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TO REBUILD FRANCE AFTER WW2: THE BEGINNINGS OF ELECTRICITE DE FRANCE (1946-1953)

Introduction:

After the WW2, it was necessary to rebuilt France¹. There were two strategies:

1/ to act immediately in favour of the destroyed cities thanks the creation of the new Ministère de la Reconstruction et de l'Urbanisme (Ministry of the Reconstruction and Town Planning);

2/to give priority to the productive sectors: infrastructures of transports and of energy, basic industries. French governments of this period, the one of General de Gaulle (to January 1946), then these ones of the "Tripartisme"² opted in favour of the second strategy. It the case with the De Gaulle's government and after, especially thanks a strong policy of nationalizations³.

Nationalizations constituted a challenge⁴, in particular in the electricity sector, with the creation, in April 8, 1946, of Électricité de France (EDF)⁵. The difficulties were particularly important⁶. On all the French territory, EDF, the new company must to assure, production, transport and distribution. Well, before the nationalization, the production was furnished by 86 steam power plants and 300 hydro-electrical power stations, respectively depending of 54 and

¹ Barjot (Dominique) (eds.), « La reconstruction économique de l'Europe 1945-1953 », HES, n° 2, 1999 ; Barjot (Dominique), Baudouï (R.), Voldman (D.), *Les Reconstructions en Europe (1945-1949)*, Paris, Editions Complexe, 1997.

² Founded on an alliance between the Christian Democratic Party (Mouvement Républicain Populaire), Socialists (Parti Socialiste SFIO) and Communists (Parti Communiste Français).

³ Andrieu (Claire), Le Van (Lucette), Prost (Antoine), (eds.), *Les Nationalisations de la Libération. De l'utopie au compromis*, Paris, FNSP, 1987.

⁴ Barjot (Dominique), « Les nationalisations de la Libération », in Stoffaes (C.), (eds.), *Psychanalyse de l'antilibéralisme. Les Français ont-ils raison d'avoir peur ?*, Paris, Editions Saint-Simon, IDHI, 2006, p. 146-156 ; Machelon (Jean-Pierre), « L'idée de nationalisation en France de 1840 à 1914 », in Administration et contrôle de l'économie, Genève, Droz, 1985, p. 1-46 ; Morsel (Henri), « Réflexions sur la nationalisation de l'électricité », in Lévy-Leboyer (Maurice), Morsel (Henri), (eds.), *Histoire de l'électricité en France. Tome 2 - 1919-1946*, Paris, Fayard, 1994, p. 1334-1354.

⁵ Barjot (Dominique), Morsel (Henri), « Introduction générale », in Barjot (Dominique), Badel (Laurence), Morsel (Henri) (eds.), *La nationalisation de l'électricité en France. Nécessité technique ou logique politique ?*, PUF, 1996, p. 7-22. See also : Bouthillier (Georges), *La nationalisation du gaz et de l'électricité en France (loi du 8 avril 1946). Acteurs et processus : contributions à l'étude des décisions politiques*, thesis, Paris, FNSP, 1968.

⁶ Beltran (Alain), Picard (Jean-François), « EDF pour la modernisation » in Andrieu (Claire), Le Van (Lucette), Prost (Antoine), (eds.), *Les Nationalisations de la Libération, op. cit.*, p. 330-338 ; Lévy-Leboyer (Maurice), « Une réussite inachevée, 1919-1946 », in Lévy-Leboyer (Maurice), Morsel (Henri), (eds.), *Histoire de l'électricité en France. Tome 2, op. cit.*, p. 1357-1370 ; Picard (Jean-François), Beltran (Alain), Bungener (Martine), eds, *Histoire de l'EDF. Comment se sont prises les décisions de 1946 à nos jours*, Paris, Dunod, 1985, p. 1-10 and 23-40.

100 private firms, the transport networks were depending of 86 companies. The electricity distribution was realized by 1150 enterprises, generally on the regime of municipal concessions. More, because the war damages and a general lack of investments, the actual equipments were become insufficient. Consequently the difficulties were most important for electricity that for railways (an oligopolistic sector in 1937), for banks (thanks to the nationalization of the Banque de France) or even for coal mining sector.

Therefore, on the end of the reconstruction process, in 1953, EDF was really a successful enterprise⁷. Thanks a rapidly and regularly growing demand (+ 10 % by year in average and in constant francs), but the also the priority given by the French Monnet Plan⁸ and, too, the American funds of the Marshall Plan⁹, the economic performances of the new public enterprise were impressive. Subsequently, 1953 constituted a turning point. After a period of priority to investments, it was necessary to adapt the strategy of the company: it was necessary to search productivity gains for to assure both the long term development of the firm (firstly in financial terms) and to continue to respond to the demand of a rapidly modernizing France.

Nevertheless, this success remained fragile. Between 1946 and 1953, EDF knew a quick growth, but financed by massive indebtedness (I). The spectacular performances of the company were pulled by demand, according to the famous “law of the doubling in ten years”. Concerning primary inputs, labour and capital, two tendencies appeared: rapid productivity gains and a bias in favour of capital. But EDF remained characterized by a fragile financial structure. Indeed, long- and medium debts dominated this one. Consequently EDF suffered of a relatively weak profitability. The period was opposing two phases (II). During a first period, from 1946 to 1949, the absolute priority was to mobilize EDF for the reconstruction. The impact of the nationalization was decisive: facing an immense task, EDF defined four priorities. Thanks this ones, the company knew a rapid take-off, pulled by demand. Its demand appeared all the stronger because, in 1946, did exist a French backwardness as far as electric consumption by capita. Its result was a strong effort in order to catching up. The years 1950-1953 constituted a second phase, characterized by a progressive return to normality –i.e. the pre-war situation-. The change was progressive: a tangible inflexion in 1950 and 1951, then a new policy, in 1952-1953, even if the reality had its limits.

⁷ Beltran (Alain), “Competitiveness and Electricity: Electricité de France since 1946”, in Aspay (William), *Technological competitiveness*, New York, IEEE Press, p. 313-325. Chick (Martin), *Electricity and Energy Policy in Britain, France and the United States since 1945*, Chetelham, UK, Northampton, MA, USA, 2007.

⁸ Bungener (Martine), « L'électricité et les trois premiers plans : une symbiose réussie » in Rousso (Henri), *De Monnet à Massé*, Paris, Ed. du CNRS, 1986, p. 107-126.

⁹ Bossuat (Gérard), « Les entreprises publiques dans le Plan Marshall », in Barjot (Dominique), Badel (L.), Morsel (H.) (eds.), *La nationalisation de l'électricité en France, op. cit.*, p. 343-370

1/ A QUICK GROWTH FINANCED BY MASSIVE INDEBTEDNESS

Between 1946 and 1953, Électricité de France knew a strong growth, but at the price of a fragile structure.

1.1/ A strong growth

EDF was characterized by spectacular performances, thanks a rapid growth of demand, but also productivity gains and a massive investment effort.

