Relocating nitrogenous fertilizer plants

A new 1,300 t/d ammonia plant and a 1,725 t/d urea plant built on a grassroots site in a location exposed to world competition cannot today produce an acceptable rate of return, even when the feedstock cost is zero. To address this problem more and more companies are turning to the dismantling, refurbishing and relocation of used plants. Derek Lennon* investigates.

Recently ten companies bid to acquire the Sapugaskanda ammonia/urea plant in Sri Lanka. This plant, which has a capacity of 545 t/d ammonia and 940 t/d prilled urea, had been built by Kellogg in 1978/82 with World Bank finance at a cost of $171 million. The plant operated from 1982 to 1985 and was then shut down. It was an economic failure partly because of the high capital cost and poor operating characteristics, but primarily as a result of the Sri Lankan government not legislating either for a subsidized naphtha supply price or a tariff to protect the urea.

In the coming years, relocating existing nitrogenous fertilizer plants could become an important factor in the industry. On the one hand, there could be a rising number of closures due to high feedstock costs, and on the other the need for more capacity especially in the Near and Far East and Latin America.

To assess the economic importance of used plants we need to know the present day capital cost of a new plant, the time to complete the project and the breakdown of the total installed costs. Given the relatively minor variation in energy consumption per tonne of product in modern and older ammonia plants, the emphasis must be on decreasing total installed cost and decreasing project completion time to reduce to a minimum interest during construction.

As an example for this article, we will consider a standard gas feed 1,350 t/d ammonia plant and a 1,725 t/d prilled urea plant with all offsites on a green field site and operating on a self sufficient basis. All the conclusions reached are typical orders of magnitude, but the data can be easily adjusted to specific situations.

Capital cost estimates for such a plant obviously exhibit wide variations depending on the site location and a multitude of other factors. There is irrefutable evidence that the contractual arrangements and ability of the buyer have a decisive influence on the contract price and the final total installed cost. For example, the recently reported total installed costs for two similar sized plants in Bangladesh and Indonesia were $459 million ($805/t of urea) and $250 million ($439/tonne of urea) respectively. In the past, the involvement of international organisations such as the World Bank and IFC has also caused significant increases in capital costs, and extended project delays.

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The total installed cost for a $250 million plant maybe broken down into:

	$ million	per cent
Ammonia plant	100	40
Urea plant	75	30
Offsites	75	30
Total	**250**	**100**

An alternative breakdown could be:

	$ million	per cent
License and engineering	28	11.2
Equipment and materials	125	50.0
Freight (notional)	6	2.4
Site preparation, civil & mechanical erection	91	36.4
Total	**250**	**100.0**

To our figure of $250 million, we have to add a further amount dependent on the schedule and other

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requirements to cover interest during construction, start-up expenses, working capital, etc. A representative figure might be $50 million giving a total project cost of $300 million.

To calculate the impact of capital cost on the ultimate production cost we must examine the effect of interest on loans, depreciation and return on equity. If we begin with a project relatively conservatively financed on a 70/30 debt/equity ratio, this would mean an equity of $90 million and $210 million in the form of long term debt. The financing of the debt would be normally undertaken by a mixture of export credit and syndicated bank loans. At the present time we will assume an interest rate of 9 per cent. Allowable depreciation can vary widely according to the tax regime of the country where the plant is to be located but we will take a flat rate of 10 per cent as being representative. Profit before tax can be considered as 20 per cent on equity, being the level of return desired for a private investment.

The total burden on the selling price of the urea due to capital costs is therefore:

	$ million
Interest	18.9
Depreciation	27.5
Profit	21.0
Total	**64.4**

With an annual on-stream time of 330 days this equates to $118.4 per tonne of urea, ignoring excess ammonia production. The quoted price of urea in April 1992 (see *Nitrogen* 197) was shown as between $120/t bulk fob E. Europe and $140/tonne bagged fob Middle East.

Cut in capital costs

Real production cost economics such as these have forced the evaluation of used plants where the relocated capital cost can be 65-70 per cent of the cost of a new plant, without sacrificing efficiency or a twenty year operating life span. If we work in reverse the attainment of these lower capital costs is readily demonstrated.

