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Political Uncertainty and Technological Development: The Controversial Case of AGIP Nucleare (1956-1962)

Investing in high-technology, capital-intensive sectors is risky, because revenues are delayed over time and because it is often very difficult to forecast the pattern of development of technological regimes,[1] especially if they are in their formative period, as was the nuclear energy sector during the 1950s. Moreover, investments' potential positive performance is strictly linked with the ability to acquire technical, as well as managerial and organizational, capabilities. Every effort to innovate in these sectors is, in fact, the result of a process of trial and error, a learning process in which gaining access to the knowledge structured or embodied in machinery is relevant, as is the ability to coordinate complex socio-technical systems.[2] As several scholars have argued, a successful innovation is often not a matter of invention, but mainly a matter of design, in the sense of devising efficient products or processes, given some cost constraints.[3] This is true for pure innovation, but also for the transfer of technology: in both cases, designing new technology is a risky activity, since technical uncertainty can rapidly translate into huge financial losses.

Regardless of the path followed to acquire knowledge and design efficient innovation processes, the implementation of a new technological regime is a costly and time-consuming activity, especially in cases in which the entire national innovation system is involved. In these cases, among which we can list the production of nuclear energy, the institutional framework is particularly relevant. Several scholars have highlighted the importance public policies have in fostering technological investments. These can ensure the presence of a stable institutional framework, which in turn allows for large

1 Franco Malerba and Luigi Orsenigo, "Technological Regimes and Sectoral Patterns of Innovative Activities", *Industrial and Corporate Change* 6, no. 1 (1997): 83-118.

2 Franco Malerba and Richard R. Nelson, eds., *Economic Development as a Learning Process: Variation across Sectoral Systems* (Cheltenham, UK-Northampton, MA: Edward Elgar, 2012), 1-20.

3 Richard R. Nelson, ed., *National Innovation Systems: A Comparative Analysis* (New York: Oxford University Press, 1993), 8-9.

investments, guaranteeing the amount of time needed to put into effect processes of knowledge acquisition and transfer. Reducing political uncertainty is very important, given that the lack of clear orientations deeply affects investments.[4] Since technological projects are not fully reversible, in the face of uncertainty protagonists become extremely cautious, and hold back on investments to such a degree that it seems possible to directly link political instability to the succession of cyclical investment fluctuations.[5]

Political certainty is always important for technological development, but different industrial sectors respond differently, in relation to the degree of complexity that characterizes them. The more an industrial sector's technology is complex, the more political stability is needed for its development. For instance, political certainty helps to explain the development of the electro-nuclear sector, because of the technology involved and the amount of investments needed to start a nuclear energy production plant. In this case, two other aspects have to be taken into consideration, which were particularly evident during the 1950s: the nuclear sector's dependence on international relations, and the relevance of state intervention. After World War II, for the majority of industrialized countries, the possibility of succeeding in the production of nuclear energy was radically linked to the import of technology and nuclear fuel from the United States and the United Kingdom.[6] Foreign policy was therefore crucial in determining the success or failure of technological innovation strategies. National industrial policies were equally important, given the degree of state intervention in the sector, both indirect – by means of regulation –, and direct – through state-owned enterprises.

This chapter examines the relationship between political uncertainty and technological development, through a study of the Italian electro-nuclear industry during the 1950s. It focuses in particular on the case of the Azienda Generale Italiana Petroli (AGIP) Nucleare, an electro-nuclear firm affiliated to the Ente Nazionale Idrocarburi (ENI), the main Italian oil public holding. The first paragraph discusses the role of state-owned enterprises and politics, and is followed by a brief analysis of the Italian government's electro-nuclear policy. The third and fourth paragraphs examine ENI's behavior in the energy sector, and give an account of the political difficulties the company faced both nationally and internationally. Finally, the chapter draws some conclu-

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4 Alfred A. Marcus, "Policy Uncertainty and Technological Innovation", *The Academy of Management Review* 6, no. 3 (1981): 443-48.

5 Ben S. Bernanke, "Irreversibility, Uncertainty, and Cyclical Investment", *The Quarterly Journal of Economics* 98, no. 1 (1983): 85-106; Nick Bloom, Stephen Bond, and John Van Reenen, "Uncertainty and Investment Dynamics", *The Review of Economic Studies* 74, no. 2 (2007): 391-415.

6 Richard G. Hewlett and Jack M. Holl, *Atoms for Peace and War, 1953-1961: Eisenhower and the Atomic Energy Commission* (Berkeley: University of California Press, 1989); John Simpson, *The Independent Nuclear State: The United States, Britain, and the Military Atom* (New York: St. Martin's Press, 1983).

sions on the role political choice had in determining the success or failure of technological development processes.