A/ spectacular performances

During the period, EDF increased rapidly her gross sales:

Table 1 – **The performances of EDF (1946-1953) by period**

(Annual average growth rates, in % and constant francs)

	1946-53	1946-49	1949-53
Gross sales	+ 13.6	+ 21.1	+ 7.9
Gross operating profit	+ 17.5	+ 8.5	+ 24.2
Net operating profit	- 3.9	- 15.2	+ 4.6

Source: EDF Annual Reports.

At the same time, the gross operating profit grew more quickly than gross sales. It was the consequence of a boom of amortization effort. Subsequently, the net operating profit was decreasing. The growth of the company was not really profitable. Nevertheless, there was a change from 1949-50. Before, gross sales grew extremely quick on the contrary of gross operating profit (positive increase) and, above also, net operating profit (spectacular fall). After 1949, gross sales slowed, but gross operating profit speeded up and net operating profit knew a sustained positive growth. Indubitably, concerning EDF, the turning point of 1950 marked a change in the model of growth.

B/ A growth pulled by demand

The most important reason of this change and, more largely, of quick growth was that demand increased strongly and regularly¹⁰. From 1910 to 1949, measured in kWh, the

¹⁰ Morsel (Henri), « le temps de la demande », in Morsel (Henri), (eds.), *Histoire de l'électricité en France, Tome 3 1946-1987*, Paris, Fayard, 1996, p. 183-202.

consumption grew of 10% by year in average¹¹. More precisely, by comparison with 1938, last normal year before WW2, the consumption raised of 28 % in 1947, of 45 % in 1949¹². It surpassed the increase of French industrial production, even if electricity suffered of measures of quota system and power cut. It was obtained with limited inputs, just a few superior to 1938 (+ 30 % to + 40 %). If the consumption had risen of 10 % in 1948, during the year 1949, on the contrary, the progress became very limited (+ 2%). Indeed, 1949 constituted an exceptionally dry year. Subsequently, EDF must drastically limit consumption. Resulted a fall of the hydraulic production (- 2.5 %), partly made up by thermic production (+ 34 %).

From 1950, the growth rate of the consumption came back to the level of long period: + 8 % (i.e. + 58 % since 1938)¹³. It was favoured by a return to the balance between hydroelectric and thermic productions. Indeed, the hydraulicity¹⁴ was characterized by a better distribution between the three production countries (Alps, Pyrenees, and Massif Central) and returned to a high level (+ 40 % compared to 1949, but around + 10 % to 1947-49). The coefficient of filling of cask dams was very superior to the level of 1949. Finally the flows were regular and frequently superior to average. The situation remained excellent in 1951¹⁵. The apparent consumption¹⁶ grew from + 14.7 % (+ 82 % compared to 1938). The consumption surplus was entirely covered by an increase of the hydroelectric production (+ 30 %), thanks the better coefficient of hydraulicity since 1936. On the contrary, the thermic production remained stable, assuring always a regulating role.

In 1952, the growth of the consumption slowed (+ 6.4 %, but + 22 % compared to 1950). Even if the coefficient of hydraulicity decreased, both hydroelectric and thermic production, thanks the filling of new hydroelectric power plants and the reinforcement of a number of steam power plants. In spite of the spectacular slowing down of the demand which characterized 1953, since 1950, the demand grew of + 24 %, confirming the reality of the doubling in ten years¹⁷. A modest progress of the thermic production and the development of the interconnection network 225 kV made up for a weak decrease of the hydraulic production (always superior to 50 % of the total).

¹¹ *Electricité de France, Rapport de gestion des exercices 1946-1947-1948-1949*, p. 20.

¹² *Electricité de France, Rapport de gestion, op. cit.*, p. 21.

¹³ *Electricité de France, Compte de gestion et rapport d'activité, exercice 1950*, p. 28.

¹⁴ The coefficient of hydraulicity of a defined area and of a specific fitting is the ratio between the productibility of this fitting, during the considered period, and its average productibility in a long term period.

¹⁵ *Electricité de France, Compte de gestion et rapport d'activité, exercice 1951*, p. 29-30.

¹⁶ Including real consumption + losses (in lines).

¹⁷ *Electricité de France, Compte de gestion et rapport d'activité, exercice 1953*, p. 12.

C/ The primary inputs: labour and capital

Indeed, EDF combined important productivity gains and capital intensive growth.

1°/ Labour: a growth founded on productivity gains

From 1946 to 1953, the labour force of EDF grew very slowly. Subsequently the labour productivity gains were spectacular:

Table 2 – A growth based on rapid labour productivity gains

(Annual average growth rates in %)

	1946-53	1946-49	1949-53
Annual employed workforce	+ 1	+ 0.5	+ 1.3
Annual labour productivity gains	+ 12.6	+ 20.6	+ 6.6

Source: EDF Annual Reports.

It was true to 1949, but, after, the productivity gains concerned also the manpower employed on the building sites by contractors and constructors.

Table 3 – Evolution of the manpower employed on the building sites of EDF

from 1947 to 1953

January 1947	23,000
October 1947	45,000
December 1949	46,000
July 1950	40,000
May 1951	33,000
June 1952	28,500
December 1953	13,100

Source: EDF Annual Reports.

In a first step, from nationalization to October 1947, the number of workers grew spectacularly (+ 95.7 %), largely because it was necessary to German war prisoners and to recruit Italian immigrants. But, from this date, the total strength diminished, in spite of an annual cycle, characteristic of an annual curve of activity on the hydroelectric building cycles: minimum of manpower employment in winter, maximum in summer.

The counterpart of this research of productivity gains was an active social policy within the company¹⁸. The nationalization had met in EDF and Gaz de France (GDF)¹⁹ around 108,000 agents. Because the nationalized companies were characterized by a large disparity of personnel statutes, the act of the April, 8 1946, then the ministerial decree of June, 23 1946 had instituted a national statute of employees, which was common at gas and electricity²⁰. Subsequently, was engaged a progressive process of reclassification of employees. Benefitting of the increase of wages decided by the government, these employees had obtained the creation of inclusive allowances. But the consequence was a flattening of wages hierarchies.

The statute had generated a specific system of social security. Based on permanent consultation between the general management and a Conseil Central des Oeuvres Sociales or CCOS (Welfare Activities General Council), this system included family allowances paid by EDF and GDF), health care and other welfare benefits²¹. But, firstly, it was necessary to unify and harmonize the previous systems. These complex operations were achieved in December 31, 1949: at this date, thanks to an appeal to mecanography, 42,000 dossiers of pensions were treated. The nationalization had instituted, in 1947, a number of Comités d'Hygiène et de Sécurité (Hygiene and Security Committees) and, in 1948, Comités Mixtes à la Production (Mixed Committees to Production). Nevertheless, the most important was the Welfare Activities General Council. Indeed, the welfare activities management escaped to the EDF board directors. Defined by the Act of April 8, 1946, the financing of CCOS was guaranteed by a levy of 1% on gross sales of EDF and, from the decree of October 7, 1948, because enforceable by decision of the government representative.

