Splitting the atom: nuclear nationalism in Argentina and Brazil

Isabella Alcañiz

In 1991 Argentina and Brazil put past rivalries aside and created a binational agency endowed with supranational powers with the task of accounting for and controlling the peaceful nature of all nuclear material in both territories. While the speedy process towards nuclear regional integration had begun only six years before, the historical origin of such a remarkable agreement is to be found in the early developments of the two countries’ nuclear programs in the 1950s. Under the aegis of the developmentalist state and a nationalist ideology, Argentine and Brazilian physicists, military and bureaucrats embarked on the project of creating a nuclear energy sector; in time Argentina and Brazil would end up with the two most developed programs in Latin America. Key to their success was the ideology that rose from the endeavor, “nuclear nationalism”, which would guide the technological choices oriented towards greater development of local know-how and lesser dependence on foreign exports. Despite the many similarities between the two nuclear programs, Argentines and Brazilians traveled two different paths towards regional nuclear integration. The development of the nuclear sector in Argentina was much more coherent and consensual than its counterpart in Brazil, where decentralization and disagreement were the norm. This paper offers a historical comparison between the two nuclear programs and shows why the ideological correspondence between Argentina and Brazil’s community of nuclear experts was stronger than the sectoral divergences, and proved crucial in forging –almost four decades after the beginning of the programs- a regional partnership.

Nuclear Nationalism

After World War II, at the onset of the Cold War, the world entered into the nuclear era. Led by the United States, and quickly followed by the Soviet Union, France and the UK, nuclear energy development was perceived as the new threshold for technologically advanced countries. Argentina and Brazil, both countries with high ambitions reflected in the prevailing popular expressions of Argentina Potencia and Brazil Potencia, aspired to separately join the nuclear club. For these two countries, the project of becoming a nuclear state was as much a political and ideological endeavor, as it was technological. Given the history of their industrial and energy development, it was only natural that the ideological formulations of a nuclear undertaking would borrow from their recent past ideas and values that shaped their path towards early industrialization. The doctrines of Peronism in Argentina and Getulio Vargas’ Novo Estado in Brazil were in a way an ideological backdrop of nuclear development.

Thus, from the very beginning nuclear planning in the two countries was determined by certain ideas and tenets that together conformed a system of beliefs that this article calls “nuclear nationalism.” The concept is borrowed from the historian Carl Solberg who in retelling the history of oil development in Argentina coins the term oil nationalism. The similarities between the creation of the two sectors, petroleum and nuclear energy, attest to the consensus on the importance of the role of the state in leading economic development. In particular in the case of Argentina the creation of its state-owned oil company (Yacimientos Petrolíferos Fiscales or YPF) in 1907 and the creation of the National Commission of Nuclear Energy (CNEA) almost 50 years later show how throughout the twentieth

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1 The Argentine-Brazilian Agency for Accounting and Control of Nuclear Materials.
2 The Nuclear or London Club grouped international nuclear suppliers. Led by the US, this sort of nuclear cartel defined the conditions for transfer of technology in the field. It assembled nuclear countries (states with atomic weapons, such as the USSR, France and UK) and other nations with advanced nuclear technology like Japan, Canada, W. Germany and Australia.
3 Solberg 1979.
century Argentine statesmen took upon themselves the task of leading economic development while controlling energetic resources central for industrialization and modernization.

In this way, nuclear nationalism can be understood as one particular manifestation of the set of ideas and beliefs that shaped industrial development in Argentina and Brazil from the 1950s onward. Characterized by the specific traits and capabilities of the sector, nuclear nationalism takes a somewhat different form from oil nationalism. One chief distinction is that developmentalists, in addition to nationalists, influenced the nuclear sector. While both advocated ISI policies to lessen the dependence on foreign markets, the former did not oppose foreign investment as the latter, which privileged national industrialists. While the strategic quality of nuclear energy brew nationalism and protectionism, the inescapable reality for Argentina and Brazil was that in order to create and advance a nuclear program, technology and know-how had to be imported from the few countries that controlled them. In the very beginning, this was facilitated by US president Eisenhower’s Atoms for Peace program that in 1953 lifted the prohibition to cooperate with other countries in the nuclear field for peaceful ends. But after the 1974 nuclear explosion conducted by India the terms of nuclear exchange dictated by the US, and internationalized through the Non-Proliferation Treaty (1968), hardened. If we understand nationalism “as an answer to an external challenge” it appears clear that the tensions in the nuclear sector between foreign and domestic involvement tended to resolve themselves in favor of the latter.

Keeping in mind the differences between the Argentine and Brazilian experiences since the early 1950s and the tension between nationalist and developmentalist influences, we can concoct a definition for nuclear nationalism as an “ideal type”. Its central tenant is that nuclear energy, in both its energy and potential strategic uses should be under state control. If not all nuclear ventures, at least planning, design and the exploration of its strategic uses were understood strictly as state competence. Several reasons explain the state’s claim over nuclear energy in Argentina and Brazil. The sensitive nature of nuclear technology was one, and in this sense the state appears as the guardian of the program’s industrial secrets. Related to this, the ambition of nuclear state monopoly was also a defense against foreign interference. But autonomy, the principle of action for nuclear experts on both sides of the border, was not only due to security issues, but also to operative ones. International meddling (through exports conditioning and safeguards) was perceived as a major hindrance to advancing the programs. Autonomy was demanded in name of nuclear sovereignty, which was equated with the nation’s sovereignty itself.

The final element of our definition is centralization, which responded to the operative rationale of state monopoly. Centralization would help ensure the coherence and consistency of nuclear development. It would permit the insertion of the sector into the general industrialization scheme of the country, contributing to the modernization endeavor. For while nuclear experts tried to acquire greater insulation from political and societal forces, the developmentalists in the sector worked towards final integration into the industrial energetic complex of the country. Centralization, however, was not achieved in the Brazilian nuclear sector. Different state groups, in particular the different branches of the military and security groups were able to co-opt at times the direction of the program. In contrast, Argentine nuclear professionals maintained the sector under central control for several decades, and credited successes and advances to precisely the degree to which the program was isolated from daily political upheavals and to the centralized control under which it developed.