State-Owned Enterprises and Technological Development

During the 1950s, countries that decided to enter the nuclear sector created public agencies devoted to research and development, and started funding national nuclear programs. In some cases, the state was directly involved in building nuclear plants; in other cases, private companies had greater freedom.[7] In Italy, the role of the state was particularly relevant: in 1952, the government founded the Comitato Nazionale per le Ricerche Nucleari (CNRN), a national agency aimed at carrying out research in the field of nuclear energy, while state-owned enterprises were involved in the construction of two of the three nuclear plants that were built in the 1950s.[8]

In this respect, it has to be considered that by definition state-owned enterprises do not pursue only their own specific interests, but have extra-enterprise aims that are external in origin, and are the result of political choices. Some of these are non-economic, social objectives, and a large part of them can be considered "macro-economic". The latter can affect several aspects of the national economy: its growth, the distribution of resources, specific budget policies, the balance of payments, the degree of the national industry's technological development, and the quality of the human capital employed.[9] State-owned firms' extra-enterprise purposes may not be so different from those of internal firms, but usually, given that the nature and timing of research and development programs are subject to government approval, they can turn out to be different from what the enterprise considers to be its aims. If, in theory, state-owned firms' pursuit of extra-enterprise targets can have positive effects on national industrial systems, and stimulate catch-up processes, in some circumstances it can also become a trap that in the long run prevents the pursuit of development programs.[10]

7 Joseph A. Camilleri, *The State and Nuclear Power: Conflict and Control in the Western World* (Seattle: University of Washington Press, 1984); Benjamin K. Sovacool and Scott V. Valentine, *The National Politics of Nuclear Power: Economics, Security and Governance* (London-New York: Routledge, 2012).

8 Giovanni Paoloni, "Gli esordi del nucleare", in *Storia dell'industria elettrica in Italia*, vol. 4, *Dal dopoguerra alla nazionalizzazione 1945-1962*, ed. Valerio Castronovo (Roma-Bari: Laterza, 1994), 383-407; Barbara Curli, *Il progetto nucleare italiano (1952-1964): Conversazioni con Felice Ippolito* (Soveria Mannelli: Rubbettino, 2000).

9 Venkata Vemuri Ramanadham, *The Economics of Public Enterprise* (London: Routledge, 1991), 72-97.

10 Daron Acemoglu, Philippe Aghion, and Fabrizio Zilibotti, "Distance to Frontier, Selection and Economic Growth", *Journal of European Economic Association* 4, no. 1 (2006): 37-74.

Some scholars have recently highlighted the role the state has played in promoting the expansion of many high-technology sectors, supporting basic research or funding expensive projects with a high risk of failure. The result of these policies has been the introduction of technologies subsequently adopted by private enterprises, both in capital-intensive sectors and in the production of mass consumer goods. In particular, these studies have underlined the importance mission-oriented funding and procurement have, along with the ability to bring together multiple protagonists, leading them toward shared objectives. According to these interpretations, the success of the entrepreneurial state lies in its ability to overcome market and policy uncertainty, in other words to reach a strong consensus on policies as such.[11]

The same scheme could be applied to state-owned enterprises. The design of widely shared strategies is, in fact, imperative to maintain an adequate level of funding and prevent the diversion of resources for political reasons. From this point of view, the development of Italian state-owned firms after World War II is illustrative: while they did not directly produce innovation, they were very effective in promoting the renewal of the managerial elite's technical knowledge and in importing technology. During the 1950s, huge public investment plans led to the modernization of entire industrial sectors. First, they led to the renewal of the steel industry,[12] and important changes were introduced in other strategic sectors as well, namely the mechanical, transport, and telecommunications industries.[13] In many cases, these policies did not lead to innovation in the narrow sense of the term, but by acquiring technology abroad the Italian industry underwent a process of modernization.[14] The existence of a widely shared vision of development, in terms of the pattern of technological innovation to follow, along with the international

11 Mariana Mazzucato, *The Entrepreneurial State: Debunking Public vs. Private Sector Myths* (London-New York: Anthem Press, 2014).

12 Gian Lupo Osti, *L'industria di Stato dall'ascesa al degrado. Trent'anni nel gruppo Finsider. Conversazioni con Ruggero Ranieri* (Bologna: il Mulino, 1993); Ruggero Ranieri, "Steel and State in Italy and the UK: The Public Sector of the Steel Industry in Comparative Perspective (1945-1956)", in *European Yearbook of Business History*, vol. 2 (Aldershot-Brookfield: Ashgate, 1999), 126-54.

