

Without and with the State: the French electrical manufacturers in a global economy

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The electric power industry has all the characteristics of a globalized market since the end of the 19th Century: powerful big companies, various technologies for electricity production, segmentation of the consumption between individuals, public authorities and industrial and also the beginning of a political interest due to the belief that electricity will become one of the key sectors of the national economy. The relationships between network operators and equipment manufacturers in the electricity sector have been studied many times over the past decades. From Harold C. Passer with his seminal book on the Electrical Manufacturers to Thomas P. Hughes with *Networks of Power* and most recently William J. Hausman, Peter Hertner and Mira Wilkins, the historians had demonstrated how financial, industrial and technical trends were closely linked¹. Nearly all these historians have let the French case aside and we have to refer to the historians Pierre Lanthier² and Albert Broder³ who showed the

¹ Harold C. PASSER, *The Electrical Manufacturers. 1875-1900. A Study in Competition, Entrepreneurship, Technical Change, and Economic Growth*, Cambridge, Harvard University Press, 1953; Thomas P. HUGHES, *Networks of Power. Electrification in Western Society, 1880-1930*, Baltimore, The John Hopkins University Press, 1983; William J. HAUSMAN, Peter HERTNER, Mira WILKINS, *Global Electrification. Multinational Enterprise and International Finance in the History of Light and Power, 1878-2007*, New York, Cambridge University Press, 2008. Of course, W. Bernard Carlson, Paul Israel, Wilfried Feldenkirchen, Richard Hirsh (and many others) could also be quoted.

² Pierre LANTHIER « Multinationals and the French electrical industry, 1889-1940 », in Alice Teichova, Maurice Lévy-Leboyer and Helga Nussbaum (ed.), *Historical Studies in International Corporate Business*, Cambridge, CUP, 1989, p. 143-150.

relationship between the emergence of electric industry in France and investments by big foreign firms, including American, German and Swiss actors. Indeed, at the beginning of the 20th century, it has often been written that the French electricity industry was financially and technically dependent on foreign manufacturers. This brings out the following question: how was built the French electrical industry as a multinational activity? What were the processes to de-link this dependency? What does “independence” mean in a globalized sector like the electric industry? The relationship between the leading manufacturers of equipment and the utilities (production and distribution of electricity) is at the center of this historical work. Since 1946 and the nationalization of the electricity suppliers (foundation of EDF – Electricity of France), the operator has indeed dominated the electricity sector, it is still necessary to identify how, in a mature industry, a single operator he could impose his will on manufacturers.

The purpose of this article is to study, in a long-time approach, the relationship between manufacturers and operators in the French electrical industry as the key to break dependency and to take part in the globalization. This approach requires both the development perspective of financial and technical relations, but also by taking into account instances of coordination, meetings, defining the respective roles of manufacturers and operators.

1. The slow growth of a national electrical industry

During the late 19th Century, the shaping of the electricity as a leading sector was done by industrial firms and not by governmental decisions in Europe. At the same time, the telephone industry, even the private manufacturers, was clearly in another way of shaping with a key-role of the administrations. This place of private firms explains the emergence of powerful private companies, from the light bulbs to the steam generator. The German word

³ Albert BRODER, « La multinationalisation de l'industrie électrique française, 1880-1931. Causes et pratiques d'une dépendance », *Annales ESC*, 39^e année, n°5, septembre-octobre 1984, p. 1020-1043.

Unternehmensgeschäft defines an organization of the electricity sector in which large equipment manufacturers, supported by banks, create subsidiaries for production-distribution of electricity to place their products. This model of development of the electricity industry was firstly adopted by German and Swiss companies. In France, the implementation of the model remained limited. The creation of the Compagnie française pour l'exploitation des procédés Thomson-Houston in 1893⁴ corresponded indeed to the desire to create captive markets by controlling electricity suppliers companies. To sell its electrical equipments (turbines, tramways), the CFTH created subsidiaries in Marseille, on the Mediterranean coast, and in Bordeaux, in the southwest of France region, but also the Compagnie générale française de tramways. By multiplying the subsidiaries, the manufacturing company ensured contracts for initial installations but also for the following years when the plants were completed or for the renewal of these materials. The Belgian company Empain played a similar strategy with investments in tramways, and of course in the Paris Metro. Involving the manufacturing of transportation equipment and electrical equipment, this company was in competition with CFTH in most French cities. Another foreign company was the Compagnie électro-mécanique, founded by Brown Boveri Company to product steam turbines. The French firms had only few markets in this configuration. The Compagnie générale d'électricité, lately created in 1898, was also a manufacturing group with operating companies (Compagnie Lorraine d'électricité, Electricité de Marseille ...), but instead of seeking profits by selling its industrial products (only light bulbs and cables), the company was entirely oriented towards finding the lowest prices for electricity. Finally, although France had organized the first International exposition of Electricity in 1881 in Paris⁵, only small

