ANNUAL REPORT
1993-94

Department of Scientific and Industrial Research
Ministry of Science & Technology
New Delhi-110016

CONTENTS

ANNEXURES

LIST OF FIGURES AND PHOTOGRAPHS

I.(A) AN OVERVIEW

1.1 The formation of the Ministry of Science and Technology was announced through a Presidential Notification dated January 4, 1985 (74/2/1/8. Cab) contained in the 164th Amendment of the Government of India (Allocation of Business) Rules, 1961; the Department of Scientific and Industrial Research (DSIR) forms a part of this Ministry.

The Minister Incharge of Ministry of Science and Technology is the Prime Minister Shri P.V. Narasimha Rao and the Minister of State for Science and Technology is Shri Bhuvanesh Chaturvedi, Minister of State in Prime Minister's Office.

1.2 The Department of Scientific & Industrial Research (DSIR) comprises of the activities of the Council of Scientific and Industrial Research (CSIR), Technology Promotion, Development, Utilisation and Transfer (TPDU), National Information System for Science and Technology (NISSAT), two public Enterprises viz. National Research Development Corporation (NRDC) and Central Electronics Limited (CEL).

1.3 During the last five decades of its existence, the CSIR has emerged as a premier national Science & Technology (S&T) agency with a vast network of National Laboratories, Extension & Regional Centres and Complexes. The total R&D plan of CSIR was catagorised into four major groups viz. industry/economy oriented programmes, societal programmes, basic research programmes and research support activities.

Among the major industry/economy oriented programmes of CSIR laboratories, those related to drugs, agro-chemicals including pesticides, catalysts, chemicals, intermediates and leather constitute a major chunk.

Based on IICT developed technology 'Ketorolac', a latest and most powerful non-steroidal analgesic and anti-inflammatory drug has been introduced in the country. NEERI has conducted regional environmental impact assessment and carrying capacity studies for industry. The laboratory has also conducted studies and developed basic engineering packages for textile industries, lime-kilns, pulp and paper, metal plating and other industries towards pollution mitigation and better environment. NCL developed methodologies for micro encapsulation of commercial pesticides using a variety of processes. The other activities include development of improved catalysts and process development of fine chemicals and intermediates. CLRI has transferred technologies to industry in the area of synthetic tanning agents. CECRI has developed technology for hard anodising of aluminium alloy for use in defence. The laboratory has also developed a know-how for production of electrolytic chromium metal on a 200 TPA scale. IIP has developed and demonstrated technologies for processing bulk thermoplastics and high performance fluids. CEERI has designed a 4000 gate complexity CMOS gate array chip for Centre for Development of Telematics (C-DOT) for use in their telephone exchanges in non airconditioned environment. CSIO has developed an eight channel seismic data telemetry system to monitor and analyse micro earthquake/earthquake data telemetered from a network of remote seismic stations via digital ground telemetry to a central recording station. NAL continued work on the light transport aircraft. NML has developed technology for production of sintered alumina grains from indigenous raw materials. CFTRI has developed a process to obtain curcumin - a colouring matter from turmeric. CMERI has developed high performance ceramic cutting inserts.

Under societal programmes, RRL Jorhat has launched a programme of providing germ free drinking water to villages in North East India by supplying water filter candles to community organisations. A technique to make thin film composite membranes was developed by CSMCRI for use in commercial single pass reverse osmosis desalination plants. NEERI has carried out studies involving critical analysis of existing facilities vis-a-vis desired service levels in the areas such as water treatment, sewage treatment and solid waste management. CLRI organised a short term training programme in making leather goods.

In the area of basic research, IICB has developed a method for isolation and purification of KDNA network from Leishmania donovani promastigotes. A sex - and tissue - specific DNA binding protein has been isolated and purified at CCMB. ITRC has characterised presence of D-1 & D-2 sites in human blood platelets. For the first time value addition of sensor materials like metabolized zirconia was carried out by NCL by incorporating several metal ions of variable valence. IICT has achieved total synthesis of Fredericamycin A, an anti-tumor antibiotic. IICT has also initiated a major programme on the synthesis of glycopeptides like K-13, an inhibitor of angiotension converting enzyme. High resolution scanning tunneling microscopic (STM) studies carried out at NPL on CGO films have, for the first time, revealed the characteristic carbon cage structure of the molecules showing well resolved hexagons and pentagons.

Under Research Support Activities, work has been carried out in the area of coal, aromatic plants, and computer simulation studies related to transportation. Consultancy services in the area of bridge engineering were provided by CBRI, CRRI, and SERC(G). SERC, Madras has successfully assembled and tested two transmission line towers of a Canada based fabricator. Assistance has also been given in the lowering of HBJ gas pipeline below the bed of proposed Narmada canal near Baroda. PID continued effective dissemination of scientific information through a number of special issues of journals on contemporary advances in different fields.

Various activities were organised to celebrate the Golden Jubilee Year of CSIR which was concluded in September 1992. Two Golden Jubilee conferences and one International Conference of Heads of Scientific Agencies (ICOHOSA) were organised. President of India in his very thought provoking address lauded the CSIR on its contributions on the material, intellectual and spiritual planes. Shri P.V. Narasimha Rao, Prime Minister of India and President of CISR in his message has congratulated CSIR and all its scientists and employees.

