EXECUTIVE SUMMARY

DIMETHYL TEREPHTHALATE (DMT)

1. DMT is used in the manufacture of polyester fibre yarn and film and also certain polyester resins. Of these, polyester fibre and yarn account for a major portion of DMT used. DMT production in the world commenced as early as 1949 in England, whereas in India the first DMT plant was set up in 1973 by Indian Petrochemical Corporation Limited (IPCL) at Baroda.

2. At present there are three (3) major producers of DMT in India with a total installed capacity of 1,35,000 TPY (Indian Petrochemical Corporation Limited - 30,000, Bongaigaon Refinery & Petrochemicals Limited - 45,000, Bombay Dyeing & Manufacturing Company Limited-60,000). The targeted production for 1985-86 was 55,000 TPY because two of the units i.e. BRPL and BDML commenced production during 1985 only. The two main raw materials required for DMT manufacture are p-xylene and methanol. For p-xylene, IPCL and BRPL have production capacity of 46,000 TPY which is not adequate to meet the demand of the installed DMT production capacity. Therefore, p-xylene is being imported to meet the short-fall. The total methanol capacity on the other hand, shared between four (4) units is 81,000 TPY. Additional capacity of 5,31,000 TPY is covered by licences and with the progress of their implementation the total installed capacity would be adequate to meet the projected demand for polyester during the VII Five Year Plan.

3. DMT is produced in the country by the well-known Witten Process involves stepwise indirect oxidation/esterification of p-xylene. The process was developed by Imhausen and later became known as the Witten Process of Dynamit Nobel AG of West Germany. In this process a mixture of p-xylene and recycled p-methyl toluate is oxidized catalytically with air to produce p-toluic acid and monmethyl terephthalate. These acids are esterified with methanol into p-methyl toluate and DMT. Crude DMT obtained is purified by crystallization and distillation.

4. The major items of equipment in a DMT plant i.e. Oxidator, esterification columns, crystallizer, flaking machine, centrifuge, special purpose pumps and spares have been imported. The foreign exchange component of the total investment is reported as 44% for IPCL, BRPL and BDML the process licensors are Dynamit Nobel AG Krupp-Koppers GmbH and Hercufina respectively.

   The agreements generally include know-how, basic engineering design as well as supply of imported equipment, supervision of erection and start-up for a total lumpsum payment. The Indian consultants/contractors associated in the implementation of these projects are Engineers India Limited (EIL) and Tata Consulting Engineers (TCE). EIL had rendered services towards detailed engineering for plant, procurement and construction services for off-site facilities for both IPCL and BRPL, TCE were associated in the supervision of dismantling of Hercufina's plant, design and engineering procurement, inspection and expediting, construction, supervision, project management, start-up and commissioning for BDML.

5. Apart from these, a number of local equipment suppliers and contractors had rendered their services covering civil, mechanical, piping, electrical and instrumentation jobs for these projects.

6. In the international scene, the majority of DMT plants in operation are based on Witten process. However, the production capacities are much higher, viz. 200 to 500 TPD.

7. All the development work relating to DMT is being carried out by IPCL, being the oldest unit in production. The research and development centre at IPCL has been active in examining steps on DMT production. In terms of indigenisation of capital goods, IPCL has introduced technological improvement in DMT manufacture with the commissioning of horizontal oxidator for the first time in the world. Efforts are still being made to further improve this. The national institution/laboratories have yet to make any significant contribution in effecting improvement in DMT technology in the country.

8. Due to the development of a production process for high purity fibre grade terephthalic acid its share in polyester fibre production has been increasing steadily and, at present, accounts for over 50% internationally. In India, following the international trend, the production facility for purified terephthalic acid (PTA) is being created and more new units are competing for it. Any new capacity to be set up in India is likely to be for PTA rather than DMT. There is however, scope for carrying out improvements in existing units and the following recommendations are made:

i) There is no need for any further import of technology for production of DMT

ii) The in-house development work should be continued to improve the efficiency and quality with a view to reduce the cost of production.

iii) The existing manufacturers of DMT may consider developing the process and facilities to make pure terephthalic acid from their DMT plants so that they are able to meet the fluctuating demand of these two raw-materials.

A co-ordinated effort by three units, in which the resources pooled and the costs shared would accelerate this development.

iv) Considering the importance of this development, financial assistance as required should be provided and R & D programmes approved to accelerate the development.

v) While the bulk of the equipment in the existing plants was imported at the time of their setting up, for future projects it should not be necessary. Import of equipment that can be produced in India, should not be allowed.

vi) Production facilities should be established for the manufacture of p-xylene to meet the demand for DMT and PTA manufacture.

Polyester Staple Fibre (PSF)

7. Polyester Staple Fibre is used in the production of textile either as 100% material or in various blends with other natural and cellulosic fibres. Among all the synthetic fibres, PSF is the most widely used fibre in fabric industry. It has shown remarkable rate of growth during the last decade. The ever increasing popularity of PSF in garment sector is because of its superior chemical and physical properties, i.e. crease resistance, longer life and attractive appearance.

8. The development of PSF in the world was started in 1940 by the Imperial Chemical Industries (ICI) of England and the Du Pont Company of the USA. The first production plant of PSF could however, be started only in early fifties. In India the first PSF plant was put in operation by ICI (CAFI) in 1965. This was soon followed by setting up similar plants by Indian Organic Chemicals at Madras. Calico at Baroda, Swadeshi Polytex at Ghaziabad and JK Synthetics at Kota, all by early 70s.

