

## **SYNTHETIC FUELS IN SPAIN, 1942-1966: THE FAILURE OF FRANCO'S AUTARKIC DREAM**

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This article studies the production of synthetic fuels in Spain under the dictatorship of General Franco. The Spanish synthetic fuels experiment was carried out by a state-owned firm which was endowed with huge financial and commercial privileges. The technological support for the project was to come from the German firm I.G. Farben. After the Nazi defeat, it suffered cutbacks and delays. The factory only reached normal levels of production in 1957, when the restrictions which had justified the project had disappeared. This study contends that the coincidence of state ownership and the absence of democratic controls may encourage economic adventurism and have serious consequences for a country's economic development.

The production of synthetic fuels was one of the great technological challenges of the twentieth century. Faced with the lack of any domestic reserves of oil, or the depletion of the existing supplies, governments of several countries funded research into the area. In spite of their efforts, synthetic fuels have always proved more expensive to produce than crude oil. Indeed, most of the attempts to promote the commercial production of synthetic fuels were made in exceptional circumstances and under intense state protection: for instance, in Nazi Germany, in the Japan of the 1930s and 1940s, and in South Africa during the years of the international trade embargo<sup>1</sup>.

The case of Spain was similar, although it had certain distinctive characteristics of its own. The Spanish Civil War of 1936-39 was followed by the dictatorship of General Franco, which sided unequivocally with the Axis powers. The United States and Great Britain retaliated by imposing an embargo on the sale of petroleum products to Spain, which meant a dramatic reduction in the country's consumption. The regime's response was to launch a project for a series of power plants to produce synthetic fuels, using brown coals and

oil shale as raw materials. The technological support for the project was to come from the German firm I.G. Farben. The project suffered cutbacks and delays. The only plant that actually became operative – Puertollano (Ciudad Real) – began production in 1956, when Spain was no longer under the international trade embargo. Production continued for ten years under the protection of the government, which passed on the high production costs to the consumer. Eventually the situation became untenable; the installations for the treatment of shale were closed, and a conventional crude oil refinery was built in their place.

The Spanish synthetic fuel experiment differed from those conducted in other countries in that it was carried out by a firm, named ENCASO, which was part of the INI (the National Institute of Industry), the large, publicly-owned industrial holding set up by the regime to implement its policy of autarky. This study contends that the involvement of a publicly-owned company and the non-democratic nature of Franco's regime made it possible to set the project in motion at a time when the external circumstances no longer justified it, and that the project continued even when the regime had abandoned its policy of self-sufficiency.

This article is divided into four sections. The first analyses the technological and economic context in which the Spanish project came into being and examines its technological links with Nazi Germany. The second section studies the difficulties that the plan had to overcome before the plant began to function, and the technological options chosen. The third section analyses the economic costs of the project and the formulas established to fund it. The last part summarizes the study's main conclusions.

## **1. Synthetic fuels in Spain after the Civil War: a symbol of the policy of autarky**

The possibility of obtaining products similar to those derived from petroleum (gasoline, diesel oil, fueloil, and lubricants) through treating various types of coals, or oil shale or tar sands, began to emerge in Germany around

1910. In the 1920s Friedrich Bergius devised a procedure based on the hydrogenation of coal at certain pressures and temperatures. The patent was acquired by BASF in 1925, a few months before the firm became part of the new firm I.G. Farben. I.G. Farben perfected the process, in particular by dividing it into two phases, and set up the first commercial production plant in Leuna<sup>2</sup>. Around the same time, Franz Fischer and Hans Tropsch developed another process based on the synthesis of carbon monoxide and hydrogen. The patent was acquired in 1934 by Ruhrchemie AG, a company controlled by the great coal producers.

The production of synthetic fuels were commercially viable only because of the policy of import substitution applied by successive German governments. In 1930 tariffs on the import of petroleum products were increased substantially and, later on, the use and consumption of these products were closely supervised by the State. After 1933 the Nazi government intensified the policy, signing agreements with a number of companies, among them I.G. Farben, which guaranteed the purchase of synthetic fuels at attractive prices. By 1944 there were twelve hydrogenation plants in Germany, and nine more using Fischer-Tropsch technology. In that year these plants provided 90 percent of Germany's aviation gasoline, 35 percent of its common gasoline and almost 40 percent of its diesel oil<sup>3</sup>.

The success of the German techniques caught the attention of countries which had no petroleum of their own. The dependence on outside sources of petroleum products was particularly dangerous in the unstable political scenario of inter-war Europe. In Spain, the matter was of great concern to the Army, which published the new technological advances in its journals, and commissioned statistical studies and quality tests<sup>4</sup>.

Prior to the Civil War, Spain had only one plant that produced fuels using domestic raw materials. It was a small shale distillation plant in Puertollano, in the province of Ciudad Real, belonging to the French company Peñarroya, which also held the rights to many of the mineral deposits in the area. The procedure used was pyrolysis, heat treatment in vertical Pumpherson retorts.

The plant treated some 68 000 tonnes per year, and obtained 8 700 t. of oils and sulfates. Refining provided around 4 million liters of gasoline, 400 000 liters of lubricants and 1 300 t. of asphalts, among other less important subproducts<sup>5</sup>.

