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BACKGROUND PAPER ON THE ALUMINIUM BAHRAIN (ALBA) PROJECT[1/]

by

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INTRODUCTION

M+F Engineering AG were appointed as Engineers in charge of Project Engineering, General Construction Management and start-up. The author, who is now managing director of M+F Engineering Consultants Ltd was the first resident director of Alba and served on Albas Board until 1975.
Since Aluminium Bahrain was intended to be a Smelting Company independant of existing large primary producers, the formation of the company and the construction of the smelter called for an unconventional approach. Consequently, Alba is an organisation which was not established according to any known pattern.

The first part of this paper deals with the conceptual aspects of the smelter. In a second part, some of the problems encountered during the early stages of operation are analysed and the measures taken to cope with them are discussed. Finally, some general aspects of smelters in developing areas are discussed. While many aspects mentioned are specific experiences relating to Bahrain, a lot of know how accumulated is applicable elsewhere.

1. Conceptual Aspects of Aluminium Bahrain

1.1 Corporate Concept

While Bahrain was discussed as a possible site for an Aluminium Smelter, an internationally composed group of Aluminium users were considering the establishment of an independant source of supply of metal. Their idea was to control their own smelter and be independant from the club of primary producers. In 1968, they formed a syndicate and the agreement spelt out the framework, under which the Smelter was to operate. The nature of the venture called for participants of substance. Although the share capital of the company was very small and remained small, shareholders had to take on guarantees in metal take-off at cost. The syndicate members, who eventually became shareholders of Alba, were cable manufacturers and trading companies. At a later stage, a primary producer joined. Sites for a Smelter considered by the syndicate were in S.E. Asia and New Zealand. Eventually, the group learned about the large natural gas field under the Island of Bahrain and, following negotiations with the Government and the Oil company owning the concession, it was decided to build a smelter in Bahrain. It is important to note that from the beginning, the Government was the largest shareholder in the Company. This was due to an early realization of the economic importance and social impact the smelter would have on the country. With the exception of the Oil company, no industrial activity was known to exist in Bahrain at that time.

The operational concept of the smelter was such, that the company would produce metal and sell it to its shareholders at cost, i.e. the company is not designed to make a profit. The shareholders, however, are obliged to take their share of metal and pay for it within a defined period from the date, at which the company has allocated an apportioned share of the production to a shareholder. The metal offtake price is determined at regular intervals at shareholders meetings. It is usually established on the basis of quarterly or half yearly cash flow projections.
It is selfevident that normally, the shareholders must tend to adjust the offtake price so that the cash flow balances it self over a relatively short period. The metal is sold by the shareholders (and not the Company) on the world market. There is no taxation in Bahrain. The Government obtains revenue from its shareholding in the company.

The concept undoubtely has many attractions.
It is basically very fair to all shareholders and since they act as salesagents, they cannot criticise the company's commercial performance.
Difficulties, however, do arise which stem from the heterogeneous composition of the company. The very diverse tax laws in the shareholders home countries can naturally lead to discussions on the financial policy of the company.

..2 Political Concept

The Government had no doubt strong political motivations to encourage establishment of a non-oil industry. Bahrain is not an oil rich country. The country has an old established commercial infrastructure, because it was a trading center in the Gulf. The advent of the oil industry in the early 1930's provided, long ahead of the neighbouring countries, a moderate wealth. The small oil deposits, however, began to deplete soon, jeopardizing the standard of living of the people. Part of the early social sophietication of Bahrain was a good educational system. With the development of the oil industry in neighbouring countries, Bahrainis consequently preferred to seek jobs abroad. One main object of the Government was thus to attract industry which could provide jobs for their people. By offering its resources in energy to a process industry, the Government could expect to benefit the country by adding substantical value to the energy when exported - as compared to the export of energy in the form of oil.

The energy content per barrel of oil - or its equivalent in gas - can produce 45 kg of metal out of alumina. The market value of this metal today is 50 US Dollars. The import requirements to the Smelter to produce this metal amount to about 25 US Dollars, provided local resources are reasonably utilized. The balance of 25 US Dollars is value added out of local energy, raw materials and services. This is substantially more than remains in the country when energy is exported in the form of oil. In order to produce this added value of about 25 US Dollars, approximately 1 manhour is required. This compares very favourably with other process industries, or indeed manufacturing industries.

