EXECUTIVE SUMMARY

0.1 PRODUCT AND ITS MARKET

0.1.1 BASIC METAL-ALUMINIUM

The Aluminium metal processed in various forms has been found to be suitable for a variety of domestic and industrial uses. The reasons of its usage in wide range of shapes and sizes can be found in physical and chemical properties of this metal. The most significant properties of this metal are :

i) amenability to thermal and mechanical treatments or malleability,

ii) lower specific gravity,

iii) good conducting properties-thermal and electrical,

iv) can be alloyed to obtain desired improvements in strength,

v) resistant to chemical attacks.

It has been possible to process this metal in various forms to obtain the products with the requisite properties. Thus, although the earlier usage of Aluminium was restricted to pots and pans, Aluminium is now being used for a variety of uses like in aircraft, electronics, roofing, packaging, building industry, etc.

0.1.2 PRODUCT - ALUMINIUM FOIL

The Foil is a continuous web of aluminium metal rolled to thickness ranging from 0.005 mm to a maximum of 0.15 mm. Foil is available in many forms, i.e., hard, soft (annealed), lubricated, non-lubricated plain, coated, coloured, printed, embossed and laminated to a variety of paper and synthetic films.

0.1.3 PROPERTIES OF ALUMINIUM FOIL

Aluminium foil has significant properties as given below :

i) good thermal and electrical conductivity,

ii) good formability,

iii) impermeability and non-absorptivity to water, grease, oil & light;

iv) odourless and tasteless,

v) good adhesion to a variety of compounds,

vi) excellent printability,

vii) resistance to oxidation and chemical attacks.

Owing to these properties, aluminium foil is preferred to other packaging materials as flexible materials cannot match these characteristics of aluminium foil.

0.1.4 APPLICATIONS

The foil is used for packaging of many products, some of which are given below :

— Pharmaceutical tablets
— Bulk & unitized packing of tea and coffee
— Prepared meals
— Bakery products
— Frozen meat, fish
— Milk bottle caps
— Wine
— Lube Oil, greases
— Powdered milk
— Confectionery
— Biscuits
— Photographic film
— Gift wraps
— Household wraps
— Butter, margarine
— Cigarettes

0.1.5 CHARACTERISTICS OF ALUMINIUM FOIL MARKET

The applications of Foil could be divided into two major groups i.e. packaging applications and non-packaging applications. Packaging applications include the products given above. For these products, the requirement of packaging is such that it should protect the product from physical and chemical changes and climatic hazards. Non-packaging applications include heat exchangers tube fins in air conditioners, capacitors and cable wraps, in which specific properties of the foil such as conductivity are used.

As compared to other flexible packaging material, aluminium foil has proved to be the superior material as far as protection of material, convenience in usage and surface finish are concerned. However, in India, aluminium foil has proved to be costly because of higher price of basic material and higher excise duty. Many a time, it is not available in requisite quantity.

Owing to the high price and uncertain availability of the foil in the past, many of the user industries like pharmaceutical industry switched over to other packaging material such as glasine — poly laminate. Some companies introduced blister packs and some companies reduced thickness of the foil. Circumstances have thus proved that usage of packaging medium for consumer items depends on its availability, price, and shelf-life desired for the product. Depending upon the situation, the appropriate packaging medium is selected.

The usage pattern, being very sensitive to price and availability, keeps on changing from time to time depending upon the economies of usage of aluminium foil vis-a-vis that of other materials.

In India aluminium foil industry, there are frequent changes in the usage patterns and specifications of foils, as compared to the foreign countries and therefore, the usage of the foil has remained restricted in variety as well as in quantitative terms.

The growth of foil industry, has thus not kept pace with the growth of its major user industries. The past production of foil shows an overall growth rate of about 7% only.

0.1.6 SUPPLY OF ALUMINIUM FOIL

At present, there are three foil plants in operation and two are under implementation. The present Licensed and Installed capacity, and production of these units are as follows:

(Figures in Tonnes per year)

Manufacturers

	Licensed capacity	Installed capacity	Production 1986 (estimated)	Remarks
		FOIL		
INDAL	4000	4000	3600	Plants in
IFL	5500	4690	5000	Operations
PGF	1500	3000	482	
BALCO	500	500	—	Closed at present
Total	11500	12190	9082	
		CONTAINER SHEET		
IFL	1750	1500	500	

The capacity utilisation at IFL was 16% followed by INDAL at 90%. The capacity utilisation of PGF was only 16%.