In 1934, under the Second Republic, Samper's Conservative government announced a competition for grants to Spanish fuel manufacturers using domestic raw materials. Seven applications were received, two of them proposing the use of shales as raw material and the other five based on the processing of brown coals from the Aragon basin in Teruel and Zaragoza. The most ambitious project was the one presented by Peñarroya, which offered to expand its plant in Puertollano to reach a production capacity of 350 000 t. per year. All the applications, however, were based on traditional distillation procedures without hydrogenation or synthesis of the oils obtained. The outbreak of the Civil War in July 1936 put an end to these plans, but the regime that emerged victorious was to play a much more decisive role in the sector<sup>6</sup>.

The political and social groups that supported Franco in his uprising against the Republic did not have a common, well-defined set of economic ideas. For the industrialists of the bourgeoisie, the role of the State was merely to ensure the subjugation of the workers and to safeguard the tariffs; it should not become involved in the processes of production. However, among the groups with Fascist tendencies, and especially among the military, there was a deep mistrust of the free market in general and of private business in particular. These groups felt that the lack of a business culture was one of the reasons for the country's economic backwardness and that the State should compensate by intervening wholeheartedly in the productive sphere. They also believed that Spain should be self-sufficient in as many areas of production as possible. From these two basic ideas emerged the *Instituto Nacional de Industria* (INI) in 1941, a public entity with the mission of creating state-financed firms to operate in sectors considered strategically important. The founder and first president of the INI was Juan A. Suanzes, a military engineer and personal friend of Franco, with wide business experience in the naval construction sector<sup>7</sup>.

The production of synthetic fuels was one of these strategic sectors. Since the outbreak of the Second World War, the Spanish government, in spite of its declaration of non-belligerence, made no secret of its support for the Axis powers. This support found expression in the sale of strategic materials to Germany, in particular tungsten. In retaliation, the United States and Great Britain imposed strict control on Spanish imports of petroleum products. The authorizations for the purchase of these products tightened, or eased, according to the position of the Spanish government in its policy of friendship towards Germany and Italy. In 1942, the gross consumption of petroleum was around half the 1935 figure. Drastic rationing of domestic sales was necessary, and many automobiles adopted converters so as to be able to use coals or other solid fuels instead of gasoline or diesel oil<sup>8</sup>. In these circumstances the interest of the authorities in any option that promised to improve domestic production is totally understandable.

This problem was one of the first that the INI sought to solve. Indeed, an official commission to study domestic fuel production had been set up as early as 1938 by Suanzes, then minister of industry. The commission gathered information on all the possible technological alternatives including hydrogenation and synthesis of coals and shales. The INI was officially created in September 1941, and Suanzes was appointed its first president. Only a few weeks later, in January 1942, the INI presented the government with its projects for the synthetic production of fuels<sup>9</sup>.

The first point defended by the INI was that no private initiatives should be allowed: the production of synthetic fuels should be the exclusive preserve of the INI itself, as the agent of the State: "Given the great interest, both economic and military, of the exploitation of the shales of Puertollano and in light of the other special circumstances of the case under study, [the INI] considers that this exploitation should be conducted by a company over which the State, that is to say, the INI created for such purposes, has absolute control"<sup>10</sup>. The government accepted this view. In the following months it drew up a series of provisions that assigned exclusive responsibility for creating firms to produce fuels to the INI and suspended the concession of new mining

exploitations for both oil shale and brown coals<sup>11</sup>. As the culmination of this process, in November 1942, the INI created ENCASO, 'Empresa Nacional "Calvo Sotelo" de Combustibles Líquidos y Lubricantes'<sup>12</sup>. The INI was the sole shareholder. Some of the private companies which had presented proposals in the 1934 competition were still interested in participating, but their proposals were all rejected by the government. In this area, as in others, the new regime saw State intervention not as subsidiary to private enterprise but as a substitution of it.

As Franco's government maintained close links with the Nazi regime, the INI sought German technological support for the project. In 1943, after a series of visits and preliminary studies, Mineralölbau GmbH were contracted to oversee the management of the project; eight Spülgas furnaces for the distillation of shale were ordered from the Lurgi company, and smaller-scale equipment from other German companies. The shale treatments designed by Edeleanu GmbH and I.G. Farben were studied and tested, but eventually no contracts were signed with these firms<sup>13</sup>.

Around the same time, the directors of ENCASO produced a general report on the manufacture of synthetic fuels, which they presented to the government<sup>14</sup>. The company intended to develop four different projects; a conventional refinery in the port of Cartagena and three synthetic fuel plants. Two of these plants, in the mining areas of Teruel near Zaragoza and in Puentes de García Rodríguez in La Coruña, Galicia, would use brown coals as raw material; the other, in Puertollano (140 miles south of Madrid), would use shale. The Puertollano project was the most detailed of the four. In the report a number of alternatives were presented; after considering the costs and the types of product that would be obtained, hydrogenation with the Bergius system was recommended.

The government accepted the firm's proposal, which became law on 24 May 1944. The project would be carried out in two phases. In the first (1944-47) the shale treatment plant was to be built in Puertollano, along with a plant for the production of nitrogenous fertilizers; two thermoelectric power stations

would be constructed in Teruel and Puentes de García Rodríguez, and the petroleum refinery would be built in Cartagena. Pilot plants were also to be built for the treatment of brown coals, but the construction of the final plants would be left for the second phase<sup>15</sup>.

For the Spain of those years, the project as a whole was extraordinarily ambitious. The total investment for the four projects amounted to almost 2 bn pesetas (about \$150 million at the time), a figure surpassed by only two Spanish companies: Telefónica, the telephone monopoly, and RENFE, the state-owned railways. The Puertollano project, with an investment of 600 million pesetas (\$45 million), was among the five largest in Spanish industry<sup>16</sup>.