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4 For a comparison between nationalism and developmentalism see Sikkink 1991, pp. 3-5.
5 Bobbio, Political dictionary, pg. 1082.
6 Interviews with, for Argentina Engineer E. Palacios (August 1997 and April 2000), Dr. J. Coll (July 1997 and December
two nuclear sectors.

**The Argentine Nuclear Sector:**

The first experience with nuclear energy in Argentina was as grandiloquent as it was failed. President Juan Domingo Perón put in front of the newborn nuclear program an Austrian physicist, Ronald Richter, who was to achieve in a period of two years (1950-1952) nuclear fission and build an atomic bomb. The laboratory to accomplish such a feat was installed on the island of Huemul located off the Southern Andean city of Bariloche. Perón had not waited for any experiments to be conducted before he announced to the world that Argentina would become a nuclear power. The alleged program was so questionable that a CIA report for the US government stated “the possibility of a hoax cannot be discarded” while noting that the announcement was “obviously timed to have the maximum political effect at the opening of the Conference of Western Hemisphere Foreign Ministers.”

Argentina going nuclear in record time and using no proven technology was indeed a big hoax. Surprisingly president Perón learned from this embarrassing experience and approached the development of nuclear energy in a very different way.

Two conclusions were drawn from the Richter fiasco. First, that the development of local human resources was key to any sustained development project, even if technology had to be acquired from the more advanced states. For that matter the incipient National Commission of Atomic Energy – CNEA- (at that time, a national division), created the Bariloche Institute of Physics (latter renamed Balseiro in honor of its founder) where the first courses of nuclear physics were dictated. The purpose of this institution was to form a small and select national community of nuclear professionals. It was modeled on the American college system, where students lived on campus and took part of the academic community with their professors. The reputation of the Balseiro was such that students from various Latin American countries strove to be admitted. Later on other related schools were added, such as nuclear engineering in 1977.

The location of the institute, in the remote Andean province of Neuquén, obeyed in part to the second lesson learned. Nuclear science had to be separated from the political ups-and-downs of the nation. The isolated location chosen for the Balseiro corresponded to the desire to insulate the nuclear program from political co-option. The CNEA was from its outset an exception to the bureaucratic rule in Argentina, where state institutions were commonly manipulated and co-opted by shifting political factions in office. Under the Perón Administration it was the only state institution that did not require affiliation to the Peronist (*justicialista*) party. Later and throughout the turbulent years of Argentine politics, while civil governments were regularly removed before their legal mandate was over and political persecution was the norm within the state, the CNEA remained remarkably stable and insulated.

Insulation was not the only defining characteristic of the Argentine nuclear program. Centralization

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7 CIA/ST 109-51 “Argentine Atomic Energy Activities” March 27 1951  
9 To exemplify the stability within the sector, one of the most influential presidents of CNEA, Admiral Quihillalt, held his position for 17 years (1955-1973), throughout which the country suffered 2 coup d’etate and had more than 6 different governments.
was also crucial. The CNEA concentrated the three main activities of nuclear development: research, construction and maintenance of nuclear power plants and reactors, and safety.\textsuperscript{10} Centralized decision making in the CNEA is credited as the basis for a coherent nuclear program, for every choice of technology was decided with regards to the whole plan.\textsuperscript{11} CNEA decided what to export and what to make locally. Even in the first years of experimentation, the criterion was long-term planning.

Once the Richter incident was overcome the CNEA set out its first task of building an experimental nuclear reactor. This coincided with the 1953 Atoms for Peace initiative, when president Eisenhower resolved to share nuclear technology with countries committed to peaceful development of nuclear energy. Industrial secrets were lifted from the American program and technology was exported to countries initiating nuclear investigation. Within this framework Argentina bought the Argonaut, an American-designed experimental reactor of 100KW power. Still, while the blueprints were imported, technicians of CNEA conducted the construction of the reactor as well as its fuel elements. This was unprecedented; countries in such an early stage of nuclear development would normally contract the construction as well.\textsuperscript{12} But CNEA wanted to develop domestic nuclear know-how, so all contracts would stipulate the progressive nationalization of the foreign technology.\textsuperscript{13} “Many people called the decision crazy and irresponsible; but Quihillalt (the president of CNEA at the time) and the guerrillas were not after efficiency; instead, they wanted to learn how to build a reactor by themselves.”\textsuperscript{14} Thus, the Argentine-built RA-1 was inaugurated in 1958 and that same year the CNEA went from importer to exporter: Argentina sold the know-how of the fabrication of fuel elements for Argonaut type reactors to a West German company.\textsuperscript{15} From that point on Argentina designed and built each and every experimental nuclear reactor in the country.\textsuperscript{16}

With the success of the first Argentine-built nuclear reactor the principles of self-reliance, autonomy or anti-dependence, central to nuclear nationalism, became crystallized in CNEA. Just a few years after this first accomplishment, nuclear professionals in Argentina were ready to move to a bigger and more ambitious project. CNEA wanted to contract the construction of a nuclear power plant. Previous to that step, a feasibility study had to be conducted in order to establish location and the articulation of the plant to the existing electric system. Again, the norm was to hire know-how from the more advanced countries to carry out such analysis, but CNEA sent its own technicians to the field. In 1966 CNEA elevated the feasibility report to the executive recommending the potential of the plant (300 to 500 MWe.\textsuperscript{17}), the location (on the Paraná River, just north of the city of Buenos Aires), and the area to service (the capital city, greater Bs As and the immediate northern provinces).

The international bidding for the contract was awarded to the W. German Siemens in 1968 to build a nuclear plant of 313 Mwe powered by natural uranium (Argentina had vast reserves) and heavy water. The choice of this particular type of plant was consistent with the goal of self-reliance. An alternative would have been a central powered by enriched uranium and light water, but this technology (enriched

\textsuperscript{10} In 1994, under President Menem’s administration, the CNEA was left only with research activity. The NASA enterprise was created in order to take over the operation of Argentina’s three nuclear plants and a regulatory agency was created to manage the safety of all nuclear activity in the country.

