0. EXECUTIVE SUMMARY

0.1 BACKGROUND OF STUDY

The Department of Scientific and Industrial Research (DSIR) is currently engaged in the preparation of the National Register of Foreign Collaboration (NRFC). The main objective of this is to carry out analysis of the imported technologies and to evaluate the status of implementation of collaborations.

The scope of objectives of the study were defined on the basis of guide lines given by DSIR. Data was collected from various urea producing units in India through correspondence and by visits to eight plants. Information about the latest developments at international level was sought from a number of leading foreign urea technology licensors. Information was also obtained from consultancy organisations and from published literature.

Macro Structure of Indian Industry
Licensed and Installed capacity in India

Status	**Capacity (Licensed/Installed)**	
	Urea ('000 TPA)	**Equivalent "N" ('000 TPA)**
Operating Plants	12,648	5818
Plants under implementation	4,290	1974
Plants approved in principle	726	334
Plants under consideration	248	114

(SOURCE : UREA PLANTS/FAI)

0.2 PRODUCTION AND CAPACITY UTILISATION

Production and capacity utilisation for the urea industry has shown a significant increase over last seven years. Production increased by as much as 1.6 times between 1980-81 and 1986-87 while capacity utilisation improved from approximately 45% in 1980-81 to 79% in 1986-87.

0.2.1 Distribution of Urea Capacity

a) Geographical Distribution

Amongst the 26 operating plants, maximum urea capacity exists in Gujarat (22.2% of total installed capacity), followed by Maharashtra (15.1%). The eastern states of Bihar, West Bengal, Assam and Orissa have a low concentration of urea capacity. As regards the plants under implementation, maximum capacity is being set up in Uttar Pradesh amounting to about half of the total capacity under implementation.

b) Sector-wise Distribution

Maximum operating capacity exists in the public sector (55.5%), followed by the private sector (26%) and the co-operative sector (18.5%). However, among plants under implementation, 62.3% of the capacity lies in the private sector, so that after implementation of current projects, the public sector's share will be 46.7% followed by the private sector with 35.2% and the co-operative sector with 18.1%.

c) Size-wise Distribution

Among the operating plants, maximum capacity lies in the stream size range of 1400 to 1800 TPD while a majority of the plants under implementation have a capacity of 1100 TPD (Refer 2.6). In terms of number of plants, maximum number of operating plants are in the size range of 400 TPD to 1100 TPD.

d) Import of Urea

The quantum of urea imports has been varying over the years. During the last ten years, the minimum quantity imported in a particular year was 868,000 tonnes in 1982-83 while the maximum quantity imported was 3,686,000 tonnes in 1984-85. The major suppliers of urea to India in recent years have been USSR, Holland, Romania, Bulgaria, German Democratic Republic and Italy.

0.3 DEMAND-PRESENT/PROJECTED

Urea presently accounts for over 8% of total nitrogenous fertilizer capacity in the country and its share in nitrogenous fertilizer projects under implementation is over 88%. Therefore demand and supply figures for nitrogenous fertilizers reflect the status of demand/supply for urea to a large extent.

The projections of the Working Group constituted by the Planning Commission to determine the demand for nitrogenous fertilizers during the 7th and 8th plan periods are shown graphically in Fig. 2.5. Although the demand/supply gap is expected to narrow down till 1990-91, it is likely to increase again and there is expected to be a large gap between demand and production, of about 3,000,000 MT nitrogen by the year 1995.

The increasing world-wide dominance of urea over other nitrogenous fertilizer is apparent from the fact that by 1983/84 urea accounted for nearly 33% of total nitrogenous fertilizer consumption while just four years earlier, in 1979/80 its share was only 27.6%. Given the frequency of ammonia/urea configurations in recent new capacity and in proposed nitrogenous fertilizer projects, it is certain that urea will continue to increase in stature as a major fertilizer material.

The major and contemporary technologies are those of Montedison (total recycle and IDR processes), Toyo Engineering Corporation (Recycle C-Improved, D and ACES processes), Urea Technologies Inc. (Mavrovic heat recycle process), Stamicarbon (CO_2 stripping process) and Snamprogetti (Ammonia stripping process).

0.4 TECHNOLOGICAL STATUS OF THE INDIAN UREA INDUSTRY

In order to examine the technological status of Indian urea Industry eight urea plants were visited by the study team and replies to detailed questionnaires were received from most other units. The units visited were RCF, Thal; GNFC, Bharuch; FCI, Talcher; NFL, Panipat; IFFCO, Kalol; MFL, Manali; ZACL, Goa and IEL, Kanpur.

0.4.1 Specific Consumptions

As far as guarantees given by process licensors are concerned, the figures offered during the 60's and early 70's for ammonia consumption varied from 0.6 (tonne/tonne of urea) to 0.58. However, the best specific consumption of ammonia on an annual basis achieved by any plant set up in the 60's is by GSFC, Baroda (0.604) followed by IEL, Kanpur (0.607). The only plant which has reported a specific ammonia consumption figure of less than 0.58 is IFFCO, Kalol which was commissioned in 1975 and has achieved an annual average figure of 0.5797. Other plants which have come close to the 0.58 figure are Mangalore Chemicals & Fertilizers Ltd. (MFCL), Mangalore (0.582) commissioned in 1976 and GNFC, Bharuch (0.581) commissioned in 1981. RCF, Thal, commissioned in 1985, has a guaranteed figure of 0.575 tonnes/tonne urea. Against this the best achieved figure is 0.5877.