The report acknowledged that the production of synthetic fuels would be more expensive than the refining of crude petroleum. The justification was the alleged need for guaranteeing provision of products that were considered strategic. ENCASO believed that the company could be profitable if it were assigned some of the revenue from the taxes on fuels. In normal market conditions, the predicted losses would be around 12 million pesetas (about \$1 million) per year<sup>17</sup>.

The synthetic fuels project was the most emblematic of the Franco regime's period of autarky. Until 1955 ENCASO was the largest company in the INI, accumulating almost 30 percent of total investment. It also represented Franco's political will (and that of his government) to attain the highest possible levels of self-sufficiency, regardless of economic considerations. But the project was formulated to meet a particular set of circumstances; by the time it was implemented those circumstances had changed completely. The fact that it was implemented at all is testimony to the autarkic, isolationist mentality of the regime.

## **2. An obsolete project comes to fruition**

The plan for the production of synthetic fuels was approved at a time when the Second World War was entering its final phase. Germany's defeat left ENCASO without suppliers of the equipment and technology, and forced the company to overhaul the entire project. The contracts with the German companies were cancelled, although only a part of the payments made could be recovered. In the case of Lurgi, ENCASO had to pay for the work done at the design stages. The most serious problem, however, was the end of the connection with I.G. Farben, the company that possessed the licences for hydrogenation, technically the most complex part of the process.

In the following years, ENCASO sought new suppliers to keep the project alive. In late 1946 the company signed a new contract with the British company Woodall Duckman and its representatives in continental Europe for technical advice, design and the granting of licences for the construction of three batteries of furnaces for shale distillation. A few years before the British company had built distillation facilities for Scottish Oil in Westwood. The furnaces were to be Pumpherton. The designs provided by Lurgi (which ENCASO had paid for) were abandoned<sup>18</sup>.

Although there was still no solution to the basic problem of the treatment of the shale oil, the company was determined to continue the construction of the remaining sections of the plant. However, the work was held up by the problems that plagued Spain in the late 1940s – the blockade imposed by the victors of the Second World War, and the lack of foreign currency. Iron, cement and copper were rationed, and often ENCASO did not even obtain the quantities to which it was officially entitled. The importing of machinery was continually hampered by the restrictions imposed by the Allies and the lack of foreign currency. In 1947 and 1948 the work on the plants practically came to a standstill.

Spain's external relations slowly improved, and by 1949 some contact with foreign countries had resumed. ENCASO remained set on its initial project, and German firms were the only ones that had commercially developed the processes of hydrogenation and synthesis which ENCASO needed to use.

ENCASO again contacted Lurgi, and BASF, which was under French control after I.G. Farben had been taken over and broken up by the Allies. In February 1950 ENCASO signed a first contract with the two German companies for the design of a project, and for the presentation of a formal tender. A year later the definitive contract was signed for the construction of the oil treatment installations, including the hydrogenation plant. The overall budget was 7.6 million dollars; an annual payment of 60 000 dollars was required to cover the licence transfer<sup>19</sup>.

Although the contracts had now been signed, the construction of the plant was still affected by the lack of foreign currency and a series of technical difficulties. The shale distillation batteries, bought in 1946, were beset by problems and did not function regularly until 1955. The installations for the treatment of shale oil were also completed in 1955, but their adjustment and testing went on for two more years. The factory only reached normal levels of production in 1957 – fifteen years after the foundation of the company, and ten years behind schedule<sup>20</sup>.

Meanwhile, the company tried to secure the supply of the raw materials it needed. The most important shale mines had belonged to the Sociedad Minera and Metalúrgica de Peñarroya, a French company, since before the Civil War. ENCASO only possessed some relatively small concessions. In 1950 it obtained the right to exploit the concessions that belonged to Peñarroya, but only after the French company had extracted the layer of coal on top of the layer of shale. In these conditions, the supply of shale was not sufficient to keep the installations functioning, and the company had to use petroleum fractions that were brought by rail from Huelva (more than 370 miles away). As much as 35 percent of the oil treated at the hydrogenation plant came from this source.

So the project took an extremely long time to set in motion; it was plagued with difficulties at every turn. Ironically, the improvement in Spain's foreign relations which made the project feasible also raised serious doubts about its usefulness. The severe restrictions on the importation of petroleum and petroleum products which had justified the project's existence in the 1940s

were gradually disappearing. The consumption of petroleum products rose from 0.5 million tonnes in 1945 to 3.9 million tonnes in 1957. In the meantime, other countries that had studied the commercial viability of the production of synthetic fuels were now abandoning the enterprise. In the United States, for example, the evidence that the cost of these fuels was much higher than those derived from petroleum led to a progressive reduction in the aid granted by the State for experimentation, and the plants in Louisiana and Colorado were closed down in 1954 and 1956 respectively<sup>21</sup>. In Germany itself, the companies that had provided ENCASO with the technology for synthetic production were now returning to conventional petrochemicals<sup>22</sup>. The leaders of the INI could claim that the process underway in Puertollano was ‘the only one of its kind in the world’<sup>23</sup> – indeed it was, but only because it lacked any financial justification.