\textsuperscript{11} Interviews with Dr Emma Perez Ferreira, Captain Roberto Ornstein, Dr. Jorge Coll, Ambassador Julio Carasales.


\textsuperscript{13} Castro Madero & Takacs point out that in order to increase the participation of national industrialists, CNEA created the Assistance Service for Industry (SATI) in charge of aiding related industrial firms to adjust to nuclear technology’s standards. 1991, pg. 53.

\textsuperscript{14} Adler 1987, pp. 296.

\textsuperscript{15} Jorge Coll & Renato Radicella in Carasales & Ornstein 1998.

\textsuperscript{16} Ornstein in Carasales & Ornstein 1998.

\textsuperscript{17} Castro Madero & Takacs 1991.
uranium) had not yet been developed in Argentina. Furthermore, it was under industrial secret and its importation at the time was virtually impossible. National industries were sought out to supply electromecanic components. National participation ended up reaching 40% of the total cost of the Atucha I plant.\textsuperscript{18}

Atucha I was a learning experience for CNEA. The second nuclear power plant to be constructed was Embalse, in the province of Córdoba. This time it was specified, in the international bidding for the contract, that international participation could not be over 50% of the total cost of the enterprise.\textsuperscript{19} An agreement to construct a second nuclear central was reached with the Canadian corporation Atomic Energy Canadian Limited (AECL). The partnership with AECL was awaited with great expectation by CNEA given the Transfer of Technology Agreement that was included in the contract. This agreement contemplated the handing over of the blueprints of the plant (Candu type) and the rights to utilize them in the future at no additional cost. In addition it determined a long-term training schedule of Argentine technicians both in Canada and in Argentina. The agreement with Canada provided for generous transfers of technology and know-how that would have allowed Argentina to advance self-sufficiently in the construction of new nuclear power plants.\textsuperscript{20}

In 1974 the construction of Embalse began. Unfortunately it coincided with India’s first nuclear explosion. Canada had been a steady nuclear provider to India, and the explosion triggered a revision of Canadian nuclear export policy. Consequently, the terms of the Argentine-Canadian agreement were revised and certain technology transfers were suspended. In particular the supply of heavy water, and the technology to fabricate it locally –included in the technology transfer agreement- was suspended. The frustration felt by the Argentine nuclear community with the unfulfilled Canadian agreement confirmed the perception of a “sort of technical-scientific colonialism imposed by the developed powers.”\textsuperscript{21}

The difficulties encountered in technology transfers in the nuclear field made Argentine professionals even more eager to explore and develop national alternatives. That is, CNEA attempted to gradually replace as much foreign know-how and technology in every shared project. For that, CNEA fomented the creation of different companies and institutions devoted to applied research or nuclear supply. CNEA supervised and evaluated if these branches of nuclear activity complied with its standards. In addition to this professional attitude, nuclear experts in Argentina had a very pragmatic approach. “Conscious of the limitations of their environment, the Argentine nuclear sector has developed in general a technology free of superficial sophistication and adapted to the possibilities of production and maintenance of the local industry, which is particularly adequate for the requirements and possibilities of many developing countries that lack the necessary logistics for the operative maintenance of highly sophisticated equipment.”\textsuperscript{22}

In the mid-1970s the terms of nuclear technology transfers were deteriorating to the detriment of developing countries. India’s nuclear explosion send a warning to the nuclear states that they no longer monopolized such destructive technology, and that developing countries with nuclear ambitions were to be controlled. Horizontal proliferation became a significant concern for the US and its allies. The 1967 Non Proliferation Treaty, to which neither Argentina or Brazil had subscribed, became a major condition to nuclear technology transfers. The new Carter administration in the US and the 1978 Non-

\textsuperscript{18} Idem pg. 55.
\textsuperscript{19} Idem pg. 55.
\textsuperscript{20} Idem pg. 56.
\textsuperscript{21} Julio Carasales 1997, pg. 17.
\textsuperscript{22} Carasales & Ornstein 1999, pg. 93.
proliferation Act hardened even more international exchanges in the nuclear field. These international events had important consequences for the Argentine program. Previously signed contracts were revised. As stated above, the Canadian accord for the construction of Embalse had to be renegotiated – also partly due to growing inflation in Argentina that had increased the cost of construction- and its scope curbed. This responded to the declaration of the Canadian government that it would no longer cooperate with non-NPT signers or countries that did not place all nuclear activity under IAEA’s full safeguards. Atucha I was also affected. The German government forced Siemens to condition the continued supply of nuclear fuel to the extension of the safeguards in place at the plant to the complete life span of Atucha I. This modified the previous agreement on safeguards that was close to expiring. 

In 1976 the last and most repressive Argentine dictatorship took over the country. For the military junta in power, nuclear energy became top priority on both the domestic and foreign policy agenda. Financed by increasing foreign debt, public investment multiplied. Benefiting from this, the nuclear sector created new programs and corporations. One of the main ones was INVAP (The Public Co. of Applied Investigations), created in 1976 and belonging to the province of Rio Negro, although CNEA got to name the president, vice-president and two more members of its board of directors. INVAP made nuclear reactors, carried out nuclear installations of all types and also had an aerospace division that manufactured satellites for scientific use. Just a year after INVAP was created, another province-owned (this time Mendoza, the largest producer of uranium) corporation emerged. The public Nuclear Mendoza specialized in mining development for the nuclear industry, purifying and converting uranium. As with INVAP, CNEA designated several members of Nuclear’s board of directors. Another key corporation created under the military regime in 1981 was CONUAR inc. (Argentine Nuclear Fuel Incorporated Company). CNEA had a third of its share, and provided the necessary technology for fuel production. CONUAR produced then nuclear fuel types for the power plants and reactors.

The creation of national companies covering three key areas of nuclear development (mining, fueling and power plants and reactors) was not the only indication that the junta was committed to advancing the sector. The military also developed a “nuclear diplomacy” sending nuclear representatives and diplomats to specific countries and international institutions in order to negotiate directly the conditions of nuclear technology and know-how transfers. At the same time, Argentina was (unwillingly) the recipient of international scrutiny regarding its nuclear activities (as well as its flagrant violations of human rights). Given the international context, CNEA decided to put all efforts in developing the nuclear national industry. As the president of CNEA Vice-admiral Castro Madero declared at the time: “We have greatly experienced what it means to depend on other countries for energy sources and it is for this reason that Argentina has defined a (nuclear) policy inclined to be as self-sufficient as possible as a way of guaranteeing the exercise of its sovereign rights.”