The licensed capacities of the two new upcoming units are as below:

	Licensed Capacity (tpa)
Annapurna Foils Ltd. (AFL)	3000
Synthiko Foils	720
Total	3720

The PICUP/HINDALCO project for 5000 tpa project is understood to be under active consideration for implementation.

The imports of foil during the period from 1983 to 1986 were as follows:

Year	Tonnes
1983	245
1984	558
1985	200
1986	367

Imports of foil are mainly for its usage in electrolytic capacitors and cable wraps. Super-purity aluminium foil (99.99% purity) is also imported by the user-units engaged in etching of aluminium foil.

The indigeneous supply has been confined to India Foils Ltd. (IFL) and Indian Aluminium Co. Ltd. (INDAL). IFL is a pioneer unit in this industry and has had highest share in total production throughout its existence. Both the companies have set up their plants with foreign technical support through their principals and have established the manufacturing facilities during the last 15-20 years. The third plant viz. P.G. Foils Ltd. (PGF) was set up with second-hand plant and machinery, at a remote place in Rajasthan. It had management as well as technical problems from its inception and hence could not make any dent in Indian market.

IFL has practically developed all the products for different applications of foil in India alongwith the gradual increase in the capacity. It also has plans for expansion, modernisation and a plan to set up a separate project for asceptic packaging. New applications of foil such as foil-jute laminate for bulk packing of tea etc. are being developed.

Annapurna Foils Ltd (ASL) and Synthiko Foils Ltd.(SFL) are the two projects under implementation. SFL based on indigenous technical know-how was expected to commence production in July 87. AFL has however, the latest plant being supplied by "New Hunter Engineering" (NHE).

The capacity of Synthiko Foils Ltd. (SFL) is very small (720 tpa). This unit is promoted by Synthiko Group and a technocrat having long experience in foil manufacturing. Pradeshiya Industrial Corporation of U.P.(PICUP) is likely to set up a new foil plant with HINDALCO as the joint sector partner. It is understood that this unit may commence commercial production in early 90s.

0.1.7 DEMAND

The present indigenous demand for the foil has been estimated to be about 9000 tpa. The sectorwise estimates are given in Table 0.1. It can be seen from the table that drugs and pharmaceutical sector accounts for almost 40% of the total demand. Among the other sectors, the tin containers, chocolates, cigarettes, biscuits, are the major foil consuming industries.

Out of the total user sectors, some are expected to grow fast, some are expected to remain stagnant while growth of some is likely to decline in future. The growthwise classification of user industries is indicated below:

Fast Growth	**Stagnant/ Slow growing**	**Declining**
Drugs & Pharmaceuticals	Tin containers	Milk
Chocolate	Tea	
Catering Services	Air Conditioners	
Soaps	Power capacitors	
Lamitubes	Cigarettes	
Flexible packaging of food items	Cheese/butter	

The growth prospects of drugs & pharmaceutical industry is very important from the point of view of foil industry as the share of this sector in total demand for foil is very high. The price rationalisation and revision under the new drug policy, is expected to result in a higher growth rate for this sector.

Due to popularity and convenience of food items, the flexible packaging sector is expected to grow very fast. The use of casserole trays in Railway catering services has been started recently and due to the convenience in handling, the usage is likely to increase. Lamitubes are recently introduced in Indian market and are likely to replace collapsible tubes in certain user sectors.

Hence, a higher growth of Lamitubes is considered in the future. In chocolate industry, the major share has been captured by Hindustan Cocoa Products Ltd. This unit had restriction on expanding its capacity.