From the beginnings of EDF, the company developed an active policy of industrial training²². This was founded on an effort in favour of apprenticeship, including the functioning of five apprenticeship centres, apprenticeship workshops in a number of power stations. EDF favoured also refresher courses and the workers promotion, using notably of recent psycho-technical methods (based on testes practices). In 1953, this policy appeared as an important success: 250 apprentices in 1946, 733 in 1953; around 2,000 workers suiting refresher courses in 1949, 4,633 in 1953. Above all, EDF produced a strong effort in favour of growing security: from 1949 to 1953, the number of death industrial injuries decreased of 25 %. At the same time,

¹⁸ *Electricité de France, Rapport de gestion des exercices 1946-1947-1948-1949*, p. 99-107. Dreyfus (Michel), « Les activités sociales et culturelles à l'E.D.F.-G.D.F. », in Morsel (Henri), (eds.), *Histoire de l'électricité en France. Tome 3, op. cit.*, p. 255-315.

¹⁹ Beltran (Alain), Williot (Jean-Pierre), *Le Noir et le Bleu. 40 ans d'histoire de Gaz de France*, Paris, Belfond, 1992.

²⁰ Siwek-Pouydesseau (Jeanne), « L'élaboration du statut du personnel », *La nationalisation de l'électricité en France, op. cit.*, p. 413-424.

²¹ Dreyfus (Michel), « Marcel Paul et les origines du CCOS », *Ibidem*, p. 7-22

²² *Electricité de France, Compte de gestion et rapport d'activité, exercice 1953*, p. 303-314.

in favour of its employees and workers, EDF subscribed a growing number of housing to French organisms of Habitations à Loyer Modéré (HLM or Cheap Rental Housing) and offered numerous financial aids for to access at free property.

2°/ The growth: a bias in favour of capital

Between 1946 and 1953, the growth of EDF was characterized by an evident bias in favour of capital:

Table 4 – **Electricité de France: a strong level of capitalistic intensity**
(Annual average ratios in % from values in constant francs)

	1946-53	1946-49	1950-53
Ratio 1 = <u>Fixed Capital</u> Total Assets	83.3	62.1	91.8
Ratio 2 = Net <u>Productive fixed assets</u> Fixed Assets	97.2	91.2	98.8

Source: EDF Annual Reports.

Indeed, the fixed capital constituted a crushing part of the total assets in the balance sheets of EDF. More, this part grew spectacularly (from less of two thirds to around 90 %). Besides, EDF privileged almost exclusively internal growth: it was the reason of the fast total lack of other fixed assets (holding and interest in affiliated companies or subsidiaries). Consecutively, EDF invested massively, but with a relatively weak profitability and an insufficient self-financing rate:

Table 5 – **The investments strategy of Electricité de France**
(Annual average ratios in % from values in constant francs)

	1946-53	1946-49	1950-53
Ratio 3 = <u>Gross Fixed capital formation</u> Gross sales	125.6	87.9	145
Ratio 4 = <u>Gross operating profit</u> Net productive assets	4.9	7.5	4.2
Ratio 5 = <u>Net operating profit</u> Net productive assets	0.1	-1.1	0.4
Ratio 6 = <u>Gross self-financing</u> Gross fixed capital formation	17.9	18.3	17.8

Source: EDF Annual Reports.

This effort of capital formation grew strongly from 1950, because the achievement of biggest hydroelectric projects and, with the beginning of 1950s, a growing interest for to modernize and develop both steam power plants and high voltage networks. The profitability of these investments remained low and, from 1950, decreasing in terms of gross operating profit. Besides, these massive investments implied strong and increasing amortizations. It was the reason

of the extremely weak profitability in terms of net operating profit, even if, from 1950, the situation became less worrying. According to these conditions, EDF was unable to finance its investments by self-financing (always less than 20% of self-financing rate). The consequence was, for EDF, a fragile financial structure.

1.2/ A fragile financial structure

Indeed, the financial structure of EDF was dominated by long-and medium debts. It was resulting directly of a weak profitability.

A/ A financial structure dominated by long-and medium debts

Even if the financial independence became better with the time, the financing of investments was shortly dependent of the long-and medium debts like the cash surplus:

1°/ Progress of the financial independence

Logically, EDF was characterized by an acceptable level of financial independence:

Table 6 – Financial independence and long-and medium indebtedness
(Annual average ratios in % from values in constant francs)

	1946-53	1946-49	1950-53
Ratio 7 = <u>Ownership</u> Total Liabilities	44.7	27.4	51.6
Ratio 8 = <u>Long-and medium debts</u> Total Liabilities	42.1	49.5	39.2

Source: EDF Annual Reports.

There was a difference before and after 1950: almost a doubling of financial independence ratio. On the contrary, the part of long-and medium debts diminished of 10 % between the first and the second periods. Nevertheless, their importance remained considerable: around 40 % in 1950-53, 50 % in 1946-49.

2°/ The financing of investments: preponderance of the long-and medium debts

Indeed, long-and medium debts financed always the major part of investments of EDF:

Table 7 – **The financing of the investments of EDF financial structure**
(in % of the gross capital formation from data's in constant francs)

	1947-49	1950-53
Self-financing	18.3	17.8
State capital endowment	19.5	12.1
Long-and medium indebtedness	62.2	70.1

Source: EDF Annual Reports.

Self-financing furnished less than one fifth of the total. More, the state capital endowment appeared insufficient, above all since 1950. Consequently, long-and medium debts financed around two thirds of the total gross investment. Besides, this part was obviously growing.

3°/ A cash surplus closely dependent of the long-and medium indebtedness

During the period, from 1946 to 1953, EDF showed a deficit of cash:

Table 8 – **A cash surplus closely dependent of the long-and medium indebtedness** (in % of total liabilities)

	1946-53	1946-49	1950-53
1/ Net working capital = Ownership-Fixed Assets	-38.6	-34.7	-40.3
2/ Gross working capital = Ownerships + Long-and medium debts-Fixed Assets	+3.5	+14.8	-1.0

Source: EDF Annual Reports.

The net working capital was permanently negative. More, the deficit of cash grew between 1946-49 and 1950-53. It was the direct consequence of the self-financing and, also, of state capital endowment. Subsequently, a growing appeal to long-and medium indebtedness became more and more necessary. Nevertheless, it was becoming insufficient between 1950 and 1953.

B/ A weakness of the profitability

The reason appeared simple: it was the consequence of a weakness of the profitability. All indicators were confirming the same conclusion:

Table 9 – **Three indicators of profitability**

(Annual average ratios in % from dates in constant francs)

	1946-53	1946-49	1950-53
Ratio 9 = <u>Gross cash flow</u> Ownerships	8.7	11.8	8.0
Ratio 10 = <u>Gross cash flow</u> Total liabilities	3.9	3.2	4.1
Ratios 11 = <u>Net income</u> Total liabilities	-0.4	-1.7	0.2

Source: EDF Annual Reports.

The financial profitability (ratio 9) was generally modest, particularly during the years 1950 to 1953: the fall reached four points in comparison with 1946-49. Even if the level of total profitability (ratio 10) seemed weakest, the situation was becoming better after 1950 than before. The consequence was the restoration of ratio 11. With difficulties, EDF was redressing the balance of its financing.