Since an aluminium smelter built in a country of 200'000 inhabitants can be expected to make some impact on the local society and since aluminium smelting can be regarded as a basic industry, it was natural that the Government should become a shareholder. This will at anytime prevent public criticism that the country's resources are exploited by foreigners. A substantial benefit of a Government participation is furthermore that a Government shareholder provides great prestige to a company. This not only relates to its public image, but can also be regarded as an asset when negotiating for finance.

1.3 Technical and Operational Concept

The decision to build a smelter in Bahrain was taken in September 1968. At that time, the smallest plant that was considered to be economically feasible was 120'000 t. The design of the plant had to fullfill the following criteria:

1. It had to utilize wellproven technology.
2. It had to be simple to build, to operate and to maintain.
3. It had to provide uncompromising security of operation, (not only for the power supply).
4. It had to be compatible with local conditions.
5. While it had to provide jobs, the harsh climatic conditions had to be borne in mind. Some comments regarding these criteria may well be appropriate:

Technology

A prebaked anode type pot of 100'000 A was chosen. It had to be simple to tend and it was expected that an end to end arrangement with provision of fresh air through the center isle would be the most appropriate solution for the climate.

Montecatini had a side fed pot design which was considered suitable and fullfilled the above requirements. The technical data are as follows:

Cathode dimension		mm	8320 x 3700
Anode dimension	L	mm	1010
	W	mm	520
	H	mm	560
Anode weight		kg	434
No of anodes per pot			26
Current density in bus	A/mm2		0,44
Current density in anode			0,76
Normal current	A		100'000
Pot operating voltage (base)			4.5
No of pots per potroom			114
No of pots per line			228
No of lines			2

Line Voltage at rectifier terminals: 1050 V
Line regulation for constant amperage.
Rectifiers laid out for n-1 operation.
Power station 19 units of 13 MW - Gasturbines, single cycle.
Paste plant designed for continuous mixing at 15 t per hour output.
There are two continuous mixers in series, but each one can be by-passed in case of emergency.
Anode forming is done by two presses. Pitch is handled, stored and added to the coke in solid form. Due to the problems of heat, the green anode store is relatively small. Baking of green anodes is done in two kilns with covered pits. The rodding method is by two round stubs, fastened in the anode holes by cast iron.
Raw material storage is for a four months supply, with the main bulk store at the harbour, 11 km from the plant site away.

Operational Aspects

The power supply, based on the 13 MW units, was laid out for dual fuel use. There is a small day-tank installed for distillate fuel, hooked up by pipe line to the large storage at the refinery.

The large number of small modules gives enough flexibility in operation and maintenance planning. Major overhauls are scheduled for winter.
Pot tendering is done by independant mobile units: Crustbreaking, alumina feeding and anode changing. All of these vehicles use standardized engines, hydraulics and other components. Operating cycles, number of standby vehicles and maintenance planning had to be carefully matched (which caused some initially serious problems) but allowed for great flexibility in assessing optimal operating conditions. Adaptation of these conditions was necessary because the logistics of the operation required a combination of raw material input which was untried before.

The number of supervisors at all levels had to be increased over known requirements. Furthermore, quality control procedures were very tight.

Alumina is purchased under a long term supply agreement from Alcoa Australia, coke from several sources, pitch also.