Table 0.1

ESTIMATED DEMAND FOR ALUMINIUM FOILS

Sr. No.	Sectors	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
1.	Drugs & Pharmaceuticals	3900	4290	4719	5191	5710	6281	6909	7600	8360	9196
2.	Tin Containers	800	816	832	849	866	883	901	919	937	956
3.	Chocolates	350	402	462	531	611	703	808	929	1068	1228
4.	Cigarettes	700	735	772	811	852	895	940	987	1036	1088
5.	Biscuits	350	385	423	465	511	562	618	680	748	823
6.	Catering Services	200	240	288	346	415	498	598	717	860	1032
7.	Tea Packets	100	104	108	112	116	121	126	131	136	141
8.	Contraceptives	400	460	529	608	699	804	924	1063	1222	1405
9.	Milk	200	—	—	—	—	—	—	—	—	—
10.	Tea Chest Linings	250	270	292	315	340	367	396	428	462	499
11.	Cheese & Butter	30	31	32	34	36	39	42	45	49	53
12.	Soaps	12	14	17	20	24	29	35	42	50	60
13.	Room Airconditioners & Water Coolers	300	321	343	367	393	420	449	480	514	550
14.	Lamitubes	50	120	200	250	300	350	420	500	520	600
15.	Flexible packaging (Misc.)	50	60	72	86	103	124	149	179	215	258
16.	Electrolytic capacitors	650	715	787	866	953	1048	1153	1268	1395	1535
17.	MFD & Power capacitors	150	150	150	150	150	150	150	150	150	150
18.	Cables	250	288	330	380	437	503	578	665	765	880
19.	Others	250	268	286	306	328	351	375	401	430	460
	Total	8992	9669	10642	11687	12844	14128	15571	17184	18917	20914

Note: The above demand estimates are made on the basis of usage of aluminium foils in some sectors and the projected growth rates of these sectors. The limited availability and high prices of aluminium foil vis-a-vis substitute packing materials have slowed down growth of demand of aluminium foils in some sectors. On the other hand there are expectations of higher demand growth rates from sectors like food processing on whose development special emphasis is placed. Because of these reasons, there are a number of demand estimates which vary widely from each other; from as low as 15000 tpa to 26000 tpa by the year 1995.

However, recently their capacity of chocolate plant is doubled and hence in the last 2 years, consumption of foil by them has increased substantially. This trend is likely to continue in future. Composite containers are likely to replace tin containers and hence this sector is likely to grow at a slow pace. In the case of milk, usage of bottles is prevalent in Bombay and in few other schemes in Maharashtra. However, it is envisaged that the use of bottles in Maharashtra would also be discontinued in the next one or two years. Hence, consumption of foil for milk bottle caps would decline to zero in the near future.

The annual demand for foil is estimated to increase from present level of 9000 tonnes to about 13000 tonnes by 1990 and to about 21000 tonnes by 1995. These estimates are based on existing application patterns and likelihood of growth prospects of user sectors.

With the likely commissioning of AFL & SFL (total installed capacity 3720 tpa), the availability of foil would improve substantially and therefore, development of new applications will not be constrained due to better availability.

It is envisaged that the new applications in the following areas could be developed in future. These developments would affect the demand for aluminium foils favourably.

— Asceptic packaging of fruit juices, milk shakes, fruit pulps, sweetened milk, etc.

— Composite containers for malted food, baby food etc.

— Flexible pouches for edible oils

— New applications for casserole trays

— Packaging of ready-to-cook/use food

On the export front, performance has been very poor. This is attributed to poor quality of indigenous foil, high price & uncertain availability. The export for the last three years were :

Year	Tonnes
1984	398
1985	319
1986	169

At present, only IFL exports the foil to the nearby countries like Bangladesh and Sri Lanka. Such exports are obligatory and in fact, IFL, in the real sense, cannot compete in international market in view of quality as well as price factors.

0.2 PROCESS AND TECHNOLOGY DEVELOPMENT

0.2.1 PROCESS

Aluminium obtained from electrolytic reduction method is remelted and refined and cast into rectangular slabs. The slabs, after surface treatment, are hot rolled to foil stock of thickness 0.4 mm to 0.8 mm. The foil-stock is then annealed and softened.

The foil of uniform gauge and desired tolerance is made by subjecting this foil-stock through a series of cold rolling passes, on one or a number of rolling mills. The minimum thickness to which the foil is cold-rolled, is 0.006 mm, achieved through pack rolling, i.e., rolling of two foils together.

At the end of cold rolling operations, the foil is annealed in order to fully soften it and impart the characteristics like dead fold and easy workability. Annealing also burns off the oil left on the foil surface. Annealing thus makes the foil free from oil and fully sterile.