1.4 The major programme of the Department of Scientific & Industrial Research (other than CSIR) have now been grouped as under:

I Research and Development by Industry (RDI) consisting of:

(a) In-house R&D in Industry.

(b) Scientific and Industrial Research Organisations (SIROs).

(c) Fiscal Incentives for Scientific Research.

II Programmes Aimed at Technological Self-Reliance (PATSER) consisting of:

(a) Technology Absorption and Adaptation Scheme (TASS) including:

- Technology Evaluation and Demonstration Scheme (TED)
- Talented Indian Engineers and Scientists (TIES)

(b) Indigenous Development of Capital Goods.

III Scheme to Enhance the Efficacy of Transfer of Technology (SEETOT) consisting of:

(a) National Register of Foreign Collaborations (NRFC).

(b) Industrial Technology.

(c) Transfer and Trading in Technology (TATT).

(d) Linkages with International Organisations including Asian and Pacific Centre for Transfer of Technology (APCTT).

(e) Promotion and Support to Consultancy Services (PSCS) which also include the Consultancy Development Centre (CDC).

IV National Information System for Science and Technology (NISSAT).

V. Public Enterprises include:

(a) Nation Reserch Development Corporation (NRDC)

(b) Central Electronics Limited (CEL).

1.5 Research and Development by Industry (RDI)

Under the Schene of granting recognition to In-house Research and Development Units, there were 1229 units having valid recognition as on 31 December 1993. 159 In-house R&D centres incurred an annual expenditure of over Rs. 1 crore each. During the year 1993, 55 In-house R&D centres were accorded recognition and 319 units were accorded renewal of recognition. During the year 1993-94, 15 publications were brought out; Seventh National Conference on In-house R&D in Industry was organised; DSIR National Awards were presented to 9 industrial units. 4 Issues of In-house R&D in Industry update were brought out.

Scientific Associations, Institutions, Universities and Colleges which undertake research in the area of medicine, agriculture, natural and applied sciences seek approval to avail the fiscal incentives provided for pursuing such work. During the year, 39 institutions were recognised as SIROs; 255 were accorded renewal of recognition.

The Government had notified an incentive and relief to the user of know-how developed in the country. This would be in the form of depreciation allowance at higher rate on the cost of plant and machinery installed after 1 April 1987. During the year, 16 certificates involving Rs. 5043 lakhs as cost of plant and machinery set up based on indigenous technology were issued.

1.6 Programmes Aimed at Technological Self-Reliance (PATSER)

The Technology Absorption and Adaptation Scheme provided partial financial support to 37 firms involving over 60 Research, Design, Development and Engineering projects in absorption and upgradation of imported technology. Out of these, 25 projects have been completed so far. The projects in progress include those of MECON concerning import substitution of hydraulic AGC (Automatic Guage Control) system. HCL's projects concerning recovery of raw material used in Fibre Optic Cables, Hindustan Organic Chemicals project concerning simulation studies for the distillation train in the Phenol plant, Swaraj Mazda's project concering improvement of fuel consumption and emission reduction in Diesel Engine, Bharat Heavy Plats and Vessels Ltd's project concerning development of flexible super insulated piping. Bharat Earch Movers project concerning Dumpers and Front end loaders, IBP project concerning explosives, Triveni Structurals project concerning transmission line towers, semiconductors complex project concerning American Standard Instruction Code (ASIC) for CDOT exchange and FACT project concerning mathematical modelling for Caprolactum plant. In addition a Roster/Directory of Research & Design Experts in Technology Absorption has been completed in this year.

Technology evaluation studies relating to various sectors have been completed and these include the sectors such as railway wagon, home appliance, secondary steel sector, refractories, plastic furniture, plastic tanks, marble granite, paint, fertiliser granuation, secondary aluminium and cement. Support has been given to ERDA for a technology evaluation and demonstration project concerning energy efficient motors, CEL for development and demonstration of 25 KW SPV power plant for rural applications.

Under Talented Indian Engineers and Scientists Scheme a total of 82 preliminary industry profiles have been completed.

The Scheme on Promotion and Support to Indigenous Development of Capital Goods was launched in 1990-91 aimed at promotion of indigenous development of capital goods, which are either imported or which have a substantial export potential. The directories of imported capital goods

cleared for import during the year 1989 to 1991 and catalogue on machine tools have been brought out in the printed forms. The reports of capital goods requirements by food processing industry, naphtha and gas cracker projects and dies & moulds sector were prepared and evaluated by expert committees. Some development projects pertaining to the special purpose machines for manufacture of conical steel barrels, CNC tool and cutter grinder, process technology and capital goods package for synthetic rutile have been approved. The project concerning development of side arm charger, machines for manufacture of electrolytic capacitor, laser based ECB drilling machine and density moisture guage are under consideration.

1.7 Scheme to Enhance the Efficacy of Transfer of Technology (SEETOT)

The Department continued its activities relating to the scheme on National Register of Foreign Collaboration. A compilation of primary data on FCs for the year 1992 was brought out. Computerisation of data collected on foreign collaborations for the period 1981 to 1992 has been completed. During the year reports on technology status of various sectors/products like TV Picture Tube, High Pressure Boiler, Water & Effluent Treatment Plant, Acrylonitrile, Shuttleless Looms, BOPP & Polyester Films, Two for one Twister etc. were printed.