Castro Madero’s nuclear policy was outlined in the 1979 Argentine Nuclear Plan. This ambitious scheme, designed by CNEA, anticipated the construction of four more nuclear power plants, to be inaugurated in the late 1980s and throughout the 1990s. The first and sole one to be started was Atucha II, a nuclear-electric plant of 700 MGW initiated in 1980 by a joint venture between CNEA and the German KWU (a subsidiary of Siemens) to be inaugurated seven years later. The negotiations prior to

28 Atucha II has still to be finished. 800 million dollars have been invested in the project, and another 800 million are needed for termination. Neither the Argentine government nor the nuclear sector can meet the charge. Many advocates for the
the signing of the contract were arduous and reflected the unfavorable international situation towards Argentina. At first CNEA had conceived a tripartite agreement with its two previous partners: the Canadian AECL and the German KWU, where the Canadians would carry out the nuclear engineering, the Germans would front the necessary conventional engineering and the Argentines would be the industrial architect of the central. The participation of AECL was crucial because CNEA wanted another CANDU type reactor and Canada held the monopoly on this technology (Germany used enriched uranium reactors). In addition, Canada was the only importer of heavy water technology, and CNEA planned on constructing such a plant in Argentina. A tripartite cooperative agreement would have also given a boost to CNEA’s interest in venturing into nuclear industrial design. And, given the existing international constraints CNEA wanted “to diversify as much as possible the origin of the supplies to avoid creating an environment that would favor the imposition of political conditions.”

As stated above, the contract for Atucha II ended up going to the Germans. The ambivalence of the Canadian government towards the Argentine dictatorship ended up negatively affecting AECL’s chances of winning the bid. A Swiss company (Sulzer Brothers) won the bid for the heavy water plant. Although CNEA preferred the technology option offered by the Canadians, Ottawa’s denial to pre-approve nuclear cooperation with Argentina, a non-signatory of the NPT, was insurmountable.

Another chief objective of the Argentine nuclear plan was to control the whole cycle of nuclear fuel, which includes uranium mining, fuel fabrication, uranium enrichment, fuel reprocessing and waste disposal. By the late 1970s CNEA had experimented and made many advances on some of the cycle’s phases such as mining, uranium concentration, and fuel elements production for both Atucha I and Embalse (which required different types). But the military-influenced CNEA of the late 1970s had the ambition to investigate more sensitive technologies, dominated at the time by only a handful of countries. The enrichment process was secretly tackled. Until 1978 the US exported enriched uranium to be used in Argentina’s research reactors, but once the Non Proliferation Act was sanctioned the continuance of this supply became contingent on the placement of all nuclear activities in the importing country under full-scope IAEA safeguards.

A few leaders of CNEA decided then to develop an enrichment plant and to keep the project secret. Participating colleagues from the commission were kept in the dark as to the end result. The enrichment process is a necessary step in building a nuclear weapon and international constraints were greater when “sensitive” technology was being developed. Thus, the directors of the project justified the secrecy as a matter of protection from international pressure, which they feared would not let the program advance. The director of the INVAP Dr. Conrado Varotto was also the director of the program that established the construction of the enrichment plant in Pilcaniyeu, Province of Rio Negro. Covertly, the technology was achieved and ready to be used in 1983. This year, a turning point in the history of Argentina, marked the democratic election of president Raul Alfonsin. The announcement of the existence of Pilcaniyeu was scheduled just one month after the presidential elections.

The announcement was a delicate operation of nuclear diplomacy. The president of CNEA explains the measures taken to minimize international criticism: Argentine representatives had been sent to the US and IAEA’s headquarters in Vienna to reveal just a few hours before the official press conference in Buenos Aires what had been achieved in Pilcaniyeu. Simultaneously, a note from the Argentine

completion of Atucha II warn that some of the already paid-for technology is rapidly becoming obsolete before even being used. Interviews with Dr. Jorge Coll and Dr. Ema Perez Ferreira.

30 Idem pg. 198.
The president was delivered to the ambassadors in Buenos Aires of the five nuclear powers (US, UK, France, USSR, and China) assuring of the peaceful intent of the enrichment technology. After the official announcement CNEA would host a meeting with all the Latin American ambassadors, and upon his arrival to the country, the General Director of IAEA would be invited to tour the plant.\(^\text{31}\) The announcement took by surprise many first level directives of CNEA. Alfonsín’s first president of CNEA, Eng. Jorge Consentino, said that he “found out on the radio of a taxi that Admiral Castro Madero announced that Argentina had developed the complete uranium cycle. They worked on it for five years and nobody new.”\(^\text{32}\) International reaction was quite favorable; the change of regime and Alfonsín’s immediate efforts to improve the country’s relations with the international nuclear community lessened the political impact of the announcement. But it appeared clear that given the characteristics of the nuclear industrial complex in Argentina, the enrichment technology was not developed out of necessity, but rather for prestige and perhaps, in the minds of a few security-driven military, for potential strategic reasons.

1983 marked the culmination of the Argentine nuclear program with the achievement of the uranium enrichment technology. This year also signalized the change in the political priorities of the program. From this year forward nuclear nationalism, the ideology that had maintained the program coherent and constant, began to dissipate and new \textit{regional} goals were formulated.