9. At present there are nine (9) producers of PSF in the country, the latest being BRPL whose plant commenced production in 1988. The present installed capacity is 1,78,000 TPY as against the total licensed capacity of 3,75,000. Looking into the past performance i.e. growth rate the demand is expected to match the target production level by 1988-89. In view of the new textile policy of the Government allowing expansion of existing capacity under PSF and encouraging use of alternate material PTA alongwith DMT for PSF manufacture, it may be possible to realise the above target. The old existing plants in India are based on either batch or continuous process technology. For expansion of their existing capacities, these manufacturers have opted for continuous process plants for which technical collaboration agreements with various technology licensors have been entered into. The continuous process plants, due to their inherent advantages in terms of lower production costs and consistency in products quality, are preferred to batch type plants. The know-how and basic engineering package alongwith the major proprietary equipment, are supplied by the collaborator against a lumpsum payment. The detailed design and engineering of the projects has been undertaken either by Indian representatives of the foreign collaborator, directly or through an Indian consulting/engineering firm.

10. The major items of imported equipment include polymerisation reactor, special product pumps, agitator for reactor, injection devices, special purpose heating systems and control instruments, spinning and drawing lines including cutters and balers etc. The main raw material required for the manufacture of PSF are DMT/PTA and mono ethylene glycol (MEG). The present installed capacity of 1,35,000 TPY for DMT and expected commissioning of PTA plant of Reliance Industry Ltd. having capacity 75,000 TPY would considerably ease the availability of raw materials for PSF manufacture. The availability situation of MEG, however, remains strained in view of the seventh five year plan target, considering the present production level and the capacity under implementation. It is anticipated that the gap will be bridged by imports.

11. Until 1963, DMT was the only material for production of PSF. After high purity terephthalic

acid (PTA) was produced for the first time, its share in the production of fibres gradually increased. In 1965, the share of DMT in PSF production was round 85% which came down to 55% in 1980 and would perhaps decline further to 25% by 1990. In India DMT, Production started in 1973. At that time it was the only raw material used for the production of PSF. Only recently, new production capacities are being based on the use of PTA as raw material.

12. The main motivation for the development of manufacturing process for PTA has been the need to continuously reduce the production cost of polyester and to make the operation more economic on international scale.

13. The existing PSF manufacturers are engaged in their own R&D work and have made some significant contribution in the process and plant improvement. The results achieved are improved fibre quality, savings in raw materials and energy, reduced waste generation and development of special type of fibre namely TRILOBAL Fibre and its production on a commercial scale.

The R&D units of almost all the old established PSF manufacturers have been recognised by the Department of Scientific and Industrial Research (DSIR) under the Ministry of Science & Technology of the Government of India.

14. Apart from in-house R&D works, the National Chemical Laboratory (NCL), IIT, Delhi and Sasmira have been engaged in R&D works relating to quality of fibres, development to design and programme for evaluating effects of different parameters on yield and quality at various process steps etc.

15. The new PSF plants being set up are capital intensive and require foreign collaboration and import of certain category of capital equipment. The rapid pace at which the technology has been changing made imports imperative. The collaboration agreement stipulate payment of lumpsum fee and in some cases additional design engineering and consultancy fee is also being paid. These new plants have inbuilt glycol and methanol recovery and fibre waste processing units.

16. A planned and concerted action by PSF manufacturers is required to maximise the production from existing plants and to obviate need to further import the technology and equipment in future. Some of the areas in which potential for joint effort by the manufacturers and national laboratories are:

i) Modification of existing plant to enable use of either DMT of PTA as the starting material.

ii) Improvements in process parameters to increase the production of polymer from the existing plants batch of continuous.

iii) Improvements in output of the spinning units by utilising higher speeds and better pack and pump as well as extrusion plants.

iv) Improvements in the throughputs of existing fibre drawing plants.

v) Development of production processes for the new type of fibres which are being introduced in the market by the major producers in the world.

vi) While a limited amount of waste processing is done by some of the units, it is necessary to carry out process studies to minimise production of waste from the fibre plants and develop plant design for economic recycling/recovery of waste.

vii) Indigenisation of catalysts and chemicals and spin-finishes required by the PSF industry, which are being currently imported/Some of these catalysts/chemicals have been developed in India. The quantities are not large but the saving in foreign exchange will be significant.

viii) Development of production facility in India for the fabrication of proprietary equipment is the most important area for foreign exchange saving. The process plant and engineering industry in India has the capacity and capabilities to produce most of the items of equipment which constitute a PSF plant.

No doubt there have been rapid developments in design of such equipment and manufacturers like Fleischner in Germany have almost a monopoly in the supply of key items of equipment. The collaboration for know-how and drawings with such manufacturers in developed countries will be necessary before the production in India can be established. This should be looked at as a national problem and the industry encouraged to come up with proposals to manufacture the specialised equipment like-cutter and palletizers for polymer packs-pumps and spinnerette for polymer extrusion, fibre collection mechanism, draw-frames, fibre crimpers and cutters, sophisticated instrumentation for the polymer, spinning and drawing sections.

ix) There is scope for improving efficiency of operation particularly in the utilisation of electricity hot oil, steam, nitrogen and chemicals. The PSF manufacturers can certainly benefit by a co-ordinated and planned development work in improving such efficiency.