Interaction meeting with manufacturers, users, Government Departments, R&D organisations, Technical Institutes, Industry Associations and others were organised to finalise the reports.

Under the scheme of Transfer and Trading in Technology scheme several activities were supported. These include: commissioning studies relating to preparation of technology profiles of developing countries; conducting studies highlighting India's technological capabilities in select industrial sectors; creation of computerised database on technologies available for transfer; organising workshop/interaction meetings and live demonstration of exportable technologies at Pilot Plant level. Technology export potential studies on Computer Software, Agrobased industry, Two-Wheeler industry and Technology profiles of Egypt, Zaire and Singapore were completed. Technology demonstration and commercialization projects on Cell Type Air Washer and Iono-Oxidation technique were undertaken. An interaction meeting to finalise the draft report on Solvent Extration industry was organised during the year.

The scheme relating to promotion and support to consultancy services essentially aims to strengthen consultancy capabilities for domestic and export markets. The activities have been towards documenting consultancy needs and capabilities in important industrial sectors and at State levels; Providing institutional and programme support to Consultancy Development Centre (CDC); Associations and other promotional agencies; Registration scheme for consultants is being implemented. Technology Business Incubator Programme launched to promote technology based small enterprises, presently include three Incubators on experimental basis.

Guidelines were prepared to invite proposals involving consultancy services in the transfer of technologies from R&D organisations to industry; some proposals were received.

CDC was promoted in January, 1986 as a non-profit society, with a view to implement some of the programmes of DSIR and also promote and strengthen the consultancy capabilities. It is not to undertake any commercial activity but, at the same time, earn revenues to the extent possible, through specialised programmes and activities. The Chairman of CDC is the Secretary in the Ministry of Science & Technology or his representative, and the Governing Body includes representatives from Consultancy (Private and Public) organisations, Government Departments, Industry, and R&D Organisations. CDC is implementing programmes such as Consultancy Development Promotion Assistance (CDPA), computerised database, training and human resources development for consultancy, and programmes sponsored by other agencies. DSIR is providing recurring and non-reccuring support to CDC.

1.8 National Information System for Science and Technology (NISSAT)

The scheme on National Information System for Science and Technology (NISSAT) envisages promotion and support to the development of a compatible set of information systems for science and technology and interlinking these into a network. The approach adopted is to bring the existing centres, systems and services to a higher level of operation so that the interests of the national community of information users could be better served.

The activities of NISSAT have resulted in establishing 10 information centres in the area of Leather, Food Technology, Machine Tools and Prodution, Drugs and Pharmaceuticals, Textiles and allied subjects, Chemicals and allied industries, Advanced ceramics, Bibliometrics, crystallography and CD-ROM. Five regular facilities to access international database services (NACIDS) have been establised in five regions. SDA service is provided to users on the basis of their information profile using CD-Rom and online. Four metropolitan library networks in Calcutta, Bombay, Pune and Delhi are established to ensure better sharing. Three generalised software for library automotion were developed; distributed and establised NISSAT-UNESCO support software in more than 960 institutions in India; several database development activities on specific subject areas were lauched; quarterly NISSAT newletter for dissemination of information activities was published.

1.9 Public Enterprises

Two public enterprises namely, National Research Development Corporation (NRDC) and Central Electronics Limited (CEL) attached to the DSIR, were engaged in important activities in the commercialisation of indigenously developed technologies.

Some of the major technologies licensed by NRDC during the year include: electrolytic chromium metal; fly ash bricks; spiece oleoresin; monocrotophos and acephate pesticides; extraction of edible grade raw palm oil; dynamic carrier control system; low cost plant tissue culture; maintenance free lead acid batteries; C-band signal generator and blood bags. The ongoing projects include: sand lime bricks; acid proof cements from rice husk; artificial heart valve; copper phthalocyanine blue; synthetic perptides for inducing the growth and fertility in fishery, poultry and cattle. The corporation has successfully transferred technologies for the manucature of AZT drug to Brazil and for setting up blood bag project in Indonesia.

Cetral Electronics Limited (CEL) holds a unique position among the family of Public Sector Enterprises in Electronics, with its emphasis on indigenous technology inducted both from its in-house developments and from the National Laboratories, for its production programme in diverse hi-technology areas of national importance. The activities of CEL are sharply focused in three thrust areas:

(i) Solar photovoltaic cells, modules and systems for a variety of applications.

(ii) Selected Electronics Systems - Equipment for Railway Signaling & Safety, Cathodic Protection Equipment for Oil Pipelines, Switching Systems and Projection Television Systems.

(iii) Selected Electronic Components - Professional (Soft) Ferrites, Electronic Ceramics, Piezo Electric elements and microwave components.

CEL has been the pioneer in the country in the areas of soalr photovoltaics, ferrites and piezoceramics. Today, it enjoys the international status of being the fourth largest producer of single crystalline silicon solar cells in the world.

2.0 During the year 1993-94, there was an alround growth in the activities of different programmes of DSIR.

Department of Scientific and Industrial Research

I (B) Financial Summary

The financial summary giving the Actuals 1992-93, BE 1993-94, RE 1993-94 and BE 1994-95 of various plan and non plan schemes (headwise/broad catagorywise) is as under.

