendered. Research Practices: Radium Research in Early 20th Century Vienna*. New York.

Schaller, Christian. 1997. "Die Österreichische Kernenergiekontroverse: Meinungsbildungs- Und Entscheidungsfindungsprozesse Mit Besonderer Berücksichtigung Der Auseinandersetzung Um Das Kernkraftwerk Zwentendorf Bis 1981. 2 Bde." Dissertation, Universität Salzburg.

Schmidt, Katharina. 2007. "Die Kernenergie-Debatte in Österreich. Analyse Der Politischen Auseinandersetzungen von Zwentendorf Über Tschernobyl Bis Heute." Universität Wien.

Schwab, Günther. 1968. *Morgen Holt Dich Der Teufel. Neues, Verschwiegenges Und Verbotenes von Der \glqq Friedlichen\grqq Atomkernspaltung*. Salzburg.

Straubinger, Johannes. 2009. *Die Ökologisierung Des Denkens*. Salzburg.

Walker, Mark. 1989. *German National Socialism and the Quest for Nuclear Power, 1939-1949*. Cambridge.

———. 2007. "Eine Waffenschmiede? Kernwaffen- Und Reaktorforschung Am Kaiser-Wilhelm-Institut Für Physik." In *Gemeinschaftsforschung, Bevollmächtigte Und Der Wissenstransfer. Die Rolle Der Kaiser-Wilhelm-Gesellschaft Im System Kriegsrelevanter Forschung Des Nationalsozialismus*, edited by Helmut Maier, 352–394. Göttingen.

Zehetgruber, Andrea. 1994. "Die Geschichte Des Kernkraftwerkes Zwentendorf von Der Planung Bis Ins Jahr 1994." Diplomarbeit, Universität Wien.