2/ TWO DIFFERENT PERIODS

Around the turning point of 1949-50, two periods can be distinguished. The first covered the years 1946 to 1949: during this phase, the priority was to mobilize Électricité de France for reconstruction. The second, from 1952 to 1953, marked a progressive, but no easy, return to normality.

2.1/ 1946-1949 – Priority: to mobilize EDF for reconstruction

The nationalization constituted an instrument for to face emergency.

A/ A rebirth for electricity: the Nationalization Act of 1946

With the nationalization Act of April 4, 1946²³, EDF must provide on all the territory, production, transport and distribution of electric energy²⁴. It constituted a wide task²⁵. On the

²³ Machelon (Jean-Pierre), « Les modalités juridiques de la nationalisation de l'électricité : la loi du 8 avril 1946 », in Barjot (Dominique), Badel (L.), Morsel (H.) (eds.), *La nationalisation de l'électricité en France, op. cit.*, p. 393-402.

²⁴ *Electricité de France, Rapport de gestion des exercices 1946-1947-1948-1949*, p. 7-9. See : Maleville (George), « La naissance de l'Electricité de France », in Morsel (Henri), (eds.), *Histoire de l'électricité en France. Tome 3, op. cit.*, p. 35-96 ; Beltran

technical side, it was necessary to accelerate achievement of the committed works and to get off a very important equipments program. On the administrative side, EDF must to merge several hundred of electric firms. Now, each company had its conceding authorities, its personnel statute, its portfolio and its controlling or minority interest, its commercial policy, its specific methods, materials and networks. It supposed:

- (1) to submit to common rules all the transferred concerns and to diffuse rapidly identical norms;
- (2) to unify technical processes, administrative methods and accounting procedures;
- (3) to redefine price schedules with conceding authorities;
- (4) to establish a single hierarchy of functions and to meet, within the same statute, in their dozens of agents originated of several hundred of firms;

EDF must realize four essential tasks²⁶:

- (1) to exploit, i.e. to provide production, transport and distribution on all the national territory;
- (2) to fit out, i.e. both to modernize existing works and to build new fittings in order to carry and to maintain production, transport and distribution on the level of growing needs of the consumption;
- (3) to finance fitting works, in particular by loans;
- (4) to balance business revenue and expenses, thanks to a cheap management and a rational administrative organization.

B/ EDF: a rapid take-off

In May-June 1946, EDF created a Direction de l'Exploitation (Direction of industrial concern), which took in charge the works of production, transport and, provisionally, distribution²⁷.

1°/ To distribute massive quantities of electricity

Its task was difficult: both to obtain a maximum production and to apply restrictions on consumption. The consequence was the constitution, by region and during the second part of

(Alain), « La mise en place d'Electricité de France entre 1946 et 1952 : construire un service public », Barjot (Dominique), Badel (L.), Morsel (H.) (eds.), *La nationalisation de l'électricité en France, op. cit.*, p. 405-412.

²⁵ Fridenson (Patrick), « Réflexion sur les étapes de la nationalisation de l'électricité », in Barjot (Dominique), Badel (L.), Morsel (H.) (eds.), *La nationalisation de l'électricité en France, op. cit.*, p. 381-392.

²⁶ Barjot (Dominique), Lu (Ang Ang), « La nationalisation de l'électricité : chronologie », in Barjot (Dominique), Badel (L.), Morsel (H.) (eds.), *Ibidem*, p. 559-573.

²⁷ *Electricité de France, Rapport ... 1946-1949, op. cit.*, p. 7-9.

1946, of 9 groups of thermic production, 15 groups hydraulic production, 8 centres of energy transport and 8 central dispatching, coordinated by a national dispatching. Thanks this organization, EDF became able to control, at the same time and at a national level, consumption, transport and production of the electric energy in France, including exchanges with neighbouring countries²⁸. During the years 1947-1949, EDF developed its purchase to other producers, in particular the Compagnie Nationale du Rhône or CNR²⁹ (the hydroelectric power plant of Génissiat was opened in 1948) and the Charbonnages de France, which furnished electricity by their specific steam power plant. In 197-49, EDF produced 77 % of the French hydroelectric production, but only 55 % of thermic production. At the same time, the company reinforced the interconnection network (150 kV and 220 kV).

The commercial activity of EDF was dominated by two priorities. The first consisted to define a long term commercial policy, founded on the principle of non-discrimination between consumers, the research of the effective cost and the necessity of special prices. The second concerned the notices of termination of the previous agreements, the definition of new specifications. The consequence was difficult negotiations with the electrochemical and electrometallurgical industries (concerning the of furnished electricity), coal mining, steel and iron industries, protected industries (mineral chemistry, cement) and Société Nationale des Chemins de Fer (SNCF). EDF took also in charge the commercial exchanges with Swiss and Germany (exports to France), Italy (import of France) and Belgium (seasonal exchanges). But the company suffered of an insufficient increase of electricity price: from 1938 to 1949, the industrial prices multiplied by 21 and the electricity price by 14.9.

Particularly difficult was the organization of distribution³⁰. Indeed, before the nationalization, 708 firms benefitted of concessions. Facing the waste, EDF reorganized the sector in two phases: constitution, in April 1947, of a first network around a group of about 40 dominant companies, in charge to merge with the others firms; at the end of 1948, formation of 25 regions coordinating 100 distribution centres, with 3 or 4 subdivisions by centre. This system of distribution must execute the decisions of power quotas and cuts, but also invoice and cash late payment charges. Nevertheless, the number of rates was growing: in December 1949, 13.6 millions, essentially in low tensions. At the same time, EDF developed good relations with

²⁸ *Ibidem*, p. 27-33.

²⁹ Giandou (Alexandre), *La Compagnie Nationale du Rhône (1933-1998). Histoire d'un partenaire régional de l'Etat*, Grenoble, PUG, 1999.

³⁰ *Electricité de France, Rapport ... 1946-1949, op. cit.*, p. 33-40. See: Loubaton (Marcel), Lescaut (François), « L'évolution des ouvrages de production d'énergie et des chantiers d'EDF », *Le Moniteur des Travaux publics et du bâtiment*, July 13, 1968, n° 28, p. 17-32.

conceding authorities³¹. It was really necessary, because, from 1947 to 1949, EDF gave an absolute priority to build production and transport works. Subsequently, France accumulated an important backwardness concerning modernisation and development of distribution networks. Nevertheless, the company developed a considerable effort in favour of mecanography: in 19149, EDF benefitted of 25 workshops of mecanographic receipting (17 in 1945).