Erection and civil engineering costs should be roughly the same at the new site and we will assume a comparable figure for freight, 50 per cent of the original engineering cost for revamping and project management and 3 per cent for dismantling. The structure of costs would then become:

	$ million
Construction and civil engineering	91
Freight	6
Re-engineering	14
Dismantling	6
Total	117

Using these assumptions, we are therefore left with $45.5-58 million for new equipment and facilities, refurbishment and purchase of the existing plant "where is as is".

Normally there will be unavoidable new offsite costs. The dock facilities and buildings such as urea storage, administration, laboratory etc., are a case in point. Of these, the dock facilities and the urea storage building have a significant capital cost of perhaps $10 million depending on the specification.

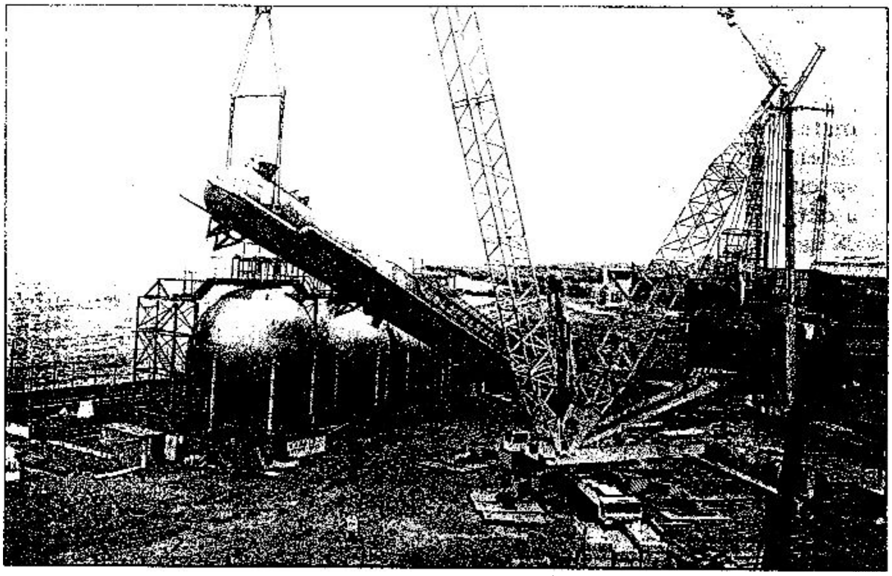
The figures in this example show that the amount available for the purchase of the existing facility must of necessity be small. Rarely should the price paid exceed 3 per cent of the original cost. In addition, in purchasing a used plant attention must be paid to the cost of removing toxics such as asbestos. Indicative of this is the estimated cost of the removal of asbestos from an existing USA ammonia plant of $1.5 million. Three years ago the cost of asbestos removal from an ICI ammonia plant in the UK was $300,000.

If an owner wants to clear a site, demolition is likely to be a cost. This is because the value of scrap and disposable equipment would not normally cover the cost of demolition unless the demolition contractor is fortunate in selling some specific items of equipment for a high return.

There is therefore a strong economic case for the rapid disposal of redundant and uneconomic plants. Many large corporations appear however to have no policy in this regard and many plants are left dormant for years as deteriorating assets.

To identify a suitable used plant which can be acquired much time can be saved by dealing with specialist organisations which is in continual touch with the market. British Sulphur Corporation, through BSC Consultants is able to recommend available used plants to individual clients. In the USA, the Louisiana Chemical Equipment Company of Baton Rouge, Louisiana is perhaps the largest buyer and seller of used plants in the world and can provide data and arrange visits to many fertilizer installations which are for sale.

If a decision is made to examine the feasibility of selecting and relocating an existing plant we must



The nitric acid absorption column at the Scottish Agricultural Industries fertilizer plant at Leith is removed in readiness to be shipped to Arklow in Ireland where the 500 t/d nitric acid plant will be relocated by Snamprogetti on behalf of Irish Fertilizer Industries.

envisage a number of steps:

1. Identification of suitable plants;
2. Selection of suitable plants and preparation of conceptual estimates;
3. Selection of one plant, its inspection and the preparation of a detailed estimate;
4. Negotiation of the purchase price;
5. Dismantling;
6. Concurrently with this, carrying out a revamp and offsites engineering for the new complex;
7. Shipment to new location;
8. Re-erection;
9. Commissioning.