\textbf{The Brazilian Nuclear Sector}

Brazil’s nuclear development differs from the Argentine experience in many ways. While Argentina kept its program centralized under CNEA’s authority, Brazil had a number of nuclear institutions that functioned autonomously and were timidly coordinated by CNEN (National Commission of Nuclear Energy). While CNEA was an autonomous institution depending directly from the presidency, CNEN passed from the executive to the ministry of mining and energy, and was overruled more than once by the Security Council, especially during the 20-year governance of the last military dictatorship. But despite the many differences, Brazil shared with Argentina a similar nuclear “ambition” of autonomous technological development that would give rise to a self-sufficient energy complex that would in turn fuel industrial growth. As Emmanuel Adler states: “The development of a science and technology policy in Brazil is the history of an idea; it started with an image of the future, which filtered through the political power structure and emerged as alternatives for action…There were also ideological and institutional factors –ideas that “burned” in the minds of some people and influenced institutional and political events.”\(^\text{33}\)

Surprisingly for a country where developmentalist and nationalist objectives were so coherently brought forward throughout the state bureaucracy, its nuclear sector was less successful.\(^\text{34}\) But more than comparing the degree of success of Argentina and Brazil’s nuclear programs, this paper proposes the comparison of the goals and ideas that guided the nuclear sector in the two countries. Paraphrasing Adler, what matters is how the goal of “technological autonomy” defined nuclear development, even though “this objective will probably not be achieved.”\(^\text{35}\) Nuclear nationalism in Brazil appeared as a political ideal, almost as an expected standard against which all nuclear decision-making had to be measured. Yet in reality the history of the sector attests to the little agreement on such ideal; moreover, the Brazilian nuclear sector developed through great debates about national protection vs. \textit{entreguismo} (give up).\(^\text{36}\)

\textit{\(^\text{31}\) Castro Madero & Takacs 1991, pg. 87.}\n\textit{\(^\text{32}\) Clarín Newspaper, Buenos Aires August 28, 1986.}\n\textit{\(^\text{33}\) Emmanuel Adler 1987, pg.151.}\n\textit{\(^\text{34}\) Solingen 1996}\n\textit{\(^\text{35}\) Adler 1987 151.}
In contrast to the history of the sector in Argentina, where we can distinguish several different stages of technological development –each of which superseding the previous one- the Brazilian nuclear plan can be roughly defined by two periods. One stage that began with the creation of the program until the 1964 military coup d’etate, and the other from that year forward, with a technological peak in 1975 as a result of the Brazilian-German nuclear cooperation treaty. The first nuclear dealings of the country started in the 1940s with Brazil as an exporter of radioactive minerals for the American nuclear program. Resulting from the alliance between the two countries during the war, Brazil supplied the US of nuclear primary material at more than favorable prices. In the 1950s, once the government of Brazil decided to create a national program the US appeared as a natural nuclear partner. Yet until 1954 the US prohibited international nuclear cooperation. Thus, the first attempts of a Brazilian nuclear program were shaped by the protest of “pioneer” physicists and military to the American lack of cooperation. These nuclear forerunners, led by the exalted Admiral Alvaro Alberto, objected to the submission of valuable radioactive material to the US without compensation in kind. They also denounced American interference in the search for alternative sources of nuclear cooperation. In 1953 the National Research Council (CNPq) had entered negotiations with West Germany to buy an ultracentrifuge reactor for uranium enrichment, and had to desist due to US pressure.36

Analogous to what happened in Argentina, international restrictions shaped the perception of Brazilian nuclear professionals from the onset of the program. “This first struggle for the defense of national raw material and for the import of nuclear equipment and know-how at the beginning of the 1950s contributed to align the nationalist forces around some goals and arguments. Changing according to the circumstances, these goals and arguments would reappear in numerous occasions among the sectors that defended Brazilian autonomous nuclear development.”37 Already in 1951 the executive sanctioned the Law # 1310 creating the CNPq and putting all activities related to nuclear energy under state control.38 In 1956 the CNEN was created with the purpose of advising the Ministry of Mining and Energy in the formulation of nuclear policy, in addition to promoting technical, commercial, and professional activities in the nuclear field.39

The CNEN emerged in a promising international setting resulting from the Atoms for Peace program. Although the commission had close ties with the US nuclear community, it became a mere importer of small research reactors (using enriched uranium imported also from the US) and had little success in promoting the development of human resources. In 1965, almost ten years after its creation it participated in part in the construction of a research reactor in the Institute of Nuclear Engineering in the city of Rio de Janeiro.40 Because of the decentralized nature of the Brazilian program, CNEN “was not effective in mobilizing national scientists and technicians around nuclear technology.”41 “Different research institutions in the field of nuclear physics would follow their own research agendas”42 Unlike their Argentine counterparts, Brazilian nuclear professionals were unable to articulate an integral plan that would advance the sector.

From the late 1950s and well into the mid-1960s Brazilian nuclear physicists debated what choice of

36 Luiz Pinguelli Rosa 1985, pg. 27.
38 Politica National de Energia Nuclear, CNEN document.
39 Ibid
40 Pinguelli Rosa 1985, pg. 28.
41 Ibid
42 Wrobel pg. 16.
technology would best fit the energy needs of the country and would also meet the goals of the incipient nuclear program. Some of the most important nuclear professionals “defended a nationalist nuclear policy” which was equal to proposing the natural uranium option for reactors and future power plants. This technology option would allow local experts to participate more actively, and gradually take over foreign partnership. In 1964 the military took over the government to remain in power until 1985. Brazilian critics argue that this regime made certain choices that moved the nuclear program away from its quest of autonomous development. As Pingueilli states “the official nationalist discourse is maintained in the nuclear sector. But in the meanwhile, the facts were in opposition.”

In 1968 the government of Costa da Silva decided the construction of a nuclear power plant to supply the energy needs in the Rio de Janeiro area (South-East Brazil). The state-owned electric company (Electrobrás) together with CNEN delegated in Furnas (Empresa Centrais Electricas Sociedad Anónima del Brasil) the call for an international bidding to construct a 600MW nuclear central. With the decision of purchasing a nuclear plant without any additional transfer of technology, the development of domestic technology and know-how was abandoned. Furthermore, the contract went to the American Westinghouse for a plant of enriched uranium and light water. Brazilians who had advocated the natural uranium-heavy water option felt that the goal of autonomy had been given up. CNEN, who made the technical decision, was blamed for caving in to the military government’s interest in trading with the US. And the decision to go with the American contractor proved problematic. Just a year after the construction of Angra I began in 1972, the US suspended the guarantee of supplying enriched uranium, the required fuel for the plant, as a result of the 1973 energy crisis. When the following year India exploded its first atomic weapon, US transfers of sensitive nuclear technology recanted even more.