⁴ Pierre LANTHIER, « L'industrie de la construction électrique en France avant 1914 », in François CARON et Fabienne CARDOT (dir.), *Histoire de l'électricité en France*, t. 1 : 1881-1918, Paris, Fayard, 1991, p. 671-726 et plus particulièrement, pour la CFTH, p. 692-698.

⁵ Kenneth G. BEAUCHAMP, *Exhibiting Electricity*, London, The Institution of Electrical Engineers, 1997.

electrical equipments were built by French firms. The heavy electrical machines (turbines, generators, boilers) were in the hands of foreign companies.

Putting the focus on these major companies is taking the risk of hiding a much more diverse reality. Several industrial firms were not related to operators, either because they arrived too late as Merlin Gerin, created in 1920, either because their technical specialization let them away from operators such as Neyret Beylier, a hydropower equipment firm. In addition, many small manufacturers of electric motors remained independent. Conversely, many operators remained independent of industry, either because they were small, either because the shaping of powerful conglomerate had waiting the 1920s to become a reality.

Finally, CFTH and Empain were the only companies adopting clearly the model putting the operators in the total dependence of manufacturers. The panorama can be completed by the mention of foreign financial companies, such as the Belgian Sofina, the Swiss Indelec or Elektrobank that favored industrial companies with whom they had contact. This was particularly the case in Rouen for the Sofina⁶.

Manufacturers could take such ascendancy because the main innovations in the electricity sector were based on heavy electrical equipment. Turbines, generators, transformers and circuit breakers built in Villeurbanne, Saint-Ouen or Belfort were placed in the network after being tested in the laboratories of manufacturers. Circuit Breakers with low oil, for example, were developed by Les ateliers de constructions électriques de Delle were a commercial success only because of the marketing efforts of the company. After WWI, manufacturing companies sought to rationalize the production by agreements (cartel) and mergers. The merger was not the only solution: the companies made the choice of specialized subsidiaries. During the 1930s, manufacturers increasingly separated products by markets: on one hand the equipments for operating companies, on the other hand the electrical appliances for the

⁶ René BRION, « Le rôle de la Sofina », in AHEF, *Le financement de l'industrie électrique, 1880-1980*, Paris, PUF, 1994, p. 218-219

domestic market. Alstom, created in 1928 by CFTH and the Société alsacienne de constructions mécaniques⁷, left aside the appliances (cooking, heater...). This separation had broken the links between the upstream and downstream activities and shaped an approach by market. For nearly half a century, manufacturers had produced the full range of electrical machines. With this divorce between small and heavy equipment, the electrical industry had become unbalanced: Extremely concentrated for heavy electrical machines, it was rather fragmented especially for small devices.

One explanation is the fact that electricity suppliers were more and more dependent on the political authorities. Local authorities were also increasingly present, mainly to promote the rural networks.

2. When EDF lead the electrical manufacturers

The creation of Electricité de France, in 1946, was a political decision based on the program of the Conseil national de la Résistance but also the outcome of the technical logics since the second part of the 1930s⁸. Indeed, the configuration of relationships between companies in the sector changed with the nationalization. Therefore, EDF tried to keep the links with the electrical manufacturers⁹ while affirming its leadership in the electrical industry. EDF put in orders to achieve the electrification of France, which benefited to the whole electricity sector.