2°/ To build up dams and power stations

In 1945, France had the same production capacity than in 1939, because the new power stations built during the war balanced scarcely the war destructions³². Consequently, at the beginning of 1946, the Commission de Modernisation de l'Électricité (Electricity Modernizing Commission) of the Monnet Plan defined the consumption needs to 1951 and studied how to respond to the future demand. The task of the Direction de l'Équipement (Facilities Department) consisted to pursuit the works begun before the nationalization and to open an important number of new building sites. The Direction de l'Équipement included region of hydraulic facilities, 4 regions of thermic facilities and 1 region of transport networks. In autumn 1946, was constituted one staff including specialists and different services (works, markets, construction, administration and projects). The challenge appeared difficult, because a lack of labour force (*vide supra*) and materials. It was the reason why EDF gave its guarantee to loans obtained by contractors to Comptoir Central du Matériel d'Entreprises (Central Bank for Public Works Materials)³³, aided to obtain dollars in order to imports of US materials (earthworks materials) and modernize enterprises³⁴.

The results were impressive: a spectacular increase of perforation works (84,240m in 1949, only 39,000 in 1947), of earthworks volumes (6.9millions of m3 in 1949, compared to 1.7 in 1947) and of the cubes of reinforced concrete executed (1.055millions, 0.526 in 1947). Thanks this strong effort of investment and a progressive change in the procedure of the drawing up of public procurements. The result was a multiplication by 2.1 of the electricity production (29

³¹ Kelhetter (René), « Les collectivités locales et leurs élus », in Barjot (Dominique), Badel (Laurence, Morsel (Henri) (eds.), *La nationalisation de l'électricité en France*, *op. cit.*, p. 337-342

³² *Electricité de France, Rapport ... 1946-1949*, *op. cit.*, p. 41-48. See : Banal (Michel), « L'équipement électrique de la France à la Libération », in Morsel (Henri), (eds.), *Histoire de l'électricité en France*, *op. cit.*, p. 97-167.

³³ Barjot (Dominique), « L'industrie française des travaux publics face à la reconstruction. L'impact du Plan Marshall », in Girault (R.) et Lévy-Leboyer (M.), *Le Plan Marshall et le relèvement économique de l'Europe*, Paris, Comité pour l'Histoire économique et financière, 1991, p. 265-282.

³⁴ Barjot (Dominique), "Catching up with America: The Story of Productivity Missions in the French Public Works Industry after the Second World War", Barjot (Dominique) (dir.), *Catching up with America. Productivity missions and the diffusion of American Economic and Technological Influence after the Second World War*, Presses de l'Université de Paris-Sorbonne, 2002, p. 359-385.

milliards kWh in 1946 to 623 in 1949) and a rapid development of the transport capacity, particularly in very high voltage (220kV).

3°/ EDF facing to the future: research and aid to development

EDF invested also in R&D, thanks its Direction des Études et Recherches³⁵. The first priority was networks. Concerning transport, EDF introduced, at the beginning of 1949, an US desk calculator using alternating current for to obtain a better control of energy movements. At the same time, the company experienced the first 500kV high voltage line and prepared the passage to the 380kV norm on the Swedish model. In the shorter time, EDF developed rapidly the first doubling of a 220kV line between the Massif Central and Paris. Thanks its laboratory of Ivry-sur-Seine, used by the Commissariat à l'Énergie Atomique, (French Nuclear Energy Commissariat) and its testing station of Fontenay-les-Roses, EDF worked actively to unify tensions and to develop capacity of low voltage networks.

Nevertheless, EDF pursued its effort in favour of energy production. It was the case with gas turbine. The company set up two models: the first, using the classical technology of the closed cycle at Saint-Denis steam power station; the second, totally experimental, at Reims and provided of the open cycle. At the same time, the national laboratory of hydraulic of Chatou used scaled down models to experiment new types of dams or hydraulic equipments. The company did explore above all new sources of energy. The most important project, because economically profitable, was the tidal power station of La Rance river, with the long term perspective to harness the bay of the Saint-Michel Mount. Already, EDF studied wind engine for to produce electricity, but the costs remained too high.

Since spring 1947, the board of directors of the Fonds d'Investissement et de Développement Économique et Social (FIDES) des Territoires d'Outre-mer (Economic and Social Development Funds of Overseas Territories) entrusted to EDF missions of electrification of the Overseas Departments and Territories³⁶. The company constituted a Service des Études d'Outre-Mer (SEOM or Overseas Studies Service). EDF obtained delegations close to administrations of Afrique Occidentale Française (AOF), La Réunion and La Guadeloupe, Annam and Tonkin. Above all, the Act of April 30, 1946 on Overseas Territories Equipment created specific Sociétés d'Économie Mixte (SEM, i.e. semi-public companies). In 1949, three were constituted: Énergie Électrique du Cameroun (March 1948), for to build the hydroelectric

³⁵ *Électricité de France, Rapport ... 1946-1949, op. cit.*, p. 51-56. See: Ramunni (Girolamo), « Hommes, sociétés savantes et groupements professionnels », in Morsel (Henri), (eds.), *Histoire de l'électricité en France. Tome 3, op. cit.*, p. 205-214.

³⁶ *Électricité de France, Rapport ... 1946-1949, op. cit.*, p. 59-61.

power station of Edéa; *Énergie Électrique de l'Afrique Équatoriale Française*, for to realize this one of Djoué and to electrify Fort-Lamy (December 1948); *Énergie Électrique de la Réunion* (October 1949). Subsidized by the FIDES, these SEM benefitted of loans of the Caisse Centrale de la France d'Outre-Mer (Central Bank of the Overseas France). EDF was also present at the international level, participations at the different international organizations of electricity³⁷ and practicing technical exchanges with Italian companies and the British Electricity Authority.

C/ Backwardness and catching up

Since 1946, EDF knew a quick growth. It was the consequence of the necessity to catching up with other developed nations³⁸.

1°/ France: an insufficient level of electrification

In 1948-49, France appeared under-equipped in comparison with the biggest economic power. France consumed in annual average only 140 kWh per capita. It was lowest compared to UK (390kWh), USA (540kWh) and Swiss (690kWh). France had suffered of the slowing up resulting of the WW2. Consequently, EDF diminished regularly the calorific performance of the steam power stations and accelerated the activity of building sites. Works reached their maximum output as early as the first part of 1947. In 1950, the balance was reestablished between production and demand. It supposed four conditions: the existence of relatively favourable natural conditions, the mobilization of a motivated personnel, the mobilization of a motivated personnel, the existence of an electricity price permitting a financial balance and a relatively satisfactory.

2°/ EDF: a necessary indebtedness

But the selling price of electricity remained too low: since 1938, this price multiplied by 12. It was insufficient, because the financial equilibrium supposed a multiplication by 15. Consequently the financing (with the condition of a multiplication by 15), by the State, because the electric power stations and networks were become the property of the Nation, and by indebtedness. In 1949, the financing of EDF was ensured by banking loans, (or cash advances), by the Fonds de Modernisation et d'Équipement or FME (Modernizing and Equipment Funds),

³⁷ World Conference of Energy; International Union of Producers Energy and Distributors of Electricity; International Conference of the Large Electric Networks.

³⁸ « Conclusions générales », in *Électricité de France, Rapport ... 1946-1949, op. cit.*, p. 161-167.

above all the counterpart of the US Aid and, in a tiny measure, by cash³⁹. Therefore, this cash would be higher, if EDF did not cover temporarily the deficit of GDF.