Despite Angra I being Brazil’s only working nuclear central since 1985, some see the decision of its construction as the first of a series of bad technological choices. For Pingueilli, the contract with Westinghouse “is the key to all subsequent developments of Brazilian policy in the nuclear field that drove the country to depend on US fuel, situation it tried to escape by buying German technology that included a process of uranium enrichment that had not yet been tested at the industrial scale.”

The Brazilian military government understood that the country needed more nuclear centrals to meet its energy requirements, fuel industrialization and replace petroleum, which was considered a more expensive and volatile –in terms of foreign dependence- energy source. The 1970s were a period of heavy foreign and public investment (as well as heavy foreign lending) and Brazil was being heralded an economic miracle. In 1975, under the rule of Ernesto Geisel, Brazil signed a treaty with the government of West Germany. The agreement established integral nuclear cooperation between the German KWU (a subsidiary of the Siemens company) and the Brazilian nuclear sector. In contrast to the contract for Angra I, the Brazilian-German accord established the transfer of technology, including enrichment processing, in addition to the purchase of several nuclear plants.

The agreement established three levels of cooperation, between governments, ministries and nuclear companies. On the Brazilian side, Nuclebrás was in charge of carrying out the joint venture with KWU to construct eight nuclear power plants in a period of 15 years. From the association between Nuclebrás and KWU three new binational companies were created. Nuclen was in charge of reactor engineering; Nuclep was to manufacture and commercialize heavy components for nuclear reactors; and Nucon was

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43 Pingueilli Rosa 1985, pg. 29.
44 Ibid pg. 30.
to build nuclear reactors and sell them in concession.\textsuperscript{46} Germany was committed to aiding in the development of Brazilian human resources and to transferring technology involving the complete nuclear fuel cycle from uranium conversion to fuel reprocessing.\textsuperscript{47} The agreement was secretly negotiated and announced after its signature; the reactions to it were resounding.

Domestically, criticisms focused on three technical aspects of the agreement. First, there was the matter of the number of plants stipulated in the treaty. The Brazilian government was criticized for exaggerating the energy needs of the country, which led to the monumental contract for eight nuclear plants. The cost of this purchase initially rounded 10 billion dollars; the military government argued that purchasing in number cheapened the final price. Still, eight plants sounded excessive and the viability of the project was put into question. The critics were proven right. To this day the Brazilian-German joint venture has constructed only two plants (Angra II and III) which are still inoperative; Angra II became critical in 2000 and Angra III is only 40\% constructed. The inauguration of the plants was to be in 1983 and 1984 respectively, but the economic crisis and the massive investment required basically paralyzed the works for more almost three decades.

Furthermore, many nuclear scientists who had not been consulted during the negotiation phase condemned persisting with the enrichment uranium technology for the power plants. Critics felt that this technological choice set up the country for continued reliance on a foreign nuclear country (in this case Germany) to power Brazilian reactors and centrals. Allegedly, Germany’s transfer of enrichment technology –contemplated in the agreement- would overcome this problem, yet this aspect of the deal raised the most objections. During the negotiations Germany had agreed to deliver the enrichment process by ultracentrifuge but other European states, partners of Germany, vetoed the transference of that technology. Thus, Brazil ended up receiving an enrichment technology of jet-nozzle that had not yet been proven in the market, and this experimental method never worked for the Brazilian nuclear industry.\textsuperscript{48}

The US also opposed the Brazilian–German agreement. The United States viewed with great concern the fulfillment of a treaty that contemplated the transfer of enrichment technology to a non-member of the NPT like Brazil. For the Carter Administration, Brazil’s interest in enrichment technology was further proof of a potential arms race in South America. Thus in 1977 Vice-president Walter Mondale was sent to West Germany in order to request this country to suspend its collaboration with Brazil.\textsuperscript{49} US pressure did not manage to stop the agreement, but it did have two important consequences. On the one hand, it forced tougher and sweeping safeguards and guarantees around the treaty, contributing to Germany’s decision to revoke the transfer of the ultracentrifuge enrichment process.\textsuperscript{50} On the other hand, US opposition had the effect of uniting most feuding factions within the Brazilian nuclear sector. “The defense of the agreement, in the name of nationalism and against American pressure, involved politicians of the government and the opposition, and even the same scientists who had criticized the agreement. Defending the agreement against foreign pressure ended up assuming more an ideological character of defense of national interests than a defense of a program considered viable and well

\textsuperscript{46} CNEN internal document.
\textsuperscript{47} Wrobel and Pingelli 1985.
\textsuperscript{48} Pinguelli 1985 and Wrobel-CNEN
\textsuperscript{49} Clarín February 10 1977.
\textsuperscript{50} In the end, Brazil attained the enrichment process more than a decade latter and using the gaseous diffusion method instead. The German-Brazilian cooperation upset is held as emblematic of how detrimental US political interference (either direct or indirect) can be regarding technology and development in the periphery. Interviews with representatives of CNEA, CNEN, Argentine Foreign Ministry and Itamaraty. Also, see Adler 1987 and Carasales 1997.
conceived.” Brazilians were outraged and “nuclear nationalism, always present in Brazil, emerged powerful in the defense of an act that was interpreted as representing simply and plainly the exercise of national sovereignty.”

The deficiencies of the cooperation with Germany and a tougher attitude on behalf of the American government made the Brazilian military under Figueiredo authorize the creation of another nuclear program, called autonomous or parallel. The Brazilian navy led this program, which was autonomous from international control, contrary to all activities covered by the German-Brazilian agreement, which were placed under IAEA full-scope safeguards. The official objective of the parallel program was to develop nationally what was not being served by the Germans, that is the dominion of the complete fuel cycle, but the real pet project of the autonomistas was the development of a nuclear submarine. The autonomous program revealed the disarray of the Brazilian nuclear sector and the lack of a central decision-making authority (such as CNEA in Argentina) that could guide nuclear professionals towards their set goals of autonomous development and growth. Nuclear nationalism, a perspective shared by all, was not enough to bring consensus on decisions that forged the sector.