The dependency of electrical manufacturers to EDF was a new configuration. The regulation authorities of this new situation were the Supreme Council of the electricity and gas, created in 1935, and the Commission of EDF markets, created in 1949 for orders over 200 MF. It is

⁷ François BERNARD, *L'Alsacienne de Constructions Mécaniques, des origines à 1965*, Strasbourg, Presses Universitaires de Strasbourg, 2000, 480 p

⁸ Les multiples débats, antérieurs comme postérieurs à la Seconde Guerre mondiale, sont présentés dans AHEF, *La nationalisation de l'électricité en France. Nécessité technique ou logique politique ?*, textes réunis et édités par Laurence BADEL, Actes du 11^e colloque de l'AHEF (Paris, 3-5 avril 1996), Paris, PUF-AHEF, 1996

⁹ Jean-François PICARD, *Recherche et Industrie. Témoignages sur 40 ans d'études et de recherches à Electricité de France*, Paris, Eyrolles, 1987, p. 15.

indeed in these commissions that were determined contracts for bulk orders and heavy equipment. These orders were strategic for the electrical manufacturers and EDF tried to share out these orders between different companies (Alstom, CEM, CGE). It was an industrial policy shaped by the public orders. The choices were not always based on the best price, or even the best technology, but on the best industrial effect. The "protection of French industry in relation to the financial interest of EDF" was discussed several times during the first sessions, particularly when foreign companies, mainly Italian, could submit with lowest prices. In nearly all the cases, the French manufacturers gained the market after according a discount. For example, in 1949, EDF launched a restricted tendering procedure for the supply and the installation of ten 30 MVA transformers. Four companies were consulted and did proposals: Société savoisienne de constructions électriques (64.8 MF for each electrical transformer) Schneider-Westinghouse (65.8 MF), Jeumont (65.3 MF), Compagnia generale di elettricità italiana (59.5 MF). But the Italian company had already received the market for two transformers six months earlier, so the order was passed to the Savoisienne (four transformers for a total of 253 MF) and Schneider-Westinghouse (six transformers, 412 MF)¹⁰.

After the intensity of reconstruction and modernization, a progressive reduction of the orders disrupted the entire electrical industry. In 1951, the first decline in the number of EDF's work was felt by the manufacturers. In 1953, however, orders were down by 22%. For some products, the fall was much more important: in 1953, the orders of armored cables represented only 54% of the volume of the previous year. In this context, the electrical manufacturers had to lower their prices and tried to organize a cartel. The government, aware of the difficulties imposed on the electricity sector, encouraged the French companies to seek international markets.

¹⁰ Séance de la Commission des marchés d'EDF du 14 février 1951, AN CAC 1977 1403-3.

The early 1960s carried on with the slow erosion of public orders. The Planning Act relating to electrical equipment, passed in November 1961 at the instigation of Jean-Marcel Jeanneney, planned an investment of \$ 9.7 MF for the years 1962-1964, which already represented a decrease from the previous law, passed in 1959, which was set a 10.4 MF investments for 1960-1962¹¹. All the products were concerned: high voltage circuit breakers, transformers, power cables, materials for high voltage... In 1953, "after four years of unremitting struggle led by our teams"¹², EDF obtained a reduction of the price of the 220 kV circuit breakers from 18 to 9.5 MF. Due to low international prices, the French manufacturers were unable to gain alternative markets.

The priority put on the hydroelectricity plants and dams and the growth of the thermal power plants (from 125 MW to 600 MW between 1955 and 1965) required the firms to change their strategy. The path chosen was to develop technical improvements for the national market.

Indeed, since 1946, EDF assumed control of technical developments by its structures of research and development. The first aim was to rationalize the voltage in the power transmission networks. In 1946, 25 different voltages between 2 and 25 kV were in service¹³. For the medium-voltage network, the standard of 15 kV was adopted. At the same time, the engineers sketched the outlines of the future 400 kV network. The public firm defined the standards of equipment it would order. Isolators, circuit breakers, cables were well defined according to EDF plans. For the heavy electrical machines, EDF had a strategy of standardization by defining technical levels. Turbo-generators of 125 MW and 250 MW to 600 MW for steam-electric power stations are the results of this policy. It was no longer the manufacturers who offer their products to the operator but the electricity supplier which set

¹¹ Eric KOCHER-MARBOEUF, *Le Patricien et le Général. Jean-Marcel Jeanneney et Charles de Gaulle, 1958-1969*, Paris, CHEFF, 2003, p. 328-330.

¹² EDF, *Rapport d'activité du Service des transports d'énergie pour l'année 1953*, 39 p. EDF Archives, 890047

¹³ Jacques TOULEMONDE, Paul LE GAVRIAN, « Le réseau de distribution », *Histoire de l'électricité en France*, t.3 : 1946-1987, Paris, Fayard, 1996, p. 816.

the standards to be met. We should not give too much importance to the influence of a single operator on its suppliers. Indeed, the orders were based on the industrial capacities. The aim of the French policy was not to impose the views of engineers or "technocrats" but to "pull up" the entire French electrical sector.