The highest specific ammonia consumptions have been reported by HFC, Durgapur, HFC, Barauni and HFC, Namrup II which have their best figures in the region of 0.64 tonnes/tonne urea.

Among the plants set up in 60's, the highest guaranteed figures of energy were those offered to Neyveli Lignite Corpn. These were 2.5 tonnes steam/tonne urea and 210 KWH electricity/tonne urea. Since then the consumptions of both parameters have ben reduced considerably over the years. In recent plants steam consumptions as low as 0.88 te/te with electricity at 80 KWH/te have been offered (FCI, Sindri modernisation). Against this, the achieved figures were 1.1 te/te and 116 KWH/te respectively.

In general, it is seen that most plants have not achieved the guaranteed specific consumption figures.

0.4.2 Investment Costs

Investment costs for battery limits urea plants have increased almost fourfold since the 1960's. Plants set up in the 80's have reported battery limits urea plant costs in the range of Rs. 3.4 lakhs to Rs. 3.9 lakhs per daily tonne of urea capacity.

Foreign exchange component of cost as a percentage of battery limits urea plant cost show a trend towards increasing indigenisation of urea plants. Starting with 70% and even higher foreign components in the 60's, the figures for plants set up in recent years such as RCF, Thal and HFC, Namrup III are 26% and 18% foreign cost component respectively which is a good achievement and clearly shows the extent of indigenisation achieved.

0.4.3 R & D Efforts

For the development and upgradation of urea technology. Indian industry depends on the already established international process licensors and design and companies. There is hardly any R & D effort towards development of process technologies for urea except for development of modified total recycle process by PDIL which has been utilised in Namrup-III plant. R&D efforts by the ammonia-urea manufacturers, as such are plant oriented where industry interacts with CSIR laboratories, IIT's and some of the engineering companies like PDIL who undertake R&D work for the industry on sponsorship basis.

R&D unit should be set up to deal with the development of fertilizer technologies.

0.4.4 Modernisation Plans

Many urea plants are currently engaged in implementing or planning various modernisation schemes ranging from complete retrofits to energy conservation measures and replacement of obsolete and inefficient equipment.

Hardly three urea plants have reported plans for expansion of urea capacity by installing additional stream for urea. This is because the trend in the urea industry is to build new plants a greedfield sites so as to achieve dispersal of fertilizer capacity closer to the areas of consumption.

There is considerable R&D activity in the industry but it is mostly plant oriented, and is directed towards solving plant operational problems, pollution and environmental control, better water management, utilisation of by products and waste products, energy conservation and effective use of indigenous raw materials.

PDIL have successfully indigenised process technologies which they received form foreign process licensors. This has culminated in the development of their own modified total solution recycle technology for urea production. Today they can undertake supply of know-how, basic and detailed engineering, procurement, construction and commissioning activities independently.

In an effort towards industrialisation, the country has built-up a large capacity to manufacture diverse forms of machines and equipment. As a result, foreign exchange cost of setting up of urea plants has come down from more than 70% in the mid-sixties to about 20% in the plants presently being set-up. Except for some critical items like high pressure centrifugal pumps for ammonia and carbamate service, carbamate solution strippers, other equipment is available indigenously.

The plants built before the mid 70' are highly energy inefficient and considerable potential exists for modernisation in order to reduce the energy consumption. The various techniques available for revamping/ modernisation of old urea plants range from small scale debottlenecking to major retrofitting. A variety of retrofit options are available which can be incorporated in different combinations.

0.5 TECHNOLOGY GAPS AND CONSTRAINTS IN THE PROCESS OF SELF RELIANCE

Although the modified total recycle process is available with PDIL indigenously, this process is not energy efficient as the later genera-

tion processes based on ammonia or carbon-dioxide stripping technology. For such technology, the country continues to rely on the foreign process licensors for grant of license and process know-how. However, PDIL claims to be in a position to undertake the role of prime engineering contractor with only licence and limited assistance in basic engineering from the process licensors. Although there was a good opportunity for PDIL to be given such a responsibility for the urea plants currently being implemented along the HBJ pipelines, this has not been done and the role of PDIL continues to be that of sub - contractor only.

0.6 RECOMMENDATIONS

— Many urea plants in India built in the 60's and 70's are inefficient with respect to specific consumptions of raw materials and utilities when compared with the latest state-of - the-art plants being built worldwide. From the point of view of environmental pollution standards also many plants are deficient specially with respect to limits on nitrogen content of effluent water. There is, therefore, a need to modernise these plants by replacement of chronically troublesome equipment such as reciprocating pumps for ammonia and carbamate solution service with plunger or centrifugal types, boosting of CO_2 compression capacity by provision of additional centrifugal compressor, provision of additional tanks with sufficient capacity to hold up urea and ammonical solution for re-use after shutdowns, introduction of catalytic dehydrogenation of feed CO_2 to bring down ammonia loss through vent gases, minimise explosion hazards and corrosion rate, provision of dedusting system for prilling tower exhaust and hydrolyzer-stripper system for recovery of ammonia and urea from process condensate, incorporation of heat recovery systems, etc.

— Some of the old plants need life extension and as such need retrofitting. This should be taken up on urgent basis as otherwise gap between supply & demand will increase.

— Some of the new energy efficient processes, recently developed and commercially proven, can be considered for retrofitting or for replacement of old Indian urea plants. Substantial savings in recurring energy costs can be achieved as per the information provided by these process licensors.

— While selecting technology for new urea plants, the improved features offered by all the major process licensors by virtue of on-going developments in their technologies should be given due consideration.

— Efforts should be made to set up R&D unit to deal exclusively with the development of fertiliser processes and subprocesses.