13 Andrea Colli, "La grande stagione dell'IRI", in *Storia dell'IRI*, vol. 2, *Il "miracolo" economico e il ruolo dell'IRI*, ed. Franco Amatori (Roma-Bari: Laterza, 2013), 58-150; Sergio Mariotti, "Le telecomunicazioni: dal monopolio tecnologico ai mutamenti degli anni Ottanta e Novanta alla privatizzazione", in *Storia dell'IRI*, vol. 5, *Un gruppo singolare: settori, bilanci, presenza nell'economia italiana*, ed. Franco Russolillo (Roma-Bari: Laterza, 2015), 201-76.

14 Fabio Lavista and Ferruccio Ricciardi, "Le nuove funzioni d'impresa: formazione, comunicazione, ricerca e sviluppo", in *Storia dell'IRI*, vol. 2, *Il "miracolo" economico*, ed. Amatori, 313-72; Cristiano Antonelli, Federico Barbiellini Amidei, and Claudio Fassio, "L'IRI, la ricerca, lo sviluppo tecnologico, la crescita (1950-1994). Esternalità e governo della conoscenza", in *Storia dell'IRI*, vol. 5, *Un gruppo singolare*, ed. Russolillo, 839-918.

financial aid available through the Marshall Plan, allowed public companies to carry out their objectives.[15]

Given its characteristics (the technologies adopted, the strategic interests involved, the opportunity of having access to international forms of aid aimed at promoting its peaceful applications), the nuclear energy industry could have followed a similar path. In practice, though, its evolution was radically different, mainly because of the lack of definite public choices, in terms both of industrial and foreign policies. The following pages aim to demonstrate this hypothesis, through a study of ENI, which in the mid-1950s developed one of the most promising Italian electro-nuclear projects.

The Italian Government's Nuclear Policy during the 1950s

In the early 1950s, hydroelectric power plants provided almost 89 per cent of Italy's electricity. However, hydroelectric energy was close to exhaustion, given that 70 per cent of it had already been or was about to be exploited. One alternative would have been to extend the use of thermal power stations, but this would have meant an increased dependence on fuel imports.[16] In the first half of the 1950s, similar estimates and reasoning led the Italian government to consider developing nuclear energy. In 1946, the Centro Informazioni Studi ed Esperienze (CISE),[17] a private research center for the peaceful use of nuclear energy, had been created, with the aim of building a first power plant; in 1952, the Italian government established the aforementioned CNRN, with the task of supporting and coordinating – through research contracts – the activities of the CISE and of the Istituto Nazionale di Fisica Nucleare (INFN), an inter-university research institute founded in 1951, and promoting several other initiatives in the nuclear field.[18]

At first, the Italian government was reluctant to start a public debate on nuclear energy. The approval of the decree that led to the creation of the CNRN was mostly due to the pressure exerted on the executive by the community of physicists. A greater government and public involvement in this area became unavoidable after Dwight D. Eisenhower's December 1953 speech in front of the United Nations General Assembly,

15 Francesca Fauri, *Il Piano Marshall e l'Italia* (Bologna: il Mulino, 2010).

16 Gino Martinoli, "Previsioni sullo sviluppo delle Centrali Nucleari di potenza in Italia, in un quadro tecnico-industriale", paper presented at the annual FNAEM congress, Rome, February 26, 1959, 4-5, Fondazione CENSIS, Roma, Carte Martinoli, b. 7, fasc. 1.

17 CISE was established by some of the main Italian large-size enterprises active in the mechanical, chemical and electrical sectors: Azienda elettrica milanese, Cogne, Edison, Falck, Fiat, Montecatini, Pirelli, Sade, and Terni.

18 Paoloni, "Gli Esordi Del Nucleare", 381-89.

and the subsequent International Conference on the Peaceful Uses of Atomic Energy, held in Geneva in 1955, which initiated international financial and technical forms of cooperation in the nuclear field[19].

The political debate on nuclear energy, however, began at a very difficult juncture. In the mid-1950s, the crisis of the political alliance that had ruled Italy since 1947 reached its peak, and was followed by a long political negotiation, which sought to enlarge the ruling majority, built around the Democrazia Cristiana (DC). Negotiations lasted until the beginning of the 1960s and led to the inclusion into the government of the Partito Socialista Italiano (PSI), which in the previous decade had already promoted some major changes in Italy's economic policy. The struggle between the various factions of the DC led to the progressive abandoning of the forms of financial stabilization that had been followed since 1947, and to the approval of the first national economic planning policy. In January 1955, Christian Democrat Ezio Vanoni, who at the time was Finance Minister in Mario Scelba's government, presented a ten-year plan for employment and income growth.[20] As we will see, these new political orientations deeply influenced the nuclear debate. There is another element that has to be taken into consideration in analyzing the beginning of the Italian nuclear program: the proposal of nationalizing the entire energy sector. The idea of nationalizing the electrical industry for anti-monopolistic purposes had already been debated during the Fascist period. Immediately after World War II, it had received support from leftist parties and unions, and at the end of the 1950s it became a major political issue, given that the PSI considered it an unavoidable element to participate in an alliance with the DC.[21] Even before the establishment of the alliance between the PSI and the DC, the debate over the structure of the national energy industry was at the top of the political agenda. In particular, its reorganization was a programmatic point of Amintore Fanfani's second government (July 1, 1958 – February 15, 1959), an issue that, as we will see below, deeply influenced ENI's behavior.