Naturally, the INI and the heads of ENCASO were well aware that there was little economic justification for continuing the project in the 1950s. The decision to do so should be understood in the context of the political situation of the time. Inside the structure of the State, the INI had wide-ranging autonomy, due in part to the personality of its president, J.A. Suanzes, and the fact that he had direct access to Franco. Suanzes, who had been minister of industry in 1938-39, took up this post again from 1945 to 1951, without giving up the presidency of the INI. His successor at the ministry from 1951 to 1962 was Joaquín Planell, vicepresident of the INI and president of ENCASO, who also held these posts until 1957. So the industrial policy of the State was in the hands of INI men until 1962. This explains why emblematic projects of the INI were allowed to continue despite the evidence that there was no financial justification for them. Finally, under Franco’s dictatorship the economic decisions taken by the government were not discussed – not even in parliament, whose members were hand-picked by the government itself.

### **3. The cost of a dream**

The investment made in the extraction and treatment of shales in Puertollano was far higher than had initially been expected. As table 1 shows, spending surpassed the budget set out in the 1944 Plan by some 45 percent. The increase was due in particular to the need to build auxiliary installations that had not been foreseen in the original plans. It is interesting to note that the final cost of 2.278 bn pesetas (about \$80 million) more than 40 percent was spent abroad. This is a significant detail, because one of the project's objectives was precisely to save on foreign currency expenditure. Furthermore, this foreign currency was spent when the Spanish economy had very little at its disposal, and the savings that the project produced in the shape of import substitution of petroleum products only materialized when the situation was far less severe.

The funds required for the investment came from the INI itself, the group's parent company. In turn, until 1957 the INI obtained its resources mainly from the State's general budgets, via public debt issued specifically to finance the INI's activities. From 1957 onwards the funding system changed and the INI now issued its own bonds. In any event, these bonds were considered public debt in the compulsory investments quotas imposed by the State on banks and savings banks<sup>24</sup>. Table 2 shows the amount and the origins of the resources obtained by the INI in those years. Everything suggests that, in spite of the limitations that the INI encountered in its attempts to fund its projects, ENCASO was always a priority for the holding and was not affected by budgetary problems.

The production achieved between 1956, when the tests began, and 1965, the last full year of operation, is shown in table 3. As can be seen, in the years of normal functioning around 800.000 t. of shale was extracted, and around 50-55 million t. of lubricants and 40-45 million t. of fuels were obtained. The production of solvents and paraffins was much more variable. The yield on the distillation phase of the shales was around 8.4 t. of shale oil per 100 tonnes treated, similar to that of the shales of Colorado<sup>25</sup>. The main object of hydrogenation was to obtain lubricants. Most of the fuels obtained were gas

oils; the gasoline obtained was low quality and was used for mixtures. Most of the other products were solvents and paraffins.

Once the factory was functioning normally, the main problem facing ENCASO was, of course, the commercialization of its products. To put the question in context, first we should say something about the peculiar structure of the Spanish fuel market. The commercialization of fuels was subject to a State monopoly, set up in 1927 by the Primo de Rivera dictatorship in order to increase the State's income. The monopoly was managed by a privately owned company – CAMPSA – closely supervised by the ministry of finance. The standard retail price was set by the government, leaving a broad margin for the amount of tax corresponding to the State. CAMPSA received a proportion of this margin in return for managing the monopoly. ENCASO's products had to be sold to CAMPSA, and so the main question was the price that the public monopoly was prepared to pay for them. The problem had a political side to it; the monopoly was controlled by the ministry of finance, but ENCASO and the INI depended on the ministry of industry<sup>26</sup>.

The debate on prices began in 1955. A technical committee was set up with representatives of the various companies involved. A report was prepared for presentation to the political authorities. From this report it was clear that ENCASO's synthetic fuels cost 80 percent more than imported fuels (table 4). The total cost to the monopoly of purchasing ENCASO's products depended on the distribution of the types of product, and on the evolution of demand. In a stable scenario, CAMPSA calculated that this cost could amount to 263.6 million pesetas a year. The figures for the main products are shown in table 4. ENCASO, on the other hand, assumed a higher demand for products with a higher tax margin, and estimated the annual cost to be 125.7 million pesetas. If the retail price was not changed, this cost would mean a reduction in the State's income. The quantities were very large: the total income of the State from the fuel monopoly was around 600 million pesetas per year. Naturally, this increase in the purchase price also had to affect CAMPSA's income.

Not surprisingly, both the company in charge of the monopoly and the ministry of finance itself were disturbed. The country's economic and fiscal situation was extremely precarious and any reduction in the State's income was a matter for deep concern. The INI and ENCASO, on the other hand, insisted that the State should cover the costs. Their arguments were simple. The company was entitled to "impose the consumption of its products", for three reasons: it used domestic raw materials, it was the property of the State and the imposition was required in order to make the company economically viable<sup>27</sup>. The tautology was evident. Once the decision to go ahead with the project had been taken, any losses that the functioning of the installations might incur had to be covered by the State.

The debate continued in the following months and was only settled when the tax system as a whole was changed. In December 1956 it was agreed to eliminate certain direct taxes on road transport; in exchange, it was decided to increase the sales margin on petroleum products. The resulting increase in the retail price grew even greater in earlier 1957 in a package of measures aimed at containing the public deficit<sup>28</sup>.

Against this background, the government decided to solve the problem of the prices of ENCASO's products. By order of the Presidency of the Government dated 12 June 1957 a new system for the commercialization of lubricating oils and similar products was implemented. This system established an order of seniority for the suppliers of lubricants, and criteria for fixing purchase prices, leaving approval to the Council of Ministers. The first supplier to put its products on sale would be ENCASO; the second would be REPESA (the INI's conventional petroleum refinery); third would be CEPESA (Spain's only private refinery) and finally, lubricants imported by CAMPSA or by authorized private traders. The State expected to corner the market, as ENCASO and REPESA together would meet all domestic demand. However, the new regulations accepted the possibility of authorizing the importation of lubricants not manufactured in Spain in special circumstances. In any event the system was extremely restrictive, and was fiercely protective of the interests of Spanish producers.