After democratization in 1985, the official and autonomous programs were integrated. The civil government in Brazil did much to demilitarize the sector’s objectives, but 20 years of military rule were not easily erased. On August 9, 1986 the Folha de Sao Paulo, one of Brazil’s most important newspapers, denounced the “discovery” of vertical perforations made by the Air Force of up to 320 meters deep similar to the ones used in nuclear explosion tests. Yet the more security-driven sectors of the Brazilian nuclear sector could no longer hide behind nationalist exhalations, the political situation of Brazil had changed and the Non-Proliferation Regime was also becoming a stronger constraint for “autonomous” action. Democratic and indebted Brazil could no longer sustain nuclear nationalism in an increasingly interconnected world. Political sanctions in the nuclear field could entail economic sanctions. The last section of this article explains how nuclear nationalism in Argentina and Brazil was regionalized, and the once uncontested nuclear sovereignty mutated into regional sovereignty.

Nuclear Integration in the Southern Cone: The Role of a Bilateral Epistemic Community

Between the years of 1985 and 1991 Argentina and Brazil went from being under international suspicion, as parties to a potential nuclear arms race in South America, to becoming partners of nuclear integration to such a degree that all nuclear facilities in the two countries were put under the control of a common bilateral safeguard authority. Integration in the nuclear sector mainly involved complementing Argentine-Brazilian nuclear industries under free trade conditions, defining a common foreign policy for international nuclear organizations (i.e.: IAEA, NPR and OPANAL) and implementing a bilateral system of control and accounting on all nuclear materials in both territories. How did this extraordinary change occur? Why was a “regional answer” to Argentina and Brazil’s nuclear problem so successful while other shared problems, such as the foreign debt or agricultural politics under the GATT, never found the same common responsiveness? The answer to these

51 Wrobel-CNEN pg. 18.
52 Carasales 1997, pg. 25.
53 Interview with Captain O. Peixoto, Rio de Janeiro, April 2000.
55 The UN International Atomic Energy Agency, the Non-Proliferation Regime (administrator of the 1968 Non-Proliferation Treaty –NPT) and the Organism for the Proscription of Nuclear Weapons in Latin America- OPANAL (administrator of the 1967 Tlatelolco Treaty).
questions lie in the role of a bilateral nuclear epistemic community with shared ideological and political beliefs, whose existence was prior to the first official agreements in 1985. Furthermore, once the leadership of Argentina and Brazil commenced a cooperation process in the nuclear area, this epistemic community became institutionalized, thus functioning as the agent of integration, strengthening the process and helping it move forward.

In 1985 Argentina and Brazil transferred part of the autonomy of their nuclear programs to common institutions. Integration was conducted at two different levels, state coordination and technical and commercial activity between Argentine and Brazilian enterprises organized through CNEA and CNEN. The former involved various issues, from nuclear safety to a common position regarding the Tlatelolco and Non-Proliferation treaties. The latter went from a never crystallized project of joint collaboration in the construction of Atucha II and Angra II to bilateral exchanges of fuel elements and reactor technology.

Regional integration came as a response to conflicting economic and political demands from international and domestic actors. The debt crisis of the early 1980s forced program reductions and budget cuts in the Argentine and Brazilian nuclear sectors, as on all state programs in general. Democratization made the leaders of the two countries more accountable to international nuclear norms and regulations. The financial emergency and the new political situation pressed presidents Alfonsín and Sarney to review past nuclear foreign policies which had contributed to submerge Argentina and Brazil in diplomatic isolation.

Facing a common nuclear problem the leaders of Argentina and Brazil with their foreign ministries and nuclear sectors worked together towards a regional solution. Throughout the process two groups were formed in order to advance integration. The first Joint Declaration on Nuclear Policy of Iguazú, signed by presidents Alfonsín and Sarney in 1985 created a task group (grupo de trabajo) chaired by both foreign ministries and formed by nuclear experts from the two commissions and nuclear industries. Three years later the group was renamed the Permanent Committee and was in charge of “setting and coordinating all initiatives in the political, technical and business areas of the nuclear sector.” The second institutional actor gathered Argentine and Brazilian industrialists, who worked as a sort of binational lobby, advocating for greater commercial integration throughout the bilateral negotiations. These two groups, in charge of carrying out nuclear integration, represented the institutionalization of a preexisting bilateral epistemic community.

Alfonsín, Sarney, and the foreign ministries favored political coordination that would show that their countries were not diverting nuclear material for non-peaceful ends. The objective was to improve political relations with the US and its western allies and refinance their foreign debt. In order to do this they set about revising nuclear bilateral relations and establishing trust between the two states that would show the international nuclear community the transparency and openness in their bilateral nuclear dealings. In this line, the presidents held high profile meeting at previously covert nuclear locations (such as the Argentine enrichment plant Pilcaniyeu). This carried great political weight for the invitations were to facilities that were not under IAEA full-scope safeguards. In addition a series of presidential Joint Declarations were signed, establishing the goals and foundations of integration.

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56 Epistemic communities have been defined as a community of professionals with shared principled and causal beliefs, common notions of validity and a common policy enterprise. Peter Haas, ed., Knowledge, Power and International Policy Coordination, special issue, *International Organization* 46 (Winter 1992).

57 This paper argues the existence of a bilateral epistemic community mainly formed by representatives of the Argentine and Brazilian nuclear sectors, and a few diplomats with experience in nuclear foreign policy.

58 Declaración de Iperó
On the other hand, representatives of both nuclear sectors were more concerned with technical cooperation. Their preferences were clearly oriented towards finding common solutions to the financial crisis that afflicted the sector and furthering the nuclear programs. One top priority shared by the CNEA, CNEN and nuclear industrialist (both private and public companies) was to finish the nuclear power plants Atucha II (Argentina) and Angra II (Brazil). For them, integration was a viable alternative to seeking sources of technology, know-how and financing from the not always receptive central nuclear countries. Professionals on both sides of the border believed in complementing their industries in order to reap economic rather than political benefits. Yet they understood that in order to advance on industrial cooperation they needed their governments to first crystallize a political agreement that would serve as an institutional framework for future commercial exchanges, in addition to improving general international conditions of nuclear transfers from the North to the South.