2. Reality

The smelter in Bahrain was conceived and built in a relatively short time. A decision to proceed was taken in September 1968, the first metal was poured in May 1971. The conceptual phase of the smelter (collecting data, evaluation and decision taking) was consequently extremely short. The construction and startup phase of the plant however fell into a period where local conditions changed dramatically. Developments in neighbouring states dried up the labour market. Service industries were established which strained local facilities like housing. Inflationary pressures in world markets were of course equally effective in Bahrain as elsewhere. These effects coincided with a marked depression in the aluminium world market. It was under these conditions that the strong position of the Government as a shareholder became most beneficial to the company. A Government can look at the industry with a long term approach during such periods. In the case of Alba, this meant that during a period when plants built simultaneously were running at part load due to commercial or technical problems, Alba was operating in excess of rated capacity. There were a number of operational problems to deal with also: Two gasturbine burnouts occurred due to liquid entrainment in the gas supply system. Recruitment and training became a matter of survival. The change in the labour-market increased the number of expatriate staff required. It took three to four years of operation until a good stock of potroom operators were trained.

Now, however, the annual turnover rate in the plant is less than in European or American smelters.

Alba is carrying through a very elaborate training program, consisting of courses in craftmanship, basic knowledge of aluminium smelting, basic language and on the job training.
Furthermore, it is sponsoring courses for supervisory training in Europe. The number of trainees in such a scheme naturally is considerably higher than the plants projected requirements, partly because of rejects and dropouts. Refresher courses in regular intervals are necessary for qualified crafts in order to retain required standards.
The company adapted a policy of health monitoring from recruitment onwards.
This medical service includes an initial examination prior to employment becoming effective, general medical care of employees and their families, first aid as well as a comprehensive industrial health program. This health program was initiated to study the effects of the working environment on the physical characteristics of the Bahrainis, in order to obtain early indication of possible hazards. The medical service became so successful that it subsequently was extended to outside clients. Today, airlines and other service corporations are subscribed and the total staff comprizes some 40 people including 3 doctors.
Logistic support services of a smelter in a developing country is of special importance.

A well administered system for supplies and spare parts should take the long lead times into account. This means that stores will have to carry much more value in inventories than in developed areas.

In perspective, it can be concluded that in spite of all this, the startup of Alba occurred with less teething troubles than plants commissioned in Europe at the same time. Alba was always more in the focus of interest in the aluminium world than other plants, since it was new, independant, isolated and all in all a challenging experiment. It has survived a difficult youth and has developed itself from a concept of an aluminium smelting company into a comprehensive industrial corporation which provides a wide range of services to the local community.

It could be inexcusable for any new venture in developing countries to try and take a less comprehensive approach. It could also be inexcusable for the investors to look upon their project in terms of direct dividends alone. The projects can only be measured and appraised in the frame work of the overall national economy.

3. Conclusion

Provided that a country has a development potential for an aluminium-industry, i.e. when it has some of the key ingrediants available locally, the following factors should be considered prior to taking a decision to proceed:

1. The vast investment necessary will have an influence on the local economy, the society and political scene. How can the impact be optimized for the benefit of the country?

2. Contrary to smelters in developed countries, smelters in developing countries will have to provide a large number of direct social services to its employees (and their families). These extend from schooling and training over medical care and industrial health schemes to direction on sport activities and leasure. It is therefore inappropriate to compare staffing requirements between various plants without taking due regard of these extra services.

3. Under practically no circumstances will the investment yield fast returns in conventional economic terms, but the substantial value addition on one hand and the large infrastructure requirement on the other hand make aluminium smelting a typical example of an industry, which benefits the economy generally rather than the owners.

3. (Contin.)
In developing countries it is therefore a business predestined for Government partnership in the form of a joint venture company.

4. With regards to corporate management, it is advantageous to employ the top executive under a special company scheme, and not to have them seconded by a management contractor. This is of significance when considering that staff seconded will always remain under the influence of their employer and consequently also retain their loyalties towards their employer rather than be loyal to the joint venture company.

5. Emphasis must be given to the formation of an appropriate corporate identity and corporate spirit within the joint venture company. Any management or consultancy agreement must give due regard to this. Employment and use of such services must always be at the discretion of the joint venture company.

The above management philosophy clearly has the following objectives:

- To prevent remote control of the company.
- To establish a strong local internal structure with proper corporate identity.
- To place the industry into a socially, economially and politically friendly setting and therefore providing an optimal basis for carrying out its business.