As far as prices were concerned, a clear criterion was established:

"CAMPSA's purchase prices of the products obtained by Spanish refineries will be established taking into account that the profits of the refineries will permit, after the standard depreciations, the establishment of a maintenance fund for the plants in order to provide the highest levels of efficiency that technical advances permit... and the payment of a dividend of the same amount that CAMPSA paid to its shareholders" (Art. 14).

The pretensions of ENCASO and the INI were more than satisfied. The company could "impose" its products on consumers and would obtain prices that not only covered costs, but would allow the absorption of future technological improvements. They were also assured of a good return, since CAMPSA was one of the companies with the highest dividends in Spain (around 8 percent per year).

The most worrying innovation in the new regulations as far the INI was concerned was also to be found in article 14. It established that the prices of lubricants that CAMPSA bought were to be approved by the Council of Ministers. This was particularly unattractive to the leaders of the INI because it meant that every year they would have to justify the enormous differences in cost between the synthetic products manufactured by ENCASO and the ones imported or produced by conventional refineries in Spain. A few years later, the president of the INI, J.A. Suanzes, said, '...this draws attention to the differences in cost between the lubricants imported from abroad and the products of REPESA, CEPESA and ENCASO, circumstances which give rise to comments, comparisons and finally to the proposal of solutions, some reasonable, some not, forgetting ... the spirit which led the Government and the Cortes... to decide to establish the industry'<sup>29</sup>. So the regulations adopted by the Government in 1957 made possible the functioning of the Puertollano plant and made ENCASO economically viable, but, in turn, imposed procedures of

supervision that constantly drew attention to the incongruity of the situation and prompted proposals aimed at rectifying it, even inside the Government itself.

Unfortunately for ENCASO, the start of the production of synthetic fuels coincided with a major change in the regime's economic policy, and with a shift in the balance of power among the forces that supported it. The timid economic liberalization initiated at the beginning of the 1950s permitted healthy growth but seriously aggravated the external imbalance of the Spanish economy. By the end of the decade the situation had become untenable, with the imminent risk of suspension of foreign payments. In February 1957 Franco appointed a new government and placed members of Opus Dei in the most important economic ministries<sup>30</sup>. The government embarked on a process of reforms, culminating in the adoption of the Stabilization Plan of July 1959. Essentially, the Plan was a strong fiscal and monetary adjustment, accompanied by a gradual liberalization of domestic markets, a reduction of protectionist measures and the encouragement of foreign investment<sup>31</sup>. Clearly, the tide was turning against the ideas of autarky and State intervention that had launched the Puertollano project.

The change in economic climate obliged the INI to seek alternatives for the industrial complex in Puertollano. In 1957 an internal study was set up to examine the possibility of establishing a conventional petroleum refinery there to provide fuels for the central area of Spain and also raw materials for a set of petrochemical plants that would expand the existing installations. Initially no mention was made of any link between this project and the future of the synthetic fuels plant. However, in the official report presented to the government in June 1961 the matter was discussed openly:

'It should not be forgotten that, even if the principal objective and the economic justification of the expansion... proposed... is to provide petroleum products for the centre of Spain..., there is another objective which could be considered secondary, in spite of its undoubted economic and political importance. This is the adaptation of the current installations in Puertollano... to the current circumstances and to those

likely to arise in the future... It is well known that obtaining liquid fuels and lubricants from shales is economically less advantageous than doing so from petroleum...<sup>32</sup>.

The report proposed the gradual closure of the synthetic fuels plant and was approved by the government in August 1961. A year later, in August 1962, the World Bank published a long, detailed report on the Spanish economy, which was to have a decisive influence on consolidating the economic policy changes launched by the Stabilization Plan. As well as supporting the policy of opening up to the international economy and reducing tariffs, the report was particularly critical of the State-owned firms, and above all of the INI, saying that its unsupervised development seriously undermined the prospects of private enterprise and that the State's participation in business should be strictly limited; public and private companies should be put on an equal footing. These recommendations affected every aspect of the INI's role, and in particular the activities of ENCASO<sup>33</sup>. Without protection or privileges, the production of synthetic fuels could no longer be sustained. In time, the change in industrial policy and in the role of the INI inevitably led to the dismissal of those in charge. In July 1962 Joaquín Planell was replaced as minister of industry, and in October 1963 Franco accepted J.A. Suanzes' resignation as president of the INI.

The Puertollano refinery developed slowly, only beginning to function around mid-1966. Immediately afterwards all the installations used in the treatment of shales were closed: the mines, the batteries of distillation and the hydrogenation plant. The products obtained in the new refinery were sold to CAMPSA at normal prices. However, for a few months the company managed to retain the right to charge the earlier prices in order to cover the remaining costs of installation. In its 1966 report, the company stated, not without a certain regret, that the closing of the synthetic fuels plant was due to a decision taken by the government on economic grounds, 'not because the system had failed, or because it produced low quality materials'<sup>34</sup>.