Political integration advanced swiftly. In 1990 the new civil leaders of Argentina and Brazil met again in the city of Foz de Iguazú and produced a Joint Declaration even more groundbreaking than its predecessor of 1985. In this document, presidents Menem and Collor de Melo approved the Common System of Accounting and Control of Nuclear Materials (SCCC) which had been concluded by the Permanent Committee. The SCCC was “the set of criteria and procedures applicable to all nuclear materials of all nuclear activities carried out in the territories of the signatory nations, in order to detect opportunely and with a reasonable degree of certainty any diversion of significant quantities of nuclear material for unauthorized uses as established in the Bilateral Agreement.”\(^59\) The declaration provided for the first mutual inspections and the immediate exchange of lists describing all nuclear facilities together with their respective inventories. In addition, negotiations would begin with the IAEA in order to set forth an agreement, with the SCCC as a basis for the treaty. Finally, the presidents stipulated that once the safeguard agreement with the IAEA was concluded, Argentina and Brazil would together ratify the Treaty of Tlatelolco.\(^60\)

Only a few months later the Bilateral Agreement was signed in Mexico, institutionalizing the resolutions of the joint declaration. An Argentine-Brazilian agency (ABACC) was created in order to administer and implement the common system. This legal entity had the power to designate, carry out and evaluate inspections, represent Argentina and Brazil before third parties regarding the SCCC, and sign international agreements with authorization of the parts.\(^61\) This last capacity was put into practice only a few months later when the ABACC became party to a safeguard agreement signed with Argentina, Brazil and the IAEA. The Quadripartite Agreement, as it was known, was based on the SCCC and the presence of IAEA came to guarantee a sort of international auditing of the Bilateral Agreement.\(^62\) A few years later, in 1994, Argentina and Brazil ratified the Quadripartite Agreement and the Tlatelolco Treaty. Adhesion to the NPT would be in 1995 for Argentina, and 1998 for Brazil.

In conclusion, in only six years Argentina and Brazil unified their system of control, verification and accountability of the uses of nuclear material. In that short period of time a regional system of safeguards was instated, and connected to international standards of control through the auspices of the IAEA. Nuclear industrial integration lagged behind political integration, yet common interests and needs were identified and to some extent, met. The issue of financing, a common problem of the whole industrial-energy apparatus, remained the key obstacle to further integration. The nuclear sectors of

\(^{59}\) The SCCC in the ABACC Bulletin.

\(^{60}\) Declaración sobre Política Nuclear Común Argentino-Brasileña in Carasales 1997.


\(^{62}\) Carasales and Ornstein 1998.
Argentina and Brazil, especially through the actions of the CEABAN, conceived alternative options to outside funding, such as a “compensated exchange” regime by which services rendered by one country would be paid in kind by the other. Still, this system of bartering was not effective in finishing the constructions of Atucha II and Angra II/III due to the massive financing required for such projects.

Shared normative and political beliefs brought the members of the two nuclear sectors together and allowed for regional integration. The two nuclear commissions were created under the conviction that sovereign states had the right to develop nuclear energy free of international supervision. From the beginning the two countries rejected the attempts made by the nuclear powers to regulate and condition transfers of technology to non-nuclear countries. In the late 1960s these regulations were crystallized in international treaties that curtailed the right of non-nuclear countries to explore nuclear energy options without international supervision. Argentina and Brazil together denounced these agreements, in particular the American sponsored NPT, as discriminatory and unfair and refused to sign. They claimed that with the pretext of proliferation this treaty was affecting their right to develop nuclear energy for peaceful ends, while the countries doing the real proliferation, such as the United States, were not affected. This anti-NPT sentiment became official nuclear policy in both countries. A public statement from the Brazilian Foreign ministry (Itamaraty) declares: “The NPT is not a strategic or military issue for Brazil. It is, rather, a matter of principle. Were Brazil to accede to the NPT, it would have no substantial effect in terms of non-proliferation. It would amount to formal acknowledgement of the status of the five nuclear-armed powers and acceptance of an international order founded on the imbalance of rights and duties among States. Brazil recognizes the status of the five nuclear powers as a temporary fact of international life, not as a right to which these powers are entitled for all time”.

In their common stand against international interference, Argentine and Brazilian nuclear professionals had discovered each other as potential alternative partners.

Conclusion

This paper explains the history of the nuclear sector in Argentina and Brazil in regards to the political and ideological beliefs of its members. Nationalists and developmentalists negotiated the goals and decisions that forged nuclear development in the Southern Cone. Despite the differences between the two programs, Argentine and Brazilian nuclear professionals shared certain goals and beliefs that can be defined as nuclear nationalism. This political formulation stressed the importance of state leadership, autonomous development, central decision-making and insulation from political manipulations. Nuclear nationalism appeared almost as a standard against which the successes of the programs were measured. In this respect the comparison of the two countries shows the importance of achieving political insulation not only from outside manipulation, but also from the appropriation of other state-groups.

Nationalist and developmentalist ideas shaped the emergence of a nuclear community in Argentina and Brazil. Similar obstacles, such as international constraints imposed on technology transfers, and similar responses to them, such like refusing to sign the NPT, put Argentines and Brazilians in the same camp. Despite a long history of regional rivalry, the two countries came together –once democratic governments were elected- to seek a common solution to their nuclear problem. Nuclear integration, an immediate antecedent to the Mercosur, emerged as a response to the financial and political demands from the US and its Western allies, in the form of NPR members as well as international creditors of Argentina and Brazil. The pre-existence of a nuclear bilateral epistemic community, with shared ideals

63 This sentiment is best expressed in the book by Argentine Ambassador Julio Carasales “El Desarme de los Desarmados”.
64 Itamaraty statement – Brazilian Foreign Policy, January 26, 1997.
and beliefs, made the partnership a natural one and allowed the once sacred nuclear sovereignty to mutate into a however incomplete supranational-regional order.

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Email: jial25@northwestern.edu o jialcaniz@udesa.edu.ar