At the beginning of the 1950s, there were two contestants in the Italian energy sector. First, private producers of energy, led by Edison, one of the founders of CISE, which entered the nuclear sector with the intention of thwarting the nationalization project or, at least, of minimizing the consequences of a political decision by meeting the country's

19 Hewlett and Holl, *Atoms for Peace and War*, 209-37.

20 Ezio Vanoni, *Discorsi sul programma di sviluppo economico* (Roma: Istituto poligrafico dello Stato, 1956); Vanoni, *La politica economica degli anni degasperiani. Scritti e discorsi politici ed economici*, ed. Piero Barucci (Firenze: Le Monnier, 1977); Bruno Bottiglieri, *La politica economica dell'Italia centrista 1948-1958* (Milano: Edizioni di Comunità, 1984), 197-328; Fabio Lavista, *La stagione della programmazione. Grandi imprese e Stato dal dopoguerra agli anni Settanta* (Bologna: il Mulino, 2010), 104-38.

21 Giorgio Mori, "La Nazionalizzazione in Italia: il dibattito politico-economico", in *La nazionalizzazione dell'energia elettrica. L'esperienza italiana e di altri paesi europei, Atti del Convegno internazionale di studi del 9-10 Novembre 1988 per Il XXV anniversario dell'istituzione dell'Enel* (Bari: Laterza, 1989), 91-115.

energy needs. Second, public enterprises working in the energy field, namely the firms of the Istituto per la Ricostruzione Industriale (IRI), controlled by the electric sub-holding Finelettrica, and the companies affiliated to ENI.

At first the Italian government, following the new planning policy introduced in the years 1954-1956, favored the cooperation among state-owned enterprises. An effort clearly testified by a meeting of the Committee of Ministers for the development of employment and income – the inter-ministerial body in charge of implementing the Vanoni Plan – held in Rome in October 1956. On that occasion, Prime Minister Antonio Segni, a Christian Democrat, who at that time was also President of the Committee, underlined "the need for Italy to start an industrial activity to produce nuclear energy". Giuseppe Medici (Ministry of the Treasury), Guido Cortese (Ministry of Industry and Commerce) and Emilio Colombo (Ministry of Agriculture and Forests) supported Segni's statement. All agreed that, given the advancement of research in the field of peaceful uses of nuclear energy in Western bloc countries, Italy should have kept itself updated. At the end of the meeting, the Committee decided that ENI – whose president, Enrico Mattei, had been invited in order to illustrate ENI's future investment plans – should have carried out the exploration and production of radioactive minerals, using one of its subsidiaries, Somiren. ENI would have drafted a new industrial plan to process radioactive materials, prepare nuclear fuel and regenerate nuclear fuel. Together with IRI, ENI would have been in charge of building a nuclear power plant in Southern Italy providing energy to Finelettrica, which in turn would have distributed and marketed electric power. In addition, the Committee authorized ENI to join Fiat and Montecatini – two private firms – in the construction of a second power plant in Northern Italy.[22]

The Italian government, therefore, decided to promote the growth of the nuclear sector in the context of the development policies started with the Vanoni Plan, assigning a key role to state-owned enterprises, which would have cooperated among each other and with private companies. In the following years, however, things took a different turn: the six years that elapsed between the 1956 meeting of the inter-ministerial committee and the 1962 approval by the Parliament of the nationalization of the electric industry – years in which the building of the first three Italian nuclear power plants was started – were characterized by a fierce political struggle. The political deal on nuclear energy was drafted in a context that favored contrasts not only between private and state-owned enterprises – respectively "victims" and beneficiaries of a possible nationalization –, but also between

22 Draft of the Comitato dei ministri per lo sviluppo dell'occupazione e del reddito nel quadriennio 1957-1960's meeting, Rome, October 11, 1956, Archivio Storico ENI, Pomezia (Roma) (hereafter ASE), ENI, BG.III.6, f. 1.

different public holdings, which started to pursue competitive development strategies in the nuclear field.