The annealed foil, is then subjected to the various treatments as per requirements :

a) Separation of pack rolled foils,

b) Slitting to desired widths, including edge trimming,

c) Embossing,

d) Sheet making and cutting to length,

e) Application of adhesives, wax, lacquer etc.,

f) Lamination with paper, paper board, LDPE,

g) Single or multicolour printing,

h) Slitting of laminated composite,

i) Packing in desired lengths or weights.

There are small scale foil processors, who specialise in particular foil treatment activity such as slitting, printing or sheeting operation for particular users, e.g., pharmaceutical units, confectionery units etc.

0.2.2 TECHNOLOGY DEVELOPMENTS

As a result of need for cost reduction and productivity improvements, developments in casting and rolling technologies have taken place over a few decades. Strip casting technology, developed in the last decade abroad, offers metallurgical advantages over the conventional slab casting and hot rolling route. Further, operational flexibility offered in terms of possible variations in width changes, in alloy compositions, coil weight, and thickness of strip, brings in substantial gains at the subsequent foil rolling stage. These gains are — lower inventory levels, lower material losses in rolling and improved productivity.

In developed countries, rolling technology underwent various stages of development such as pack rolling, strip rolling, two-high rolling, three-high rolling, four-high rolling and lastly the development of universal foil mill. All these technologies were developed, in stages, with a view to improving the productivity and yield, so that technical and cost competitiveness could be ensured. The development of universal foil mill (UFM) enabled single installation of high production plant with in-built flexibilities, thereby reducing the capital investment earlier required for multiple units. This mill is equipped with a variety of on-line control and feedback systems to ensure smooth and automatic production function. These UFMs are presently capable of rolling foil in width upto 2100 mm, with coil weights upto 20,000 kgs at a maximum speed upto 2500 m/min.

0.3 TECHNOLOGY STATUS OF INDIAN INDUSTRY

0.3.1 EQUIPMENT

As mentioned earlier, the following units are now in regular production of various types of foil and its derivatives :

India Foils Ltd. (IFL)
Indian Aluminium Co. Ltd. (INDAL)
P.G. Foils Ltd. (PGF)

In addition, plants of the following companies are being set up.

Annapurna Foil Ltd. (AFL)
Synthiko Foils Ltd, (SFL)

In the case of IFL, alongwith old equipment installed over a number of years, new facilities such as four-high rolling mills, 6-colour rotogravure printing machine, foil separator, double spindle slitter, annealing furnaces of 1 tonne and 7 tonnes, lacquering machine, gum laminating machine, have been added. In 1987-88, IFL proposes to add UFM and new machines for printing, laminating, extrusion coating and gravure cylinder processing. Thus, IFL has now old as well as new facilities of a variety of nature.

In the case of P.G. Foils, majority of the equipment was brought in as second-hand equipment.

Both these units presently have a number of machines of smaller capacities. This can result in imbalance in capacities for processing operations in which case the individual special purpose machines would not be optimally utilised.

The particulars of the facilities of SFL and INDAL are not available. It is understood that INDAL has an advantage of in-house manufacturing facilities for slab casting and hot rolling the same into foil-stock of required width. It is further understood that a new cold strip mill of 1425 mm width has been supplied by Davy Mckee of U.K. alongwith VIDIPLAN facility to INDAL in 1982. Earlier in 1981, one foil separator of operating width of 1100 mm has also been procured from Schmutz. These brief details indicate that the widest foil mill in operation at present is at INDAL. A cold strip mill has also been installed for rolling foil-stock.

The facilities of AFL have the recent technical developments duly incorporated by NHE. The total cost of project works out to about Rs. 2775.00 lakhs.

The installation of new facilities at IFL will ensure improved product quality and operational flexibility while AFL will have technical advantage through better facilities.

0.3.2 ECONOMIES OF INVESTMENT

The analysis of costs of IFL, presented in Chapter 3 brings out the fact that marginal improvement in yield or processing cost will not be enough

to sustain the new investment. The incidence of raw material cost and excise duty makes the operation susceptilble to low profit margin. The only way out, therefore, is mass scale production. However, under the existing conditions, it may not be sustainable unless export possibilities are explored.