2.2/ 1950-1953 – Progressive return to normality

From 1950, Électricité de France operated a progressive return to normality. It was realized in two steps: a tangible inflexion in 1950-51, then definition of a new policy, with its realities, but also its limits.

A/ 1950-1951- A tangible inflexion

1950 saw the end of the exceptional dryness, which had characterized 1949⁴⁰. More, the restrictions on consumption ended after ten years of scarcity.

1°/ An easier financing

In spite of a rapid growth of demand during autumn 1950, EDF maintained a balance between demand and supply, benefitting of the return to an average hydraulicity. In order to finance new power stations, EDF launched a long term loan, consisting in bonds repayable in 30 years with a progressive interest and redemption premium: it was more interesting for EDF than the bonds repayable in 5 years emitted in 1949. These new resources authorized EDF to cover expenses of investments, to reimburse the receivable part of banking loans to medium term concluded before 1948 in order to finance establishment expenses. Subsequently, EDF benefitted now of larger banking facilities. At the same time, the company realized a number of studies and introduced measures in order to improve management: cutting down of general expenses improvement and modification of the rules concerning the settlement of public markets, progressive revision of contracts.

1951 constituted an excellent financial year⁴¹. The introducing into service of new installations marked the progressive achievement of the Monnet Plan: it was true for hydroelectric plants (+ 1.5 billions of kWh), but also steam power stations. The financing of investments was partly covered by an important contribution of FME:

³⁹ Feiertag (Olivier), « Les conditions financières de la reconstruction : le cas de l'électricité à la Libération (1944-1947), in Barjot (Dominique), Badel (L.), Morsel (H.) (eds.), *La nationalisation de l'électricité en France, op. cit.*, p. 45-60.

⁴⁰ *Electricité de France, Compte de gestion et rapport d'activité, exercice 1950*, p. 7-21.

⁴¹ *Electricité de France, Compte de gestion et rapport d'activité, exercice 1951*, p. 7-8 and p. 67.

Table 10 – **Financing of investment expenses of EDF in 1951** (in current francs and in % of total)

	In billions of francs	In %
Loans of FME	77.4	63.0
EDF bonds 1951 5%	12.4	10.1
Loans of Caisse des Dépôts et Consignations	7.0	5.7
Banking loans (medium term)	8.3	6.8
EDF cash	17.7	14.4
Total	122.8	100

Source: EDF Annual Reports.

If the company remained shortly depending of the FME, the novelty was its capacity to collect specific resources (around 25 %) and to reduce its banking dependence.

2°/ EDF: a symbol of the rebirth of France

Even if EDF did not benefit of an efficient indexation of the electricity prices, the company pursued important commercial negotiations with different partners⁴²: progressive suppression of the specific advantages of protected making, thanks in particular new agreements with electrochemistry and electrometallurgy; introduction into service of new steam power stations by Charbonnages de France; agreements steel and iron industrialists of Lorraine concerning exchanges of energy; above all, transfers by SNCF, in March 1951, of all its transport network to EDF. More, in 1951, Électricité de France did conclude important agreements with the Compagnie Nationale du Rhône (CNR), about the two electric plants of Génissiat and Seyssel, with Electricité de Strasbourg and about Saarland. At the same time, the French Commissariat Général du Plan (Planning General Commissaryship) authorized the company to launch a new program in order to modernize and reinforce steam power stations (Arrighi in Paris, Nantes-Cheviré, Creil) and to harness the Rhine (Fessenheim) and the Durance (Serre-Ponçon and Jonques)⁴³.

It was a necessity because EDF achieved in 1951 a number of very important projects⁴⁴. The perforation works were declining rapidly with the end of big works of Montpezat, Pragnères and Isère-Arc. The same evolution characterized also earthworks volumes, because the finishing of the hydroelectric plant of Ottmarsheim upon Rhine. On the contrary, the cubes of reinforced concrete increased spectacularly, because the maximum activity of four enormous building sites:

⁴² EDF, *Compte de gestion...1951, op. cit.*, p.43-46.

⁴³ *Ibidem*, p. 55-56.

⁴⁴ *Ibid.*, p. 53-54.

Ottmarsheim, the dams of Cap-de-Long, Bort-les-Orgues and, above all, Tignes. Indeed, Tignes constituted, at this time, the highest dam in Europe (160m). On this site, EDF obtained record performances (3,700 m³ of concrete by day). Tignes symbolized the rebirth of France...to the profit of the EDF's image⁴⁵, in spite of a few number of resistances⁴⁶.

Electricité de France did continue to invest in R&D⁴⁷. The testing station of Fontenay worked about short circuits and the effects of thunderbolt. The national laboratory of Chatou pursued actively studies of the future tidal power of La Rance. This one, now, can reach comparative costs with hydroelectric plants. Consequently, EDF obtained that the demand of concession could be submit to inquiry of public utilities. Under the impulse of Albert Caquot, a famous French engineer, it became possible to study the gigantic tidal power program of Chausey Island. In parallel, EDF continued to work about the gas turbine: now the superiority of the open cycle appeared as an evidence.

EDF furnished always an important aid to the Ministère de la France d'Outre-mer (French Overseas Ministry)⁴⁸. The SEOM realized missions of study in AEF, AOF, La Réunion, La Guadeloupe and Cameroun. EDF achieved also important projects for Annam (Dahim falls), Tonkin (steam power station of Campha-Port) and Tunisia (hydroelectric plants of Nébeur and Taulierville, interconnection network to Algeria). In the same period, appeared new semi-public companies: Énergie Électrique de Guinée (hydroelectric plants of Grandes Chutes and of the Konkouré), Énergie Électrique d'Afrique Occidentale Française (steam power station of Bamako), Société de Production et de Distribution d'Électricité de Guadeloupe. The international relations service of EDF developed very well its activities, sending regularly missions of experts to foreign countries, in particular in view of to respond to the Technical Assistance Bureau of the United Nations. At least, EDF cooperated with Swiss, Belgian, Italian, Spanish (Iberduero) and, above all, German (RWE⁴⁹)⁵⁰. Finally, EDF had reestablished its economic position. Nevertheless, new problems appeared, with the declining financing by FME and the rapid increase of the electricity consumption. How to finance the pursuit of the growth of the firm?

⁴⁵ Varaschin (Denis), *Tignes. La naissance d'un géant*, Arras, Artois Presses Université, 2001.

⁴⁶ Bodon (Valérie), *La modernité au village. Tignes, Savines, Ubaye...La submersion des communes rurales au nom de l'intérêt général 1920-1970*, Grenoble, PUG, 2003.

⁴⁷ EDF, *Compte de gestion...1951, op. cit.*, p. 57-59.

⁴⁸ *Ibidem*, p. 59-60.

⁴⁹ Rheinisch Westfälisches Elektrizitätswerk.

⁵⁰ *Electricité de France, Compte de gestion 1951, op. cit.*, p. 47.