It is also clear that managment under these circumstances requires high caliber personalities. Not only will plants in developing countries normally run under more difficult conditions than in other places, it has to be remembered that a heterogeneous composition of the staff (which will inevitably happen in many cases) requires better qualified people at all levels of management than would normally be the case.

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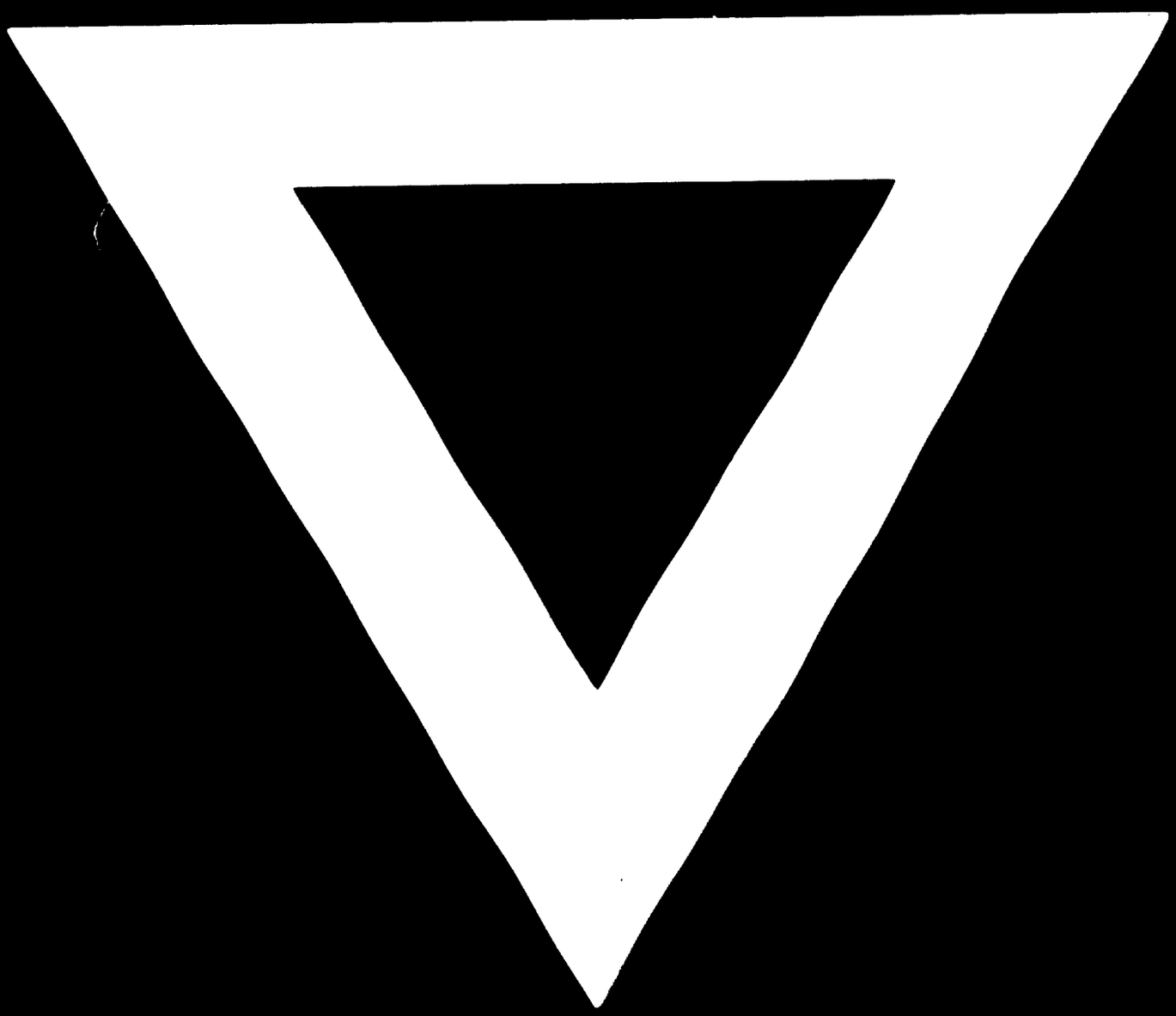

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