While political uncertainty influenced the decisions of the protagonists, two international elements should also be taken into consideration: first, the difficulties enterprises active in such an unknown and risky sector had to face in order to raise capital from international financial markets. Second, the international political and economic forms of pressure carried out in favor of different technological options. The United States and Great Britain fought for dominance in the field of nuclear reactors, and in the case of the United States, economic objectives went hand in hand with strategic needs tied to Cold War power politics.[23]

ENI's Strategy

Considering this context, it is interesting to follow the evolution of ENI's strategies, given that political uncertainty and the absence of a clear political will deeply influence the operations of this state-owned company. Its actions are in some ways paradigmatic of how the protagonists of the nuclear sector operated in that period. In fact, ENI decided to enter this new field mainly for extra-enterprise objectives and tried to leave as soon as the political framework changed, putting an end to its projects.

In order to understand this behavior, one has to keep in mind that in the mid-1950s ENI was in the midst of an intense growth phase. Once Mattei assured ENI control over the natural gas fields discovered in Northern Italy, he tried to increase the company's access to international oil sources. While it was struggling to control the nuclear sector, ENI signed two of its most controversial oil deals, namely an agreement with Reza Pahlavi of Iran and one with Gamal Abdel Nasser of Egypt.[24] As a result of this expansion strategy, ENI increased its financial commitment and experienced growing international tensions, especially with the United States, which accused the Italian company of challenging its interests in Italy, with the legal monopoly it established on natural gas resources in Northern Italy, and abroad. At an international level, the economic contrasts resulting from ENI's strategy, whose aim was to decrease oil prices, soon turned into political tensions, given that the company's agreements challenged consolidated

23 Robin Cowan, "Nuclear Power Reactors: A Study in Technological Lock-In", *The Journal of Economic History* 50, no. 3 (1990): 541-67.

24 Marcello Colitti, *Energia e sviluppo in Italia. La vicenda di Enrico Mattei* (Bari: De Donato, 1979); Daniele Pozzi, *Dai gatti selvaggi al cane a sei zampe. Tecnologia, conoscenza e organizzazione nell'Agip e nell'Eni di Enrico Mattei* (Venezia: Marsilio, 2009).

international balances, grounded on a static repartition of expenses, profits and roles between big international oil companies and producing countries.

Until that moment, ENI's national and international strategies were successful, thanks to Mattei's and his staff's political abilities and the support of Vanoni, to whom Mattei was closely tied, both politically and personally.[25] Vanoni's sudden death in February 1956 opened up a difficult political period for ENI, as its orientation became more and more dependent on the temporary alliances Mattei was able to establish. With Vanoni gone, Mattei's political points of reference were DC members Fanfani and Giovanni Gronchi, with their neo-Atlanticist foreign policy.[26] In this framework, ENI's nuclear strategy, which was intended to ensure Italy's energy independence, became a prerequisite for a more independent foreign policy.

This, however, is only part of the story, since Mattei half-heartedly decided to enter the nuclear sector. As we have seen, the initial input came from the Committee of Ministers in charge of carrying out the Vanoni Plan. Mattei was eager to comply with the Committee's solicitations, because in the same months the government was discussing a reorganization of the energy sector, which would have led to the creation of a new all-embracing public energy agency, the Ente unico per l'energia. By becoming involved in the nuclear sector, ENI would have been in a more favorable position than IRI, in case the project would have been approved. The Italian government started talking explicitly about this a few months before the 1958 political elections. As an internal ENI report noted, the plan was part of the DC's political agenda and of the agreement signed by the DC and the Partito Social-Democratico Italiano (PSDI), the two political parties that after the elections formed Fanfani's second government. The project was also mentioned in the keynote speech Fanfani gave to the Parliament, after he was appointed Prime Minister. The DC clearly stated in its electoral program that public energy holdings were crucial in achieving a balance between public and private enterprises, assuring the exploitation of national energy sources and promoting economic development. After the establishment in 1956 of the Ministero per le partecipazioni statali,[27] the government program became even more explicit: the document referred to the need for ENI and IRI of introducing a series of reforms, aimed at "obtain a clearer distribution of tasks

25 Fabio Lavista, *Analisi economica, politica estera e sviluppo. Giorgio Fuà, l'ufficio studi dell'Eni e la governance delle partecipazioni statali* (Bologna: il Mulino, 2016).

26 Anna Bedeschi Magrini, "Spunti revisionistici nella politica estera di Giovanni Gronchi presidente della Repubblica", in *L'Italia e la politica di potenza in Europa (1950-1960)*, ed. Ennio Di Nolfo, Romain H. Rainero, and Brunello Vigezzi (Milano: Marzorati, 1992), 59-73; Agostino Giovagnoli and Luciano Tosi, eds., *Amintore Fanfani e la politica estera italiana: atti del convegno di studi tenuto a Roma il 3 e 4 febbraio 2009* (Venezia: Marsilio, 2010).