The organisation of this, via a specialist company is the next step. The buyer will almost certainly have precise ideas on the type of plant he wishes to purchase. The conceptual estimates are best prepared by consultants. They will be able to provide an overall estimate after visual inspection of the plant. This will serve as the basic reference for the preliminary decision whether or not to proceed to the next stage. In the USA the cost of these services is not high and could range from $10,000 to $50,000.

If a decision is taken to proceed with a particular plant, a detailed inspection must be carried out and a revised estimate prepared which should be of sufficient accuracy to assess the total installed cost of the relocated plant with a contingency not exceeding 10-15 per cent. A medium sized or small engineering contractor can normally best undertake these services. The cost should not exceed $100,000.

The efficient and timely dismantling of the plant is a key ingredient of the success of the whole project. Major engineering contractors today are system driven to push major projects through on production line basis. While in no way neglecting project management systems, the utilisation of used plants requires a much more detailed and individual analysis of all activities. The optimum would be to employ a low cost company if its staff are allowed to work in the country where the plant is located. An example of this was the dismantling of the OMV methanol plant in Austria by Humphreys and Glasgow India and its successful refurbishment and relocation in India within a period of 23 months. The Chinese, however, have been unable to dismantle plants they have purchased in the USA because of labour restrictions.

In general a local contractor can be found who will execute the work but adequate supervision is needed to ensure the work is carried out correctly and the plant can literally be put together at the other end. For this, the small or medium size engineering contractor that has undertaken the estimate is in general the prime candidate. The initial consultant can often advise on individual companies and the best form of contractual relationships.

The key to revamping resides in the equipment vendors and process design. In general there is not problem in determining from equipment vendors what can be done to improve the performance of equipment they have supplied and obtaining the costs of refurbishment. It should be noted that in the USA there are many companies that will refurbish equipment although they are not the original vendors.

Especially in the USA and UK there are now a number of individual highly specialised process engineers who work on the revamp of existing ammonia/urea complexes. Their services can be linked with one of the small or medium sized engineering contractors to produce a reliable revamp which can be of much lower cost than approaching a major contractor. One example is Planners, Engineers & Consultants, Inc., of Baton Rouge, Louisiana which is completing the revamp of Apache Nitrogen in Arizona, with equipment derived from a shutdown plant in New Mexico.

In a used plant project a great deal of money can be saved by careful control of shipping arrangements. Piecemeal shipping is highly expensive and arrangements should be made so the equipment and materials can be shipped in the minimum number of chartered vessels - ideally two shipments. Again in this field it is wise to contact the specialists in project shipping such as companies like TransGlobal Projects in London.

The importance of the final civil and mechanical erection work cannot be underestimated. It is essential that the supervisors for the dismantling provide construction supervision or advisory supervision for the plant's re-erection. If possible, as in the example of the methanol plant, there is considerable advantage if the dismantling team does the re-erection.

It is instructive to see how the general considerations set out relate to the work for one client bidding for the Sapugaskanda plant in Sri Lanka. Prior to a visit to the plant a conceptual estimate was carried out with no knowledge of the conditions of the existing plant but with full knowledge of all factors at the new location. This work was undertaken in one week and led to a total installed cost estimate of $108 million based on a recommended purchase price of the existing plant of $3 million.

The decision was then taken to proceed to an inspection and the preparation of a more detailed estimate. Humphreys & Glasgow India were retained for the inspection and the dismantling estimate and Fish Engineering & Construction Partners, Houston for the preparation of the overall estimate. The inspection revealed that it had been inadequately maintained and had not been properly shut down and all equipment drained. Water has seeped through lagging and corroded the surface and nozzles of many carbon steel vessels and heat exchangers. In particular water seepage had occurred in the boiler with the result, that this unit with a new value of $3-4 million could not be salvaged. Other problem areas were also encountered.

Humphreys & Glasgow India estimated the dismantling at a considerably lower figure than had originally been envisaged, but in spite of this, the new estimate escalated to $125 million or $73.5 per cent of the new cost. The increase was entirely due to the very poor condition of the plant revealed by the inspection.

The highest bid for the Sapugaskanda plant was $7.2 million with Emirates as the probable country of relocation. A relocation there rather than to another hemisphere helped save shipping costs of around $2 million and made the deal cost effective. ■