0.3.3 RAW MATERIAL

The main raw materials required for the manufacture of foil are the foil-stock, paper, polyethylene, dyes, lacquers, thinners etc. Foil-stock, used as raw material, is available in the country. INDAL, HINDALCO can supply foil-stock of required quantity. Bharat Aluminium Co. Ltd. (BALCO) is another producer. With National Aluminium Co. (NALCO) coming on stream, smooth supply of foil-stock of requisite with and purity could be ensured.

The finer the grain size of the foil-stock, better is the performance of the light gauge foil. If the foil is rolled down to 0.006 mm from the poor quality foil-stock, numerous problems, such as pinholes, foil breakage, permeability to liquids, light etc., arise. The overall yield in the present foil plants is around 70% The main reason for high level of wastage (around 30%) is poor foil-stock quality. This is also one reason for poor export performance.

The problem of wastage would be more serious when the existing units are modernised or new mills are commissioned. The rate of rejections would increase as the modernised units or new plants would be designed to operate at higher speeds, resulting in more frequent breakages of foils. This problem could be minimised by upgradation of existing slab-casting-hot rolling route, or introduction of continuous casting route, which would improve quality of foil-stock resulting in finer grain structure, uniform physical properties across the width and along the length of foil-stock as also the lower level of oxides and impurities. Other alternative is to import the foil-stock till new technologies are stabilised and availability of good quality of foil-stock is assured.

The super-purity foil, used after etching in electronic components, is of 99.99% purity and is not manufactured in India. It has to be imported totally, for direct use.

0.3.4 COLLABORATION

IFL and INDAL have no formal technical collaborations but have access to latest technological developments through their foreign prin-

cipals, whereas PGF and SFL have gone ahead without any foreign collaboration. The only formal technical collaboration, reported so far has been arranged by AFL, having joined hands with M/s. New Hunter Engineering. The collaboration includes supply, erection and commissioning the entire equipment, technical know-how and training of technical personnel. Alcan Aluminium Ltd. (being a shareholder of INDAL) and Alcan group and its British counterparts have been technically associated with INDAL.

0.3.5 RESEARCH & DEVELOPMENT (R&D)

In foil industry, R&D is basically restricted to the product developmental activities. Special R&D facilities or sponsored research projects are absent in all companies.

The developmental work carried out by IFL and INDAL are given below:

I) IFL

— tea chests

— blister and strip packing for pharmaceuticals

— pouches for food items

— wraps for biscuits and chocolates

— capacitors and condensors

— telecom cable wraps

— laminates for flexible packaging

— thread in currency notes

New products under development are:

— package of lube oil

— cooling oil

— shrikhand

— tetrabrick for soft drinks

Process improvement relates to wet tension control, matching the multicolour prints, ink quality, viscosity, etc.

II) INDAL

The process product development activities of INDAL, during the last few years are :

— blister packs for pharmaceuticals uses,
— cable wrap
— extrusion laminated foil
— cigarette carton warp
— food trays
— lid foil for polystyrene containers
— condensor foil rolling and annealing
— wax coating for biscuit wrap
— in line corona treatment
— increased foil width (from 1050 mm to 1130 mm)

The other developments include standardization of indigenous raw materials (including IPCL made polyester granules), improved sealability and printability of pharmaceutical foils, removal of odour from printed foils etc. (INDAL's R&D activities are presented in Table 3.5(c).

The product developments and process improvements have helped in extending the usage of foil to a variety of purposes. However, the efforts for improving the consistency in product quality and printing quality have been inadequate.

There is definite scope for introduction of new technologies either indigenously developed or bought from foreign parties in order to offer better products and as per desired delivery schedules so that exportability of foil products could be improved.

0.4 TECHNOLOGY ABSORPTION EFFORTS

0.4.1 TECHNOLOGICAL GAPS

As explained earlier, technological advances made in India relate to marginal modification to old equipment and piecemeal installation of new facilities. Technology employed in most of the cold rolling mills, presently

in operation is quite old and dates back to '60s, resulting in poor productivity of foil rolling mills.