#### **4. State-owned firms and economic adventurism under a dictatorship.**

##### **Some concluding remarks**

The story of the Spanish synthetic fuels program may be illustrative of the role of State-owned firms in countries without democratic institutions. The representatives of the new political system set up after the Spanish civil war were dazzled by technical and political achievements of the Nazis. Under the pressure of the allied blockade, the possibility of securing a certain economic and political freedom through the production of fuels from domestic raw materials was very attractive. The objective, however, would not be achieved by the methods used in Nazi Germany, where the government encouraged the production of synthetic fuels through guaranteed prices and direct subsidies. In Spain, the authorities decided to set up a new firm under the control of a State-owned industrial holding, the INI. This firm, ENCASO, was a symbol of the new policy that gave priority to economic independence over economic common sense. For more than fourteen years ENCASO was the INI's largest single investment.

The fact that the project was built around the creation of a State-owned firm had serious consequences for its development. The defeat of Nazi Germany delayed the project in its early stages, and later on economic and technical difficulties played havoc with its progress. So by the time the first important contracts for the acquisition of equipment abroad were signed, the state of emergency in which the project had been launched had already passed. But the firm and the INI went ahead with the project, regardless of the high costs it involved. The institutional context in which the project developed played a large part; the promoters of the project were influential members of Franco's governments who were able to impose their will in spite of the reluctance of other authorities.

This would not have been the case if the project had been discussed in public and in a context of political freedom. Equally, if the project had involved private companies and had not been run by a state owned company, those in charge would have demanded greater guarantees from the State before

making an investment of this size. Such guarantees could only have been granted with the agreement of the heads of various areas of the government, and this consensus would have been extremely unlikely given the diversity of opinions among the authorities on the role of the State in the economy and on the development of synthetic fuels. ENCASO built its plant without an explicit, approved price system and with no guarantee that its products would be purchased by the company in charge of the fuel monopoly, but it was able to finance its investments because of the privileges that the INI enjoyed. The fact that it was a public company meant that its managers could act with a greater degree of freedom (or impunity).

In short, the case of synthetic fuel production in Spain shows that the coincidence of state ownership and the absence of democratic controls may encourage economic adventurism and have serious consequences for a country's economic development. The case also illustrates the economic malpractices of Franco's regime – malpractices which had a disastrous effect on the conditions of every-day life in Spain. The Spanish people, living in a country already devastated by a long civil war and overwhelmed by the absence of political freedom, paid a high price for the interventionism and economic irresponsibility of the dictatorship.

Table 1. ENCASO investment at Puertollano (million PTA at 1951 prices)

	Estimate investment		Final investment 1957		
	1944 Plan	1951 Revision	Total	Spanish supplies	Foreign supplies
Mines	28.5	99.8	134.1	48.2	85.9
Distillation	1,260.0	274.4	286.8	160.9	125.9
Oil treatment		825.1	915.3	369.9	545.4
Power station	197.0	233.8	233.8	106.6	127.2
Water supply	51.6	75.0	84.6	84.4	0.2
Workers village	35.3	50.0	109.6	109.6	
Auxiliary services		156.3	196.7	166.0	30.7
Land		57.4	139.4	75.7	63.7
Other		131.0	178.2	178.2	
<b>Total synthetic fuels</b>	<b>1,572.3</b>	<b>1,902.8</b>	<b>2,278.5</b>	<b>1,299.5</b>	<b>979.0</b>
Fertilizers plant	325.6	313.3	431.2	200.8	230.4
Sulphuric plant			82.7	44.5	38.2
<b>Total Puertollano</b>	<b>1,897.9</b>	<b>2,216.1</b>	<b>2,792.4</b>	<b>1,544.8</b>	<b>1,247.6</b>

Source. "Revisión del reformado del Plan", INIA, Leg. 311.3 Economía y finanzas 1958, exp. 219.

Table 2. INI financing and investment in ENCASO (million PTA)

	1946	1950	1957	1963
State contribution	854.1	3,450.0	25,809.9	25,804.6
- public debt		2,413.7	24,129.4	24,129.4
- other	854.1	1,036.3	1,680.5	1,675.2
Self-financing	8.7	103.1	857.4	3,332.7
Outside resources	3.9	207.3	4,890.9	49,016.0
- bonds				35,289.2
- Bank of Spain		160.0	4,660.0	11,115.0
- Other	3.9	47.3	230.9	2,611.8
<b>Total</b>	<b>866.7</b>	<b>3,760.4</b>	<b>31,558.2</b>	<b>78,153.3</b>
Investment in ENCASO	246.9	1,027.0	4,702.4	7,185.1
- capital	182.0	1,000.0	4,619.7	5,000.0
- credit	64.9	27.0	82.7	2,185.1

Source: Pablo Martín Aceña and Francisco Comín, INI, 50 años de industrialización en España (Madrid, 1991), p. 269; and ENCASO reports.

Table 3. Production of Puertollano synthetic fuels plant

	Oil shale 000' t.	Fuels 000' m3	Lubricants 000' t.	Paraffin 000' t.	Other 000' t.
1952	103,7				
1953	193,2				
1954	237				
1955	497,9				
1956	597,8	46,7	17,1	6,9	
1957	739,9	57,1	27,2	3,1	4,5
1958	773,1	68,1	50,3	4,4	16,5
1959	844,8	41,1	54	6	19,6
1960	832,5	39,1	38	7,1	18,9
1961	856,4	45,7	53,9	5,3	27
1962	730,6	41,1	56,9	1,7	25,1
1963	811,4	45,1	54,9	3,1	38,2
1964	712,4	46,9	67,7	4,4	42,2
1965	630,2	53,3	83,2	3,6	50,4
1966	224,1				

Source: ENCASO Memorias.