27 Fabio Lavista, "Dallo statuto del 1948 alla programmazione economica nazionale", in *Storia dell'IRI*, vol. 2, *Il "miracolo" economico*, ed. Amatori, 523-61.

between the two holdings; establish a more efficient managerial control, in order to enhance their economic performances and guarantee a coherent development program, subordinate to central authorization mechanisms; organize state-owned enterprises in a new central bargaining agency; and, finally, allow some form of profit sharing, involving workers in decision processes". The agreement, which was clearly grounded on the primacy of politics, also included the possibility of merging all state-owned enterprises working in the research, production and distribution of energy into a new public holding. As ENI's report pointed out, Fanfani's keynote speech offered a deep insight into the project. It underlined the need to "distribute competencies and enterprises between ENI and IRI more efficiently", and merge their electric subsidiaries into a new holding, to which the two companies would have transferred their long-term concessions for the exploitation of energy sources and which would have used its profits to acquire new concessions.[28]

In the following months, the new holding was not created. The struggle inside the DC, stirred up by Fanfani's attempt to include the PSI in the government, led to the project's failure.[29] The nationalization of the energy sector would have been carried out only a few years later, under the first centre-left coalition government, in a profoundly different context and following a different procedure. For some time, though, it seemed possible that ENI could became the new holding as proposed by the DC's political program.

After the creation in the first half of the 1950s of Somiren – an enterprise active in nuclear fuel research –, and the founding in 1956 of AGIP Nucleare, placed under the supervision of Gino Martinoli, ENI started to hire and train new personnel; study the nuclear technologies available on the international market; and build – not by chance in 1958 – a first nuclear power plant in Latina (near Rome), after signing an agreement with the British Nuclear Power Plant Company (NPPC).[30] As we will see in the following paragraph, two aspects of this story are particularly interesting, as far as the relationships between political uncertainty and technological development is concerned. First, the fact that the survey on available technologies led ENI to draft a development plan that went far beyond the construction of a single power plant, a plan tailored for a public holding that was ready to manage the whole electric sector. The second interesting aspect is ENI's decision to opt for British technology, a decision that was grounded in the need to diversify nuclear technologies, given that the other Italian enterprises active in those years in the nuclear sector used US technology. Since British nuclear power plants

28 See *Appunti sulla costituzione di un Ente nazionale dell'energia*, 1958, ASE, ENI, BG.III.6, b. 2.

29 Giorgio Galli, *Storia della Democrazia Cristiana* (Bari: Laterza, 1978), 183-205.

30 Mauro Elli, *Atomi per l'Italia. La vicenda politica, industriale e tecnologica della centrale nucleare ENI di Latina 1956-1972* (Milano: Edizioni Unicopli, 2011).

were fueled by natural uranium, whereas American ones relied on enriched uranium, which could only be enriched by US enterprises, such a choice would have assured Italy a more independent future.[31]

Political Uncertainty, at Home and Abroad

The peculiar development of the Italian nuclear sector during the 1950s and the 1960s led to the building of three nuclear power plants, each designed following a different technology: thanks to a loan granted to it by the Export-Import Bank, Edison signed an agreement with Westinghouse to buy an enriched uranium reactor, moderated with pressurized water. IRI participated in the research project Energia Nucleare Sud Italia (ENSI), which was promoted by the CNRN and received funding from the International Bank for Reconstruction and Development (IBRD); the enterprise signed an agreement with General Electric to build a second enriched uranium reactor, moderated in this case with boiling water. Finally ENI, using its own financial resources, signed an agreement with NPPC in order to build a natural uranium reactor, graphite-moderated.[32]

The diversification of the nuclear industry was partly justified by the immaturity of the technology, given that it was impossible to know in advance which technological pattern the nuclear sector would have followed. However, this decision led to a scattering of resources and to an almost complete lack of synergies, with negative effects on the further developments of the field. Some protagonists have argued that this dispersion of resources was the outcome of a "feud" between the main actors of the Italian nuclear industry, who focused their efforts on gaining a favorable position in the case of a reorganization or nationalization of the industry.[33] The main responsibility for the development of the sector, though, was undoubtedly political.

The story of the Italian nuclear industry took place in a very unstable political environment, both nationally and internationally. In ENI's case, this uncertainty explains the choices – especially the technological ones – made by the public holding. If one considers the possible future developments of the sector, the agreement signed with NPPC was a rational choice, given that at the time Euratom was supporting research programs aimed

31 See internal report on different nuclear technologies written on the occasion of a Mattei's trip to Great Britain, May 1957, ASE, ENI, H.III.2, b. 35.