Technologcal status in India has remained more or less stagnant in the sense that little has been achieved through genuine Indian contribution towards product quality or design and development of better facilities The development efforts are more or less duplication of the efforts already made by foreign producers. Even these efforts have been restricted due to older equipment and poor quality of foil-stock.

a) The review of technological status in Indian Foil industry Indicates that upgradation modernisation of existing plants or installation of new plants must aim at:

i) improvement in product quality and its consistency,

ii) increase in productivity of mills,

iii) reduction in inplants losses to reduce cost,

iv) increase in the availability of foils in various forms for critical mass-consumption usages,

v) improvement in the exportability of foils.

b) Technological gaps as identified are:

i) Process improvements required for improving quality of foil-stock.

ii) Standardisation of process of continuous strip casting for attaining better quality of strip and consequently foil-stock,

iii) Alloying and refining processes used while treating liquid aluminium,

iv) Automation of foil rolling mill process incorporating control of thickness, flatness, roll contour etc.,

v) Foil mill automation for roll changing, spool transfer, coil transfer,

vi) Automation of foil processing equipment for web-tension control and quick coil transfer,

vii) Multifunctional and multi-configuration oriented foil-processing equipment,

viii) Development of quick drying inks, adhesives and lacquers

These gaps have been caused due to apparent isolation of foil industry from other sectors such as engineering, electronics etc. Wherein the technology developments have made considerable strides that could have been put to use for upgradation of foil technology through modifications/ improvement in plant facilities.

0.4.2 TECHNOLOGY UPGRADATION EFFORTS

The details of the technological upgradation efforts required to bridge the gaps through indigenous efforts and equipment/technology imports are given in Table 0.2. In addition, equipment manufacture in India, use of imported foil-stock for improvement in performance of existing mills, supporting the jobbing oriented small scale sector, etc. are a few other suggestions for making indigenous efforts gainful.

It is to be noted that the proven design features and the on-line accurate measurements and feedback control systems on new mills enable the mills operation at a very high speed. Similarly, the sturdy mill designs, developments in roll coolant and flatness sensing techniques have enabled increase in the foiling width to around 2000 mm.

The efforts are also required to optimise the productivity of foil mill through minimum setting time, lesser down-time and long duration rolling passes. Such improvements can be incorporated in the existing foil mills.

Thus, the alternatives available to existing units are either to modernise the old mills or to install a new equipment. Considering the market situation, modernisation may be appropriate. However, it is not essential to install very high speed and wider foil mills in India, as the investment in such mills will be high and returns will be poor due to possible poor utilisation of the mill. If the demand grows at the faster rate and better raw material is available, such an investment may be justified. However, if the export is the main aim, the investment will be worthwhile (provided good quality raw material is also available at internationally competitive prices).

0.4.3 SMALL SCALE PROCESSORS

As the large foil producers cannot cater to the specific small quantity requirements, it will be essential to encourage or support small units engaged in jobbing type work. Adequate support to these units can contribute substantially towards the improvement in customer service.

Table 0.2

TECHNOLOGY UPGRADATION EFFORTS (PROPOSALS IN BRIEF)

	Particulars	Indigenous Efforts	Equipment/ Technology Imports
1.	Process improvement for foilstock manufacture (Slab rolling)	Review foil stock specifications. Investigate process drawbacks at INDAL/HINDALCO/ BALCO. Indicate need for special facilities to meet specific requirements. (e.g. melting refining etc.) Identify economics of installing these facilities.	Metal deoxidation, refining and degassing process know-how and equipment for the same.
2.	Strip caster operation Standardisation of operating parameters. Alloying and refining process.	Conduct trials to establish relationship between various casting parameters and the cleanliness/solidification patterns. Establish the gains of superior product, in terms of wastage & cost reduction. Esatblish process parameters for different alloy composition. Indigenise equipment manufacture.	Import of engineering and operational know-how for continuous strip caster. Import of special purpose proprietary equipment for refining and process control. Performance guarantee essential.
3.	Foil Mill process automation	Indigenisation of components (e.g. electronics, control panels etc.)	Feasibility of installation on existing units. System design, operational training and import of special purpose proprietary equipment.
4.	Foil Mill material handling automation.	Aim for minimising mill down-time Indigenisation of equipment manufacture.	System designs for specific mills with performance guarantee.
5.	Improved mechanical, electrical, hydraulic systems.	—do— Retire/replace mills which cannot be modified.	Feasibility of modifying the existing mills. System design, import of critical components with performance guarantee.