(Rupees in crore)

Sl. No.	Head of Development Project Programmes/Schemes	Actuals 1992-93 Plan	Non-Plan	Total	Budget Estimates Plan	Non-Plan	1993-94 Total	Revised Estimates Plan	Non-Plan	1993-94 Total	Budget Estimates Plan	Non-Plan	1994-95 Total
1.	Assistance to Council of Scientific and Industrial Research	99.66	162.11	261.77	126.50	166.28	292.78	126.50	194.07	320.57	140.00	198.50	338.50
2.	Technology Promotion Development and Utilisation Programme	12.15	0.00	12.15	11.00	0.00	11.0	10.97	0.00	10.97	14.10	0.03	14.13
3.	Research and Development	1.72	0.00	1.72	2.20	0.00	2.20	2.20	0.00	2.20	2.10	0.00	2.10
4.	Investment in Public Enterprises												
4.1	Central Electronics Limited	2.58	0.00	2.58	4.00	0.00	4.00	4.00	0.00	4.00	2.25	0.00	2.25
4.2	National Research Development Corporation	0.10	0.00	0.10	0.15	0.00	0.15	0.15	0.00	0.15	0.15	0.00	0.15
	Total	2.68	0.00	2.68	4.15	0.00	4.15	4.15	0.00	4.15	2.40	0.00	2.40
5.	Loans to Public Enterprises												
5.1	Central Electronics Limited	2.58	4.56	7.14	4.00	0.00	4.00	4.00	0.00	4.00	2.25	0.00	2.25
5.2	National Research Development Corporation	0.10	0.00	0.10	0.15	0.00	0.15	0.15	0.00	0.15	0.15	0.00	0.15
	Total	2.68	4.56	7.24	4.15	0.00	4.15	4.15	0.00	4.15	2.40	0.00	2.40
	Total Investments & Loans	5.36	4.56	9.92	8.30	0.00	8.30	8.30	0.00	8.30	4.80	0.00	4.80
6.	Secretariat Economic Services	0.00	0.82	0.82	0.00	0.87	0.87	0.00	0.90	0.90	0.00	0.92	0.92
	Grand Total	118.89	167.49	286.38	148.00	167.15	315.15	147.97	194.97	342.94	161.000	199.45	360.45

II. COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

1. INTRODUCTION

1.1 During the last half a century of its existence, the Council of Scientific & Industrial Research (CSIR) has emerged as a premier national science & technology (S&T) agency with a vast network of National Laboratories, Extension & Regional Centres and Complexes spread through the length and breadth of the country (Annexure II-1). Over these years, CSIR has made major contributions to the industrial and socio-economic development of the country besides achieveing excellence in basic research and creating a strong infrastructure in terms of S&T manpower in the country. In general, these contributions encompass three important sectors of the national fabric, viz. industrial progress, socio-economic development and generation of export potential for the country's products.

1.2 CSIR's involvement in accelerating the industrial development of the country has been in terms of providing technical know-how for upgradation of existing technologies, improving efficiency of existing processes and generating indigenous technologies in response to emerging needs of the industry. The major areas of CSIR's R&D activity have been: agro-chemicals including pesticides, catalysis, drugs, petroleum processing, electronic control systems for agro-industries and natural products.

The formulation of the Eighth Five Year Plan (1992-97) of CSIR during the last quarter of 1991 marked the beginning of a reorientation of the R&D programmes of national laboratories in accordance with the new industrial and trade policies of the Government of India. The total R&D plan was categorised into four major groups viz. industry/economy oriented programmes, societal programmes, basic research programmes and research support activities and technical services. The achievements of CSIR laboratories are categorised as:

- Industry & Economy-oriented
- Societal
- Rural Development
- Basic Research
- Research Support Activities

2. INDUSTRY/ECONOMY ORIENTED PROGRAMMES

2.1 Drugs, Diagnostics, Pharmaceuticals

2.1.1 Process Technology :

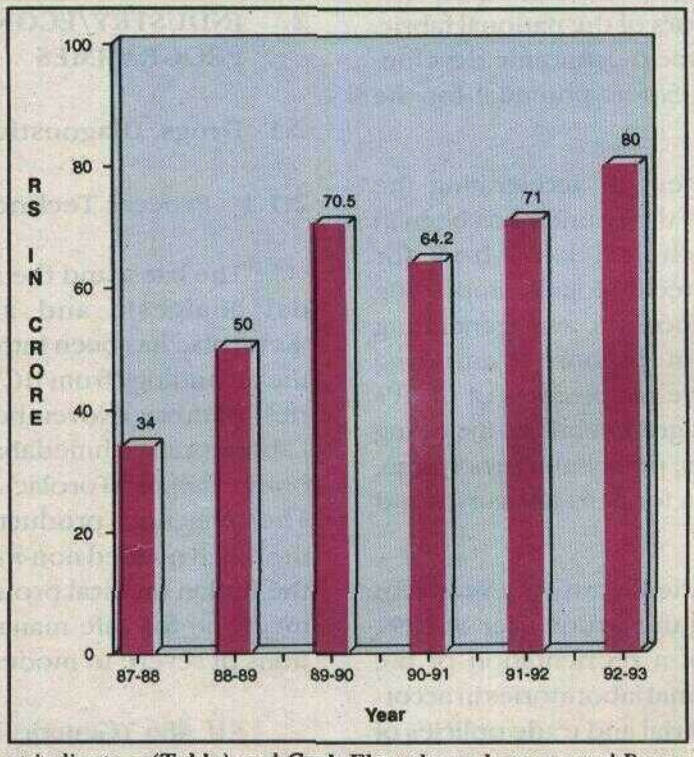
The latest and the most powerful non-steroidal analgesic and anti-inflammatory drug 'Ketorolac'has been introduced in India, based on the technology from IICT, by M/s. Lupin Laboratories, Bombay (November, 1992) and M/s. Cadilla Laboratories, Ahmedabad (January, 1993) under brand names 'Torolac' and 'Dolac' respectively. The indigenous production of Ketorolac, provides the much needed non-*narcotic* analgesic and gives the Indian medical professional a broad spectrum medicine for safe management of various conditions of severe to moderate pain.

RU 486 (Generic Name Mefepristone), the latest abortificent is the monopoly of the French

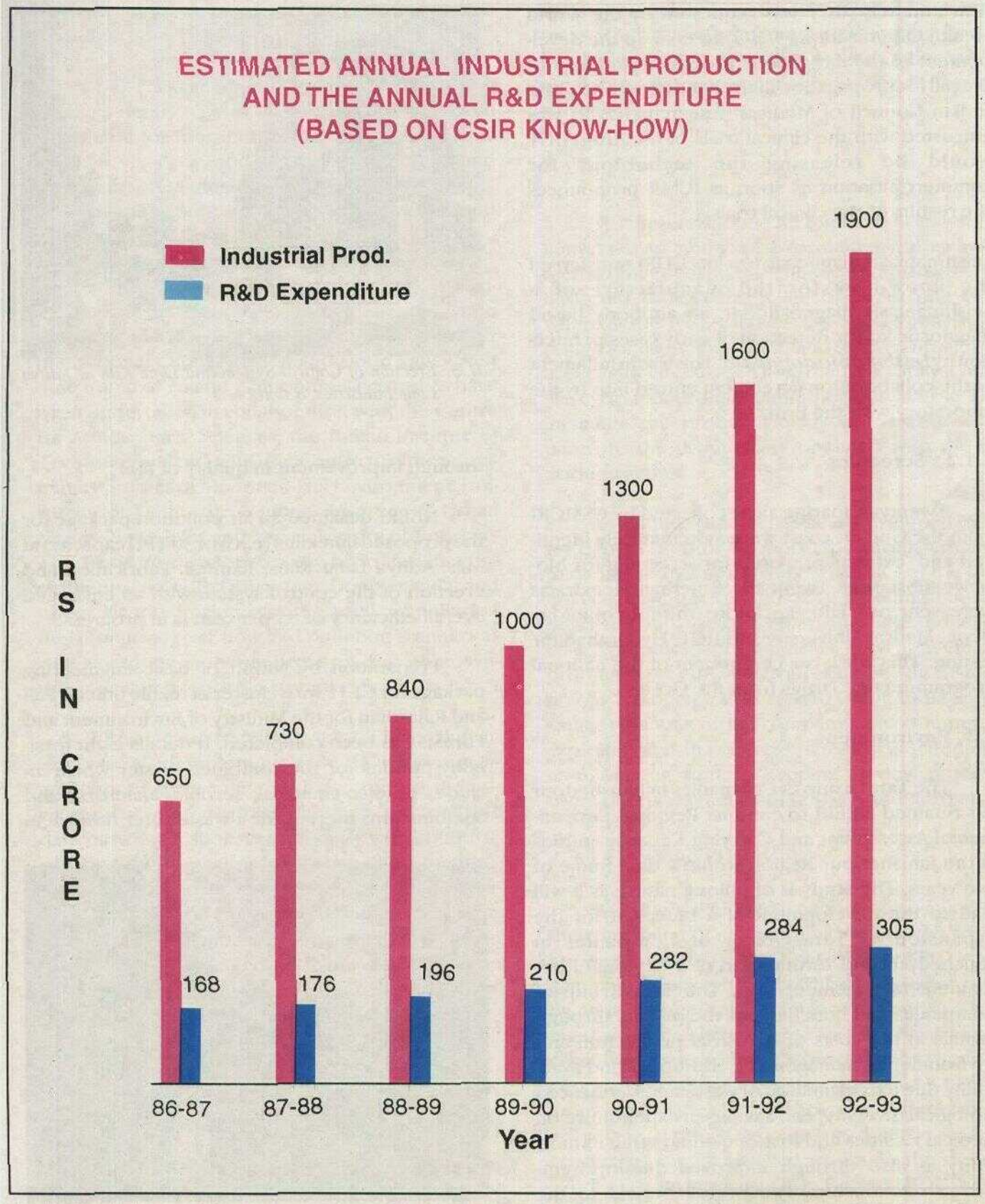
Research Output Indicators

	1991-92 Cumulative		1992-93 Cumulative (Provisional)	
Know-how licensed (No.) (First time)	39	1887	53	1940
Licence agreements	200	5732	200	5932
Industrial production based on CSIR know-how (Rs. crore)	1600	11,500	1900	13,400
Saving in productivity accruing through CSIR R&D efforts (Rs. crore)	200	2500	200	2700
Patents filed (No.)	238	5425	251	5676
Contract value (Rs. crore) (of projects in hand)				
(a) Contract Research	150		180	
(b) Consultancy	24		20	
Cash flow (Rs. crore) through				
(a) Contract Research	61		68.5	
(b) Consultancy	10		11.5	

Cash Flow through sponsored Research & Consultancy



II.I Research Output indicators (Table) and Cash Flow through sponsored Research & Consultancy



II.2. Estimated Annual Industrial Production and the Annual R&D Expenditure (Based on CSIR Knowhow)

firm Roussels. IICT was requested by the World Health Organization (WHO) to take up the development of the indigenous process technology of the pill for propagation in the needy countries. The Indian Council of Medical Research (ICMR) was entrusted with the clinical trials of the drug. IICT would be releasing the technology for commercialisation as soon as ICMR pronounces the results of the clinical trials.

Leishmaniasis diagnostic test kit - CDRI transferred the know-how for the manufacture of a Leishmaniasis diagnostic kit, an antibody based diagnostic kit for detection of early cases of infection by *Leishmania donavani*. This was in fulfilment of the collaboration agreement entred into by the laboratory with the firm.

2.1.2 Screening

Twentysix marine algae collected by CSMCRI from the Gujarat coast were systematically identified and extracts prepared for screening for bioactive substances. Twentythree methanolic extracts were sent ot CDRI, Lucknow, the Microbiology Dept., Madras University and IICT, Hyderabad for testing. This work is a component of the national programme on "Drugs from the Ocean".

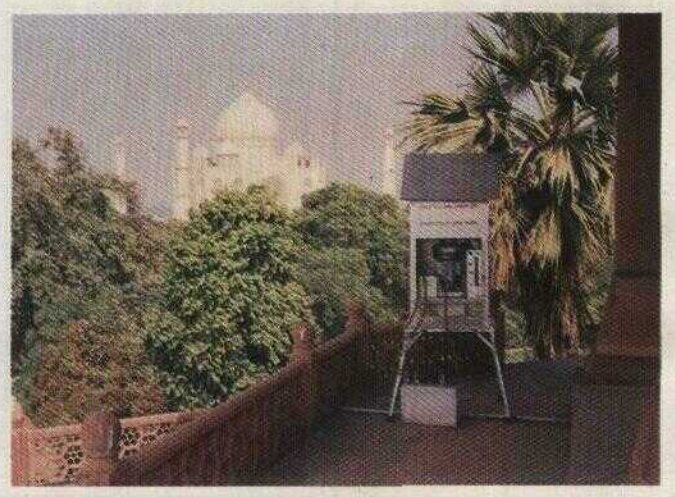
2.2 Environment

The Tata Group of Companies in Jamshedpur has retained NEERI to conduct Regional Environmental Assessment and Carrying Capacity studies in the Jamshedpur Region within a time-frame of two years. The study is of unique nature as it will lead to the development of a blueprint for the expansion of Tata Group of Companies in Jamshedpur and formulation of a Regional Environment Management Plan. The Tata Group of Companies will benefit from the project through savings in the costs of industrial production and environmental management, additional land availability due to reclamation of wastelands, enhanced biological diversity, and savings in expenditure on medical facilities and loss of mandays due to morbidity as also through improved employer-employee relationship. The overall benefit to the people living in Jamshedpur region would be through improvement in quality of life.

II. 3. Erection of Control System and Lime Kiln at Aditya Lime Industries, Ramtek

NEERI designed an air pollution package for the proposed limekilns (each of 30 TPD capacity) at M/s. Aditya Lime Kilns, Ramtek. Fabrication and erection of the control system with an envisaged overall efficiency of 85 per cent is in progress.

Preparation by NEERI of basic engineering package for CETP for a cluster of textile units at Pali and Rajasthan for the Ministry of Environment and Forests has been completed. It details eight feasibility options for the combined waster which includes physico-chemical, aerobic, anaerobic and combinations thereof for a wastewater flow of 36



II. 4. Air Quality Monitoring within Taj Trapezium

MLD. In addition caustic recovery from process water has been recommended.

CETP Package for industrial clusters involving heterogeneous type of industries have also been completed for four industrial estates in Himachal Pradesh, viz. Parwanoo, Barotiwala, Kala Amb and Mehatpur. The industries include fruit processing, metal plating, pulp and paper, engineering and pharmaceutical units.

NEERI was retained by the Ministry of Environment & Forests (MEF), to take up studies on carrying capacity based development planning for the National Capital Region and Doon Valley with time-frame of 36 and 27 months. The studies have been undertaken in collaboration with the Centre for Atmospheric Sciences, the Indian Institute of Technology, New Delhi, the Centre for Inter-disciplinary Studies of Mountain-Hill Environment, University of Delhi, the National Institute of Urban Affairs, New Delhi and the University of Roorkee. The Institute developed state-of-art facilities/instruments, viz. GIS/DIP system, Doppler sodar and upper air monitoring systems, total air pollution flux monitors, river flow and pollution scanners as well as canopy monitors, leaf area and photosynthesis analyzer for these studies.

With a view to redefining the Taj Trapezium in view of considerable time lapse since the recommendations were made and also due to the advancement in prediction techniques and available data base, MEF sponsored a study with NEERI to redefine the trapezium with state-of-art methodologies based on air environment assimilative capacity and to evolve regional developmental plans within the impacted zone. The project also aims at delineation of concrete guidelines for evaluation and decision-making related to further industrial development in the Agra region.

2.3 Chemicals

2.3.1 Agrochemicals & Pesticides

NCL developed methodologies for microencapsulation of commercial pesticides using a variety of matrices and processes. Polymer microencapsulated pesticides offer many advantages. They are safer to handle and can be formulated as sprayable emulsions in water, thus avoiding the use of environmentally unfriendly organic solvents.

2.3.2 Catalysis

NCL has developed an improved catalyst for conversion of methanol to formaldehyde, an intermediate needed by the chemical industries. The imported catalyst has a life of about one year, whereas the NCL catalyst had successfully functioned for eighteen months and showed no signs of absence of effectivity. Thus, the NCL catalyst has a life cycle longer than the imported catalyst. This increases the productivity by about 15%, compared to the productivity obtained with the imported catalyst.

An alumina catalyst has been developed by IIP for dehydration of alcohols (specifically ethanol) to olefins (ethylene). Nearly 30 tonnes of the catalyst costing about Rs. 4.00 crore are being annually imported and used by companies like India Glycols, Synthetics and Chemicals, Polychem etc. for production of ethylene from ethanol. The IIP technology has been transferred to Oxide India Ltd. (a catalyst manufacturing company) and commercial exploitation is in progress. The firm is scheduling its marketing strategy keeping in view potential users of this catalyst both in India and abroad.

2.3.3 Organic Chemicals

NCL has developed a continuous process for the conversion of maleic anhydride (MAN) to 1,4-butanediol (BDO), tetrahydrofuran (THF) and gammabutyrolacton (GBL). This process sponsored by Adarsh Chemicals, Bombay, has several advantages over the conventional acetylene-based process involving handling of hazardous acetylene and copper acetylide catalyst. Also, acetylene is becoming increasingly scarce and expensive. Another major advantage in the NCL process is that the reaction conditions can be tailored to obtain the desired product (from amongst GBL, THF and BDO) selectively.

2.3.4 Chemicals - Intermediates

Trimethyl Phosphite (TMP) is an intermediate for several pesticides, and an important reagent in organic synthesis. The process know-how for production of TMP from phosphorous trichloride via the ammonia route has been successfully demonstrated by IICT to the sponsors M/s. Sabero Organic Pvt. Ltd., Bombay, at a pilot scale of 10kg/hour continuous process. The know-how package includes detailed engineering for a plant of 1.5 TPD capacity.

Cyanuric Chloride is the most valuable organic intermediate extensively used for the manufacture of reactive dyes, explosives, etc. The production of this chemical is monopolized world over by Degussa, Germany and Ciba-Geigy, Switzerland. IICT has licensed the indigenous technology developed by it to M/s. Aerra Chemicals Pvt. Ltd., Hyderabad, against a fee of Rs. 2.00 crore (Rs. 175 lakh for process know-how and Rs. 25.00 lakh for detailed design engineering of commercial plant of 2000 TPA), recurring royalty of 1% (for 5 years) on ex-factory sale price of cyanuric chloride manufactured. The demand of Cyanuric Chloride is around 2500 TPA.

2.3.5 Process Technology

A process for the production of ultra pure polymer grade hexane from a hexane feedstock has been developed by IIP through a novel adsorptive separation route. The present annual requirement in the country is around 3500 tonnes, costing around Rs. 7.00 crore but met through imports. The technology development on Bench Scale has been completed and the basic process design for commercialization is being prepared by the Engineers India Ltd., (EIL).

2.3.6 Leather Chemicals

Balmer Lawrie & Co. commissioned CLRI for the development of a technology for producing phosphorylated fatliquor. A process know-how package was provided by CLRI. The company has since been utilizing CLRI pilot plant facilities for producing this fatliquor for initial trials. The product finds application in the manufacture of softie uppers from cow hides, buffalo hides and goat skins. The process does not involve the use of hazardous chemicals or by-products harmful to the environment.

Salts of chromium are cited as polluting agents in leather processing. CLRI technology for making synthetic tanning agents, based on aluminium (Alutan) and chromium & aluminium (Alcrotan) had been transferred to M/s. Nirmala Leather Chemicals, Sultanpur. Alutan can be used as a chrome saver as well as a retanning material while Alcrotan can be used as a tanning material in place of conventional chrome salt.

CLRI restandardised the process parameters and demonstrated the laboratory scale process for the preparation of thio cyano methyl thio benzo thiazole (TCMTB), to M/s. Chemocrown India Ltd., Madras. Pilot scale level experiments are in progress. TCMTB is an effective replacement for pentachlorophenol (used as a biocide for purposes of preservations), the use of which has been found unacceptable from the environmental point of view, by Germany, the East European countries and the USA.

2.3.7 Electrochemicals

A technology for the hard anodising of aluminium alloy has been developed by CECRI at the instance of the Hard Alloy Penetrator Project (HAPP) of the Ministry of Defence. This technology is being utilized by HAPP for hard anodising of Aluminium alloy components of Anti Tank Missile assemblies. Unlike electroplating and anodising, hard anodising is well known for its superior throwing power.

Electronic component manufacturers employ printed circuit board (PC) microcircuitry in their equipment. The board is a copper clad epoxy laminate electroplated with nickel and gold. Occasionally when plating is defective the gold has to be recovered. A typical board carries 500 mg of gold on an average per piece of 25 x 16 cm dimensions. (0.8% W/W). The technical know-how for recovery of gold from electroplated electronic contacts has been developed by CECRI. The process has been

handed over to M/s. Rangam Electronics Ltd., Madras; M/s. Fortran Cirkit Electronics Pvt. Ltd., Madras.; M/s Himagiri Exim, and M/s. Grishma Special Materials, Bombay.

M/s. Kannvarees Chemicals Limited, Madras will put up a 10 tonnes per day plant for production of potassium hydroxide based on CECRI know-how using membrane technology. This process is the latest technology for the manufacture of caustic soda, caustic potash and chlorine. CECRI Technology has certain advantages, like use of coated anodes and ctalytic cathodes, indigenous equipment and machinery except the membrane, and requires less investment. The technology has been scaled up to commercial dimensions and successfully operated. The performance and results are on par with those of foreign technologies. The other benefits of use of this technology are: capital cost of the process is less compared to imported ones; product is pure and competitive both in quantity and cost in terms of international market and consequently may lead to higher exports; conservation of energy and securing of foreign exchange.

2.3.8 Electrometallurgy

Hindustan Zinc Ltd. (HZL), Udaipur, a Public Sector Unit, established for production of non-ferrous metals like zinc, lead and silver is going in for the production of Electrolytic Chromium metal on a 200 TPA scale exploiting CECRI's know-how.

The Indian demand for the chromium metal is of the order of 250 tonnes per annum which at present is met mostly through imports. Only very few countries like the U.K., U.S.A., Japan and Russia are producing electrolytic chromium. Indigenous production would save considerable foreign exchange and provide scope for the export market also.

2.3.9 Metallurgy

NML has developed through the powder metallurgy route, a process know-how for the production of stainless steel powders which find use in the production of sintered items, welding rods, porous thimbles for filters and also for sprayed powder coating. The process, through a chemical route, with a yield of a 94-96%, is unique. The process know-how has already been transferred to M/s. Nitu Electronics, Muzaffarnagar, Bihar and M/s G.D.Stainless Industry, Yavatmal (Maharashtra).

A process know-how for vapour phase inhibitor was developed by NML. This is used for protection of finished steel products during transit and storage with no adverse effect on workers. The product has undergone trial run successfully at M/s. Tinplate Co. of India Ltd., Jamshedpur. Negotiations are under way to transfer the process to the industries.

A tripartite agreement has been signed among RRL, Thiruvananthapuram, Sponge Iron India Ltd. and Travancore Chemicals (TCC) Ltd., for technology transfer of the high grade synthetic rutile from ilmenite. The plan envisages setting up jointly a pilot plant at TCC Ltd., (about 50 tonnes) at a cost of Rs. one crore, prior to going in for commercialisation (25,000 tpa capacity).

Blue dust is a powdery iron ore. It is an important raw material for the production of high purity iron oxides and superior quality red oxide pigments. It is usually brought into solution by treatment with 5.9M HCL at 108°C, at a solid to liquid ratio of 1:10 and with 100-200 rpm agitation. The process takes about 8 hours for achieving 95% dissolution. The National Mineral Development Corporation (NMDC), Hyderabad considered the importance of improving the dissolution characteristics of the blue dust and funded a project at RRL (Bhu). The RRL scientists undertook a study on the role of a few selected promoters to increase the rate of dissolution of blue dust in HCL followed by solvent extraction to obtain high purity ferric chloride. The work was completed as scheduled and the process demonstrated on a 200g scale to NMDC.

2.4 Petroleum Refining & Petrochemicals

The high temperature antioxidants constitute the world monopoly of a few multinationals and are sold under proprietary brand names. These are used in processing of bulk thermoplastics, some

elastomers and high performance fluids. The annual requirements in the country are around 100 tonnes. Technologies for their manufacture, with certain novel features, have been developed and demonstrated by IIP to M/s. AEC India Ltd., Delhi, who arranged funding through the Industrial Credit and Investment Corporation of India (ICICI), under its Sponsored Research and Development (SPREAD) programme.

2.5 Applied Biology & Biotechnology

2.5.1 Bio-Technology

The work on standardization of methods for micropropagation of forest tree species namely *Eucalyptus teretticornis* (Eucalyptus), *E. camaldulensis, Dendrocalamus strictus (bamboo-bans Khurd)* and *Salvadora persicba (tooth brush-pilu)* was completed by NCL under Phase III of the National Agricultural Bank for Rural Development (NABARD) Programme.

Two regional laboratories were established for the Grasim Forest Research Institute (GRFI), Harihar, and CSMCRI. Field trials of these plants are expected to lead to an increase in biomass/yield from a given planting area.

Production of mannitol by the NCL process has commenced in Unicorn Organics Ltd., Hyderabad. The process is based on the inversion of cane sugar to glucose and fructose, and hydrogenating the sugars to mannitol and sorbitol. Mannitol, used in the pharmaceutical industries, is separated by crystallization. The company plans to produce 220 TPA of mannitol worth Rs. 4.