Table 4. Cost differences between ENCASO and imported products

	Imported (c.i.f.)	ENCASO	differenc e	Annual production	Annual total cost
	PTA/k.	PTA/k.	PTA/k.	t.	000' PTA
<b>Lubricants</b>					
A	2.05	4.10	2.05	6,780	13,899
C	2.22	4.30	2.08	3,830	7,966
H-4	4.01	7.67	3.66	300	1,098
H-7	4.01	11.01	7.00	500	3,500
K	1.16	3.49	2.33	800	1,864
J	2.22	5.00	2.78	300	834
L	3.50	6.33	2.83	5,700	16,131
SAE-EG	2.43	8.36	5.93	10,720	63,570
SAE-EM	10.70	16.15	5.45	10,720	58,424
SAE7-H-D	10.70	17.16	6.46	4,680	30,233
SAE-MG	10.70	18.17	7.47	680	5,080
Weighted total	5.45	9.95	4.50	45,010	202,598
<b>Fuels</b>					
	PTA/l.	PTA/l.	PTA/l.	000' litres	
Gasoline	1.04	1.40	0.36	6,120	2,203
Diesel oil for agriculture	0.90	2.17	1.27	11,498	14,556
Diesel oil	0.88	1.62	0.74	53,166	39,173
Weighted total	0.90	1.69	0.79	70,784	55.932
<b>Other products</b>					5,053
<b>Total cost</b>					<b>263,583</b>

Source: "Propuesta sobre producción, distribución y consumo de lubricantes y parafinas", INIA, Leg. 220.0 Varios de combustibles sintéticos 1956, exp. 7.

<sup>1</sup> Arnold Krammer, "Fueling the Third Reich," *Technology and Culture* 19, n. 3 (July 1978): pp. 394-422; Raymond G. Stokes, "The Oil Industry of Nazi Germany, 1936-1945," *Business History Review* 59 (Summer, 1985): pp. 254-277; Anthony Stranges, "Germany's synthetic fuel industry, 1927-1945" in John E. Lesch, ed., *The German Chemical Industry in the Twentieth Century* (Dordrecht, The Netherlands, 2000): pp. 147-216; Anthony Stranges, "Synthetic Fuel Production in Prewar and World War II Japan: A Case Study in Technological Failure," *Annals of Science* 50 (1993): 229-265; Peter Hilsenrath, "The Development of Synthetic Fuels in South Africa" *The Journal of Energy and Development* 14 (1991): pp. 269-283. In the United States a number of experimental programs were carried out, but none of them was commercially viable: see Richard H. K. Vietor, "The Synthetic Liquid Fuels Program: Energy Politics in The Truman Era" *Business History Review* 54 (Spring, 1980): pp. 1-34; Richard H.K. Vietor, *Energy policy in America since 1945. A study of business-government relations* (Cambridge, 1984): pp. 44-63; 163-189; 324-340; Ernest J. Yanarella and William C. Green, eds., *The Unfulfilled Promise of Synthetic Fuels. Technological Failure, Policy Immobilism, or Commercial Illusion* (Westport, Conn., 1987).

<sup>2</sup> Anthony Stranges, "Friedrich Bergius and the Rise of the German Synthetic Fuel Industry", *ISIS* 75 (1984): pp. 643-667; Anthony Stranges, "Germany's synthetic fuel industry, 1927-1945" in John E. Lesch, ed., *The German Chemical Industry in the Twentieth Century* (Dordrecht, The Netherlands, 2000): pp. 147-216.

<sup>3</sup> Ibid.

<sup>4</sup> Elena San Román, *Ejército e industria: el nacimiento del I.N.I.* (Barcelona, 1999): pp.117-123.

<sup>5</sup> INI Archives (henceforth INIA), Legajo Único Shales, carpeta 2121/9, exp. 3.

<sup>6</sup> These projects were taken over by the INI after the war. INIA, Archivo de la Presidencia legajo 212.0 Varios de combustibles líquidos 1er y 2º legajo.

<sup>7</sup> On the origins of the INI, see Elena San Román, *Ejército e industria: el nacimiento del I.N.I.* (Barcelona, 1999); Antonio Gomez Mendoza, ed., *De mitos y milagros. El Instituto Nacional de Autarquía (1941-1963)* (Barcelona, 2000); Antonio Gomez Mendoza and Elena San Román, "Competition Between Private and Public Enterprise in Spain, 1939-1959" *Business and Economic History* 26, n. 2 (1997): pp. 696-708. On the history of the INI as a whole, see Pablo Martín Aceña and Francisco Comín, *INI, 50 años de industrialización en España* (Madrid, 1991).

<sup>8</sup> Carles Sudrià, "Energy as a Limiting Factor to Growth" in Pablo Martín Aceña and James Simpson, eds., *The Economic Development of Spain since 1870* (London, 1995): pp. 282-283.

<sup>9</sup> Elena San Román, *Ejército e industria: el nacimiento del I.N.I.* (Barcelona, 1999): pp.192-195.

<sup>10</sup> "Informe sobre la explotación y beneficio de las shales bituminosas de Puertollano en relación con el proyecto que se propone desarrollar la Compañía Anónima Española del Azoe" (14-01-1942), INIA, 311.4 Estudios y Proyectos (1942 a 8-1943), exp. 2. (our emphasis)

<sup>11</sup> Elena San Román, Carles Sudrià, "Autarquía e ingenierismo: la Empresa Nacional 'Calvo Sotelo' y la producción de lubricantes sintéticos" in *Doctor Jordi Nadal. La industrialització i el desenvolupament econòmic d'Espanya* (Barcelona, 1999), vol. 2, pp. 1508-1509.