	Particulars	Indigenous Efforts	Equipment/ Technology Imports
6.	Automation of foil processing units	Identify specific parameter/ equipment to be modified. Indigenise component manufacture.	Equipment suppliers to study automation modernisation possibilities, identify limits of automation.
7.	Multifunctional and multiconfiguration equipment.	Identify market needs and establish feasibility of new installations. Indigenise component manufacture.	Essential equipment import. System design with supply of special purpose/proprietary components/systems.
8.	Development of quick drying materials.	Indigenous production after getting know-how.	Material production know-how.
9.	Integrated know-how transfer.	For existing or new plants. Indigenous nature of equipment.	Total engineering and know-how transfer arrangement with detailed performance guarantee.

0.4.4 FINANCE FOR UPGRADATION

It is suggested that existing policies of special consideration for modernisation and technological upgradation should be extended to foil industry.

0.4.5 MANPOWER

The existing units have a number of experienced and trained technical persons. However, for successful technological absorption of new technologies, it is advisable to train the technical staff at the equipment suppliers' plant.

05 CONCLUSIONS

To sum up, it can be said that the immediate thrust areas for technological upgradation of foil industry are :

i) improvement in quality of foil-stock and

ii) productivity improvement in foil rolling mills operations

The retarded development of foil industry can be attributed to :

i) poor foil-stock quality

ii) high price of foil-stock

iii) inadequate and uncertain availability of foils

iv) old machinery,

v) high excise duty incidence

vi) slow growth of domestic market and

vii) non-exposure to export market.

Owing to these factors, the technological development of the industry has been quite slow.

0.5.1 RECOMMENDATIONS FOR SHORT TERM ACTIONS

a) Non-Technical

i) Need of the industry of foil-stock for immediate productivity and quality improvement, should be met on priority.

ii) Duty structure for foils/composites used for critical hygienic food and drug packing appliances, should be such to promote use of the foils.

iii) Consider making available imported foil-stock for fulfilling export obligations.

b) Technical

i) Encourage small scale sectors for processing foils and composites.

ii) Encourage ancillarisation of such small processors by the large foil consumers.

iii) Review technology of the existing foil mills with a modernisation or for deciding on replacement by new mills.

iv) Foil manufacturers should obtain full specifications of rolling mills and their sub-assemblies/components for indigenisation of spares.

v) Review the existing technology transfer arrangements for the benefits accrued and modifications of terms and conditions for transfer of new technologies effectively.

vi) Provide for training of technical personnel at the plants of reputed foil manufacturers or plant manufacturers, while allowing technology transfer for existing as well as new schemes.

vii) Foil manufacturers should indigenise plant spares and incorporate automisation systems on mills.

0.5.2 RECOMMENDATIONS FOR LONG TERM ACTIONS

a) Non-Technical

i) Introduce MODVAT scheme of excise for foil industry also and ensure that benefits are passed on to foil users.

ii) Provide long term finances for modernisation/new units, provided the following objectives for development are ensured:

- quality improvement
- productivity improvement
- reduction in wastages
- increased foil availability and
- exportability of foils.

b) Technical

i) Encourage foreign know-how transfer for continuous strip casting and cold rolling of strip. This may be for in-house use and/or for sale of foil-stock and strip for making other flat/extruded products of aluminium.

ii) Explore improvement in quality and availability of indigenous foil-stock.

iii) Allow technology transfer for integrated automation system for existing mills, (with manufacture of components indigenously).

iv) Encourage new integrated foil plants (i.e. strip casting, rolling, processing activities under one roof) to make the products export oriented.

v) Allow the units to replace old multiple units by new 'universal' installation.

vi) Provide in all techology transfer arrangements training of technical personnel at operating units abroad, indigenisation of component manufacture and specific performance guarantees which must be fulfiiled.

vii) Encourage specific R & D projects. These should be for equipment design features for :

- improved productivity,
- reduction in foil wastage during processing,
- new products i.e. foil composites for specific applications.
- indigenising manufacture of components/systems or for new materials (i.e. inks, papers, films, coolant additives, etc.).