B/ 1952-1953- Realities and limits of a new policy

1952 introduced important changes. The first resulted of the definitive parting with Gaz de France, realized at the January 1, 1952⁵¹. It was particularly significant in terms of personnel: at this date, the workforce of GDF represented 47.6 % of this of EDF. The financial consequences were also important. Because the Act of August 29, 1952 separated completely the two accountings, EDF benefitted of this in terms of cash⁵². The second concerned the composition of the board of directors: a succession of decrees reduced the number of seats from 18 to 12 (then 15 in 1953) and named new directors⁵³. The nominations were largely inspired by political considerations. The government and, in particular, the Ministry of Industry, Jean-Marie Louvel (MRP), wished to reduce drastically the communist influence: it was the reason of the appointment, for example, of Albert Caquot, Bernard Clappier, Directeur des Relations Économiques Extérieures (International Economic Relations), Gilbert Devaux, Directeur de la Comptabilité Publique (Public Accounts) or, above all, Ambroise Roux, engineer of Ponts et Chaussées, and director of the J.M. Louvel's department staff. These measures seemed to announce a new political line.

1°/ 1952-Growing difficulties for to finance investments

The third change resulted of the present economic situation⁵⁴. In 1952, were achieved and brought put into service the most important dams and hydroelectric plants: Ottmarsheim, Bort, Brévières-Malgovert. More, there were launched any new hydroelectric works, because the lack of budget appropriations. Indeed EDF knew a surplus of revenues, but it constituted the direct consequence of a highest hydraulicity, permitting the employment of the existing power stations, of the raising up of electricity prices and a resistible reducing of general expenses. But, this surplus remained insufficient. The Second Plan seemed to define modest purposes and the first authorized works began very slowly. The most important difficulties resulted of the weakness of the financing means. In spite of two balance sheets reassessments (decrees of March 27, 1949 and February 18, 1952), investment expenses were hardly financed⁵⁵:

⁵¹ *Electricité de France, Compte de gestion et rapport d'activité, exercice 1952*, p. 70.

⁵² *Ibidem*, p. 8, 63 and 66.

⁵³ *Ibid.*, p. 8.

⁵⁴ *Ibid.*, p. 73-74.

⁵⁵ *Ibid.*, p. 69-70.

Table 11 – **The financing of investment expenses of EDF in 1952** (in current francs and in % of total)

	In billions of francs	In %
Loans of FME	64.4	49.4
EDF bonds 1952	17.0	13
Banking loans	16.0	12.3
Diverse participations (15)	10.1	7.7
EDF Cash	23	17.6
Total	130.5	100

Source: EDF Annual Reports.

EDF remained always shortly depending of the financing of the FME⁵⁶. It involved a structural fragility, because the loans of FME declined regularly from 1950: 51 billions of francs in 1950 to 64.4 in 1952. In these circumstances, the logic consisted to turn to the financial market (medium-and long term bonds, parts of production, *etc.*). Between 1949 and 1952, the company had floated around 70 billions of francs. But it did not suffice, leading necessary to increase banking loans at medium terms (23 billions of francs in 1952 compared to 8.3 in 1951) and also, at short term (14.9 billions of francs in 1952, 11.9 in 1949). The lack of self-financing constituted a key problem, largely because there was not an indexation scheme in favour electricity.

Nevertheless, EDF continued its commercial action⁵⁷: revision of contracts, definition of specifications, negotiations concerning an indexation scheme, discussions with industrial partners (agreements with the Régie Nationale des Usines Renault, Commentry-Fourchambault et Decazeville and Pont-à-Mousson) or other French (CNR, SNCF, Charbonnages de France, *etc.*) or Foreign (RWE, CIELI⁵⁸), increase of consumers (14.4 millions for low voltage in 1952, 14.1 in 1951), agreements with conceding authorities (Department of La Vienne, Cities of Toulouse and Colmar), unification of the frequency (Marseille, Nice), rationalization of EDF's real estate, development of mecanography (38 workshops in 1952) and security. In the same time, the procedures of indemnification of previous companies realized decisive progress: in 1952, the Caisse Nationale de l'Énergie had issued 82 billions of francs of bonds. Progressively, there was a return to normality.

⁵⁶ *Ibid.*, p. 74-75.

⁵⁷ *Ibid.*, p. 74-75.

⁵⁸ *Compania Imprese Elettriche Liguria.*

2° / 1953-The end of a cycle

1953 marked probably the end of a cycle, the first of the recent history of EDF. This opinion of the board of directors confirmed this analysis⁵⁹. In spite of a slowing up of the electricity demand, EDF knew a weak progress of its gross sales (+ 2 %), but thanks the progress of the low voltage (+ 6 % for 14.7 millions of consumers instead + 1 % in high voltage)⁶⁰. If the company did sign new agreements with Swiss concerning imports of electricity plant of Le Châtelot), electricity price was left unchanged. More, EDF agreed, on an express demand of the government, to reduce certain prices of 10% during winter 1953-54. On the social side, the number of employees remained stable. It was the case for the wages also⁶¹. Therefore, EDF knew a number of difficulties strikes during the first semester or in August 1953, scarcity of skilled workers⁶². Nevertheless, the company maintained its ambitious social policy, in particular concerning industrial training or social housing.

This policy constituted a necessity. Indeed, EDF finished the totality of the thermic program defined by the Monnet Plan: introducing into service of the steam power plants Arrighi and Saint-Denis near Paris, and Nantes-Cheviré⁶³. Concerning the hydroelectric building site, activity declined spectacularly. Besides, the financing remained difficult, in spite of the progress of the part of the financial market:

Table 12 – **The financing of investment expenses of EDF in 1953** (in current francs and in % of total)

	In billions of francs	In %
Loans of FME	49.1	38.3
EDF bonds (parts de production) 1953	24.5	19.8
Banking loans (at medium term)	27.5	21.5
Ownerships	26.8	21.0
(including War damages)	(1.2)	(0.9)
Total	127.9	100

Source: EDF Annual Reports.

⁵⁹ *Electricité de France, Compte de gestion et rapport d'activité, exercice 1953*, p. 21.

⁶⁰ *Electricité de France, Compte de gestion 1953, op. cit.*, p. 11-13.

⁶¹ *Ibidem*, p. 14-15.

⁶² Dreyfus (Michel), « Les luttes sociales à l'EDF-GDF de la Libération à nos jours », in Morsel (Henri), (eds.), *Histoire de l'électricité en France. Tome 3, op. cit.*, p. 215-245.

⁶³ *Electricité de France, Compte de gestion 1953, op. cit.*, p. 15-17.

Indeed, the contributions of FME decreased strongly, falling under 50 % of total resources. Consequently, EDF must to develop the part of the financial market, benefitting of a constant progress of the personal savings. A second way consisted to increase banking loans at medium-and long terms. It was relatively easy, but dangerous, because the growth of long-and medium terms indebtedness generated growing financial charges. In spite of a net diminution of the part of long-and medium debts within the total liabilities (14 % in 1953, 23 % in 1952), these financial charges led to operating losses (after amortization)⁶⁴. Although a tardive state capital endowment (Act of December 31, 1953), the financing by cash supposed to use banking short term indebtedness. The solution existed: to raise electricity prices so as to catch with the general index of prices and, in a second step, to practice an indexation on this general index⁶⁵. It was become very necessary, all the more so since the operations of indemnification of previous shareholders were finishing⁶⁶.