32 Paoloni, "Gli esordi del nucleare".

33 Mario Silvestri, *Il Costo della menzogna. Italia nucleare 1945-1968* (Torino: Einaudi, 1968); Colitti, *Energia e sviluppo in Italia*; Carlo D'Amicis and Mirella Fulvi, eds., *Conversando con Gino Martinoli* (Roma: Fondazione Adriano Olivetti, 1991); Curli, *Il progetto nucleare italiano*.

at evaluating the possibility of developing the gas/graphite technology.[34] However, the plan Martinoli drafted for AGIP Nucleare did not focus only on the use of this technology. In the same months in which it tried to reach an agreement with the British nuclear authorities, ENI tried to sign a similar cooperation agreement with the US firm Babcock & Wilcox. Its aim was to build a second nuclear reactor moderated with pressurized water, in compliance with the directives received in 1956 by the Committee of Ministers for employment and income.[35] The decision to focus only on British technology came later, between 1957 and 1958, and it was not the result – as some scholars have argued – of Mattei's hostility toward the United States, but rather of domestic and international political pressures.

Some telegrams sent by the US embassy in Rome to the State Department in May 1957 leave little doubt about the nature of these pressures. Two days after the resignation of Segni's government – the one that assigned IRI and ENI the task of building two nuclear power plants, one in the Northern and one in Southern Italy –, Ambassador James David Zellerbach informed the State Department that even before the government crisis, "efforts [had] been made [by Italian officials]: a) to convince Mattei that AGIP Nucleare [had] no business in the electric power field but should [have confined] activities to search for uranium, b) should Mattei and supporters [have insisted] on entering the power field to try to convince them to buy Calder-Hall type plants [the British nuclear power plant type]". Therefore, in 1957 there were several national interests that were putting pressure so that ENI would not have entered the nuclear sector or, at least, that it would not have entered it thanks to an agreement with the United States. The telegram stated that, "foreign and career officers and other interested ministers [believed] SEN [AGIP Nucleare's competitor, controlled by IRI and private enterprises] [was] the logical group to represent the State in this field". As a matter of fact "knowledge that AGIP-Nucleare could not [have obtained] a world bank loan [figured] heavily among the reasons for favoring SEN".[36] International ostracism against ENI undoubtedly favored IRI and private enterprises: just ten days later, Zellerbach confirmed that "both the foreign office and CNRN [were] opposing AGIP entrance (Mattei) in the nuclear energy field and the earlier report of SEN to the Babcock Wilcox project was the first step in this campaign".[37] The new government (May 19, 1957 – July 1, 1958),

34 See *Partecipazione dell'Euratom a reattori di potenza*, May 2, 1961, ASE, ENI, I.V.4, b. 280.

35 See *Osservazioni sul programma di sviluppo dell'energia nucleare*, Roma, March 8, 1957, ASE, ENI, H.III.5, b. 84.

36 See telegram by James David Zellerbach to State Department, May 17, 1957, National Archives and Records Administration, Washington, DC (hereafter NARA), General Records of the Department of State, Central Decimal File 1955-1959, b. 2541, f. 611.6597/1-3157, d. 611.6597/5-1757.

37 See telegram by James David Zellerbach to State Department, May 27, 1957, NARA, General Records of the Department of State, Central Decimal File 1955-1959, b. 2541, f. 611.6597/1-3157, d. 611.6597/5-1757.

largely controlled by the DC and placed under the direction of Adone Zoli, along with the CNRN, took advantage of the possibility of accessing international funding, and granted precedence to SEN in signing an agreement with a US corporation.

The strategy pursued by the US government is clearly explained in a third telegram that Zellerbach sent to the State Department two days later, while Mattei was in London to negotiate a deal with the British nuclear agency. Zellerbach hoped that Mattei's trip would be successful because: "1) Mattei would thereby [have removed] himself from contention over concrete US projects and thereby [have] immensely [simplified] the task of getting on with these projects, and 2) there was a reason to believe that [the Italian government] would [not have approved] 'any time soon' another ENI loan of magnitude necessary to finance the Calder-Hall project in which event Mattei would [have been] out on atomic power business where he belonged".[38] Therefore, after supporting the agreement between Edison and Westinghouse with the aim of limiting public intervention in the electric sector, the US government also supported the agreement that led to the ENSI project. This included IRI, but not ENI, and could be considered part of a well-established tradition of international aid granted by the IBRD to Southern Italy.[39] By doing so, the US government achieved several aims: it helped private electric enterprises, it offered its support to the development policies Italian governments had been promoting since the approval of the Vanoni Plan,[40] and it excluded ENI. For the Italian public holding, opting for British technology became the only feasible alternative.