<sup>12</sup> The firm was named after José Calvo Sotelo, minister of finance under the dictatorship of General Primo de Rivera (1923-1929), creator of the petroleum monopoly and leader of the extreme right wing opposition to the Second Republic; assassinated in 1936.

<sup>13</sup> Elena San Román, *Ejército e industria: el nacimiento del I.N.I.* (Barcelona, 1999), pp. 200-204. Roland W. Rammler, Hans-Juergen Weiss, "Lurgi-Ruhrgas process" in Robert A. Meyers, ed., *Handbook of Synfuels Technology* (New York, 1994), p. 4-14.

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<sup>14</sup> “Resumen del informe técnico-económico sobre los proyectos de la empresa nacional Calvo Sotelo”, INIA, Legajo 311.0 Varios 1944, exp. 7, anexo 1.

<sup>15</sup> The production plants in Teruel and Puentes did not have a technical plan of their own, and they were left out of the general plan in 1952. The Cartagena petroleum refinery came into being as an independent enterprise in 1949.

<sup>16</sup> Elena San Román, Carles Sudrià, "Autarquía e ingenierismo: la Empresa Nacional 'Calvo Sotelo' y la producción de lubricantes sintéticos" in *Doctor Jordi Nadal. La industrialització i el desenvolupament econòmic d'Espanya* (Barcelona, 1999), vol. 2, p. 1512.

<sup>17</sup> Ibid, p. 1514.

<sup>18</sup> ENCASO, Memoria 1946.

<sup>19</sup> INIA, Leg. 311.7 Actas 1951 (Consejo de Administración de 5 de febrero)

<sup>20</sup> Elena San Román, Carles Sudrià, "Autarquía e ingenierismo: la Empresa Nacional 'Calvo Sotelo' y la producción de lubricantes sintéticos" in *Doctor Jordi Nadal. La industrialització i el desenvolupament econòmic d'Espanya* (Barcelona, 1999), vol. 2, p. 1519.

<sup>21</sup> Richard H.K. Vietor, *Energy policy in America since 1945. A study of business-government relations* (Cambridge, 1984), pp. 59-63.

<sup>22</sup> Raymond G. Stokes, *Opting for Oil. The Political Economy of Technological Change in the West German Chemical Industry, 1945-1961* (Cambridge, 1994).

<sup>23</sup> Speech by Joaquin Planell, president of ENCASO, to the company's council of administration (5/2/1951). INIA, leg. 311.7 Actas 1951, n. 164.

<sup>24</sup> On the funding of the INI at this time, see Pablo Martín Aceña and Francisco Comín, *INI, 50 años de industrialización en España* (Madrid, 1991), pp. 265-273.

<sup>25</sup> See Roland W. Rammner, Hans-Juergen Weiss, "Lurgi-Ruhrgas process" in Robert A. Meyers, ed., *Handbook of Synfuels Technology* (New York, 1994), p. 4-32.

<sup>26</sup> The system of government established by Franco was based on giving each minister full autonomy in his area of responsibility, reserving for himself and his right hand man (the minister of the Presidency, Luis Carrero Blanco) the task of mediating in the conflicts that arose. So for long periods there was no government policy to speak of – rather decisions taken by each ministry that may be contradictory.

<sup>27</sup> “Presidencia somete a Presidencia del Gobierno, previa exposición de antecedentes y datos, propuestas para la designación de Consejo Técnico...” INIA, Leg. 220.0 Varios de combustibles sintéticos 1954-55, exp. 29, 6/8/1955.

<sup>28</sup> Elena San Román, Carles Sudrià, "Autarquía e ingenierismo: la Empresa Nacional 'Calvo Sotelo' y la producción de lubricantes sintéticos" in *Doctor Jordi Nadal. La industrialització i el desenvolupament econòmic d'Espanya* (Barcelona, 1999), vol. 2, p. 1523.

<sup>29</sup> “Ampliación del Complejo Industrial de Puertollano con una Refinería de Petróleos y con instalaciones para la fabricación de productos químicos” INIA, exp. único n. 615, doc. 3, 12/6/1961.

<sup>30</sup> Opus Dei is a personal Prelature of the Catholic Church, essentially lay, which proclaims the propagation of Christian ideals in the professional activity of its members, some of whom are among the best educated sectors of society.

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<sup>31</sup> Significantly, the INI maintained a position of reticence, if not direct rejection, of the program of economic stabilization. See. Pablo Martín Aceña and Francisco Comín, *INI, 50 años de industrialización en España* (Madrid, 1991), pp. 295-298.

<sup>32</sup> “Ampliación del Complejo Industrial de Puertollano con una Refinería de Petróleos y con instalaciones para la fabricación de productos químicos” INIA exp. unico n. 615, doc. 3, 12/6/1961.

<sup>33</sup> *Report of the International Reconstruction Bank. The economic development of Spain* (Madrid, 1962), especially ch. 15. Not surprisingly, the INI’s reaction to the report was highly critical. See Pablo Martín Aceña and Francisco Comín, *INI, 50 años de industrialización en España* (Madrid, 1991), pp. 298-302.

<sup>34</sup> ENCASO, Annual Report 1966.