As we have just written, EDF led also a policy of research and development by taking over a part of the experiments in the laboratories of Clamart, Chatou and the Renardières, three places in the Parisian area. EDF researchers then worked with industry to develop new equipments, such as insulator strings or high-voltage electrical power transformers.

Of course, the nuclear concentrated the dynamics of innovation. With the beginning of the construction of the first civil nuclear power plant in 1957 (commissioned in 1963), the public company began the development of a pioneered knowledge. EDF prepared technical specifications of the equipment. Manufacturers were nearly subcontractors. This role of a global entrepreneur allowed the "francization" of the technology of the pressurized water reactors, adopted in 1969. The license fees paid to Westinghouse decreased and the French electrical manufacturers (Framatome, Alstom) could compete on the international market. By controlling the establishment of national nuclear industrial sector, EDF also adopted the function of standard-bearer for the conquest of international markets. The contracts for the nuclear power plants of Koeberg (South-Africa) in 1975 or Daya Bay (China) in 1986 were obtained by the covenant of the operator EDF and manufacturers (including Alstom).

3. A new balance between national and international markets

However, the second part of the 1970s shows a declining weight of EDF. Manufacturers have gradually left their dependency ratio. This new position was established through the reintroduction of innovation among manufacturers. In the field of heavy electrical equipments- particularly for Alstom generators- manufacturers could not restore profit

margins without introducing technical improvements. The titanium blades of steam turbines, for example, significantly reduced the length of turbine generators from the late 1980s. For network equipments, the situation was quite similar and improvements in SF6 circuit breakers allowed their widespread adoption in the late 1970s¹⁴. Again, manufacturers were the vectors of technical innovations. This evolution is mainly due to the EDF attitude within the national industrial policy. Indeed, EDF was used to systematically keep two or three suppliers for each material to ensure a competition. However, the trend of mergers between 1969 and 1977 led to the creation of two giants: CGE-Alstom on one hand and Schneider on the other¹⁵. Of course, this innovative pressure made the electrical manufacturers more autonomous and responsible and allowed them to establish normal contractual links with EDF. They could also occur more freely on foreign markets. The role of the European Commission in the establishment of new market rules should not be under-estimate since the beginning of the 1980s.

Meanwhile, the electrical manufacturers opened a movement of merger at the European level: GEC and Alstom in 1987, Asea and Brown Boveri the same year, and between ABB and Alstom in 1999. However the European manufacturers met with several difficulties to compete on a global market. Alstom was thus saved from bankruptcy in 2004 by the input of the State capital. French groups born in the 1970s became European groups in the second half of the 1990s. This scaling was not done smoothly but they obtained a sufficient size to compete with the American or Japanese companies.

Conclusion

¹⁴ Denis DUFOURNET, « Disjoncteurs SF6 – évolution de 1959 à 1994 », *Revue générale de l'électricité*, mai 1994, n°5.

¹⁵ Alstom became a subsidiary of the Compagnie générale d'électricité in 1969. Since 1956, Alstom and the CGE had put together some laboratories (high-voltage). Schneider has taken the control of Merlin Gerin in 1975 and the control of Télémécanique in 1988.

The electricity industry has been defined, at the end of 19th century, by the proximity between the industrial manufacturers and the suppliers. For production plants (turbines, generators) or power transportation equipments (circuit breakers, cables...), the manufacturers were usually related to the activity of electricity production and distribution. Separating the operator from the manufacturers, the nationalization of 1946 shocked the leadership of the industrial sector. EDF took over the definition of technical standards (including for voltage lines), organized research policies, built laboratories and put them available for industrial trials. In few years, manufacturers became nearly subcontractors, and lost their capacity to define equipments. The electricity sector was reorganized by the public authority with the consolidation of national industrial. The nuclear program increased this configuration during two decades. Then, in the mid-70s EDF failed to impose two suppliers for each market and had to deal with the monopoly of Framatome for the construction of reactors, and the monopoly of Alsthom for turbogenerator. In the 1980s, a slow movement of industrial concentration at European level was engaged. The innovation process was reintroduced in the manufacturing companies.