The reasons behind the US government's hostility to ENI went beyond competition in the nuclear sector. However, the US strategy would have been less successful if the Italian government had had a clearer policy for the development of a national nuclear industry, as it had done in the oil field, where ENI was able to gain more leeway.[41] In this context, Mattei was forced to follow multiple strategies: a few months after the aforementioned political skirmishes, and after Zoli's government resigned and was substituted by Fanfani's second government, ENI's President came close to becoming chairman of the new Ente unico per l'energia. The crisis of Fanfani's government a few months later led to a temporary dismissal of the plans to reorganize the electric industry. In this context, it was clear that the plan promoted by Martinoli for AGIP Nucleare would be

38 See telegram from James David Zellerbach to State Department, May 29, 1957, NARA, General Records of the Department of State, Central Decimal File 1955-1959, b. 2541, f. 611.6597/1-3157, d. 611.6597/5-1757.

39 Leandra D'Antone, "Straordinarietà e stato ordinario", in *Storia del capitalismo italiano dal dopoguerra ad oggi*, ed. Fabrizio Barca (Roma: Donzelli, 1997), 579-625.

40 Barbara Curli, "Energia nucleare per il Mezzogiorno. L'Italia e la Banca Mondiale (1955-1959)", *Studi Storici* 37, no. 1 (1996): 317-51.

41 Pozzi, *Dai gatti selvaggi*, 307-458; Lavista, *Analisi economica*, see fourth chapter.

of little interest for Mattei, while oil would continue to be ENI's core business. This was a field that started registering a rapid increase in investments, just as ENI was entering into the nuclear sector. As a result, the company became unwilling to immobilize huge financial resources in the nuclear field.

ENI's growing indebtedness (see Figure 1) explains its progressive disengagement from nuclear energy, starting in 1959. The process began with the firing of Martinoli and the resizing of his development plan; it was followed by a suit against NPPC, aimed at reducing the cost of the Latina nuclear power plant, which had already started to be built; and by the attempt to sell the plant to IRI, even before the government made a decision on the nationalization of the energy sector.[42]

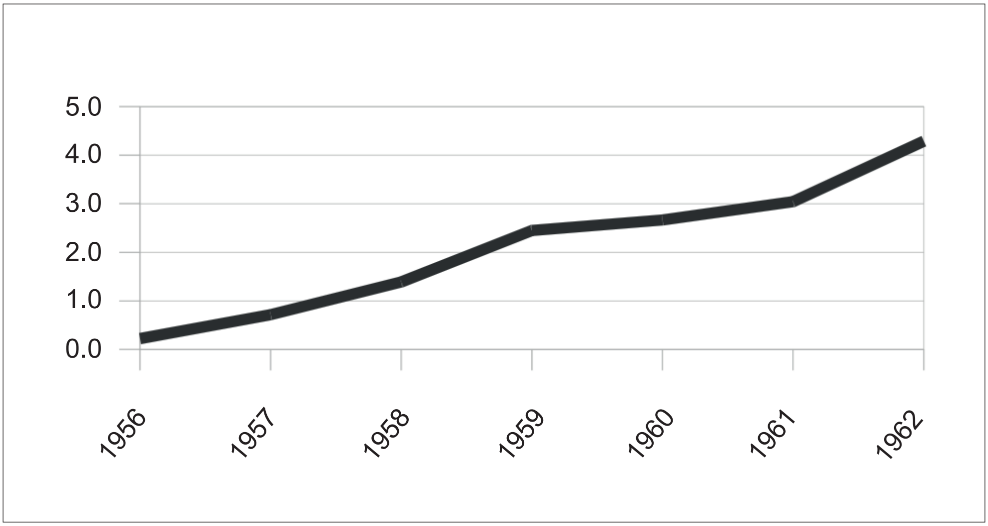

Figure 1: ENI's debt to net worth ratio, 1956-1962. Source: ENI's financial statements, various years.

Conclusion

Despite ENI's success in the building of the Latina nuclear power plant (in 1963 it was the first active plant in Italy), it soon became evident that the nuclear field could not become a priority for this public group. Given the political context described above, even other protagonists of the nuclear industry found it difficult to develop their policies.

42 Elli, *Atomi per l'Italia*, 75-95.

The turbulent international context, coupled with political uncertainty at a national level, deeply influenced the decision processes of both public and private enterprises. On the one hand, international forms of pressure affected their decisions concerning international partnerships and this, in turn, had important consequences on the technological evolution of the sector. On the other hand, uncertainty negatively influenced companies' levels of investment. Given that the Italian government did not offer any reassurance about its support for nuclear programs, enterprises active in the energy industry limited their efforts in the nuclear field. Even the Ente Nazionale per l'Energia Elettrica (ENEL), the energy agency created in 1962 with the nationalization of the energy sector, limited its investments in the nuclear field and decided to focus its efforts on managing the investments made by other firms during the 1950s.

Considering these developments, we can conclude that the evolution of the Italian nuclear sector during the 1950s confirms two initial assumptions: the success of public intervention rests on the ability to overcome not only market, but also political, uncertainties; this ability is one of the most important prerequisites for technological development.