At the same time, EDF pursued its effort of R&D⁶⁷. The priority remained the transport of energy. This sector knew spectacular progress with the introduction of a new calculator, able to resolve the problem of shackled networks, and new method, perfected in 1953, named “énergie phase” and permitting a better regulation of complex networks. The same year, EDF introduced highest voltage on two lines (Massif Central-Paris and Malgovert-Génissiat-Paris) and new types of electric pylons, in particular the pylon-cat, cheaper than previous models. EDF worked also to realize the junction France-United Kingdom by underground and submarine electric cables. Different categories of cables were tested at the laboratory of Fontenay, with several other materials of transport or distribution. At Chatou and Cherbourg, EDF continued to test on scale models the future tidal power station of La Rance and La Rance and, perhaps, this one of Chausey Island.

EDF increased progressively its relations with the Union Française (French Union) and foreign countries⁶⁸. The different SEM knew a strong development. The Société des Forces hydroélectriques de Tunisie offered a good example, with a doubling of energy production from December 1952 to December 1953. Engineers of EDF continued to do some missions, in particular in French Guyana, in Cameroon (building up of an important aluminium plant at Edéa) and in French Guinea (for to realize another aluminium plants on the Konkouré). In parallel, EDF studied several projects in different Overseas Territories. 1953 saw the finishing of three

⁶⁴ *Ibidem*, p. 27-45.

⁶⁵ *Ibid.*, p. 23-24.

⁶⁶ *Ibid.*, p. 19. See : Asselain (Jean-Charles), « Les paradoxes de l'indemnisation », in Barjot (Dominique), Badel (L.), Morsel (H.) (eds.), *La nationalisation de l'électricité en France*, *op. cit.*, p. 425-456.

⁶⁷ *Electricité de France, Compte de gestion 1953*, *op. cit.*, p. 75-77.

⁶⁸ *Ibidem*, p. 80.

big building sites: the hydroelectric complexes of Edéa, Djoué-Brazzaville and Grandes Chutes-Conakry. The foreign relations of EDF were also in quick increase: the company exchanged engineers and experts with 45 other countries, in particular Austria, Germany, United Kingdom, but also a lot of underdeveloped countries.

Conclusions:

In 1954, began a second period in the development of *Électricité de France*⁶⁹. During the first, from 1946 to 1953, EDF had realized the integration of several hundred companies, unified the statute of personnel, the management methods and commercial practices, rationalized the business concern, consolidated accounting situation. Above all, the company had met at the doubling of the electricity consumption, thanks the investment effort of the Monnet Plan, and, finally, the decisive Marshall Aid⁷⁰. Between 1947 and 1950, the growth rate of the gross fixed capital formation had increased of + 10.2 % in average by year (and inconstant francs)⁷¹. During this period, EDF was reaching the highest gross investment rate of all the French state-owned companies:

Table 13 – The investment effort of EDF from 1947 to 1955

	1947	1950	1955
Part of EDF investment in the French national capital fixed formation	7	6.5	4.0
Annual gross investment rate of EDF	51	63	46

Source: EDF⁷².

The situation was changing. After a period dominated by massive investments in production, above all hydraulic (“the national energy”), it was now necessary to reorient fixed assets to the profit of transport and, more, distribution:

⁶⁹ *Ibid.*, p. 21-25. See : Barjot (Dominique), Beltran (Alain), Le modèle EDF depuis 1946 : les fondements d’un consensus », in Barjot (Dominique), Badel (Laurence), Morsel (Henri) (eds.), *La nationalisation de l’électricité en France*, *op. cit.*, p. 471-483.

⁷⁰ Barjot (Dominique), Dreyfus (Emmanuel), “The impact of the Marshall Plan on French Industries”, in Fauri (Francesca), Tedeschi (Paolo), *Novel Outlooks on the Marshall Plan*, Bern, Peter Lang, 2011, p. 133-163.

⁷¹ Olivier-Martin (D.), «L’évolution des grands programmes d’équipement », in « Electricité de France, bilan et perspectives », *Revue française de l’énergie*, n° 134, novembre-décembre 1961, p. 64-72.

⁷² Ormesson (H. d’), «Le financement des investissements d’Electricité de France », in « Electricité de France, bilan et perspective », *op.cit.*, p. 73-82.

Table 14 – Allocation of electric investments according to the First Plan (in % of total)

	Estimates	Realizations
Hydroelectricity	36	57
Thermoelectricity	16	23
Transport and transformation	8	9
Distribution	40	11
Total	100	100

Source: Planning General Commissioner.

EDF benefitted of a number of assets: vigorous productivity gains, growing efficiency of the management, important effort of R&D, increasing returns of scale.

Nevertheless, the question of financing remained without satisfactory answer. The problem appeared very simple: in order to respond to the strong increase of demand, it was necessary to pursue a rapid growth. In a sector as capitalistic as electricity, this growth implied massive investments. It supposed also to mobilize massively capitals. In this way, there were only three possibilities. The first was self-financing: it supposed net profits, but also a radical change of the state economy policy. This one supposed to renounce to the prices control. It was politically unacceptable⁷³. The second implied that State did exert its role of shareholder: it was impossible because the structural deficit of the state budget. Consequently, EDF must use a third way: indebtedness at medium-and long term, with the hope that inflation could depreciate sufficiently debts. It was finally the choice of the French governments. EDF was able to develop an independent technical and industrial strategy, but not financially speaking.

The case of EDF became emblematic of the contradictory situation of the state owner enterprises⁷⁴. Instead of to question the state policy, successive French governments preferred to resolve the financial difficulties by subsidies: so in favour of SNCF or Régie Autonome des Transports Parisiens (RATP). Only in 1967, the famous Nora report denounced the incoherence of the state attitude facing these state owner enterprises⁷⁵. More, an effective solution was only found in 1978-79 with a first abandoning of the policy of prices control defined in 1944 by the Gouvernement Provisoire de la République Française (Provisory Government of French Republic). Rejected for a time by the left government in 1981, the policy of deregulation finished to prevail in 1983-84.

⁷³ Bungener (Martine), « Le rôle des pouvoirs publics : une tutelle contraignante, mais obligeante », Morsel (Henri), (eds.), *Histoire de l'électricité en France. Tome 3, op. cit.*, p. 315-323.

⁷⁴ Barjot (Dominique), Nationalisations et dénationalisations : une mise en perspectives historiques », *Entreprises et Histoire*, n° 37, 2004, p. 9-23.

⁷⁵ Barjot (Dominique), « Nationalisation et dénationalisation : quand la crise transcende : les axes idéologiques », *Revue Economique et Sociale*, volume 67, décembre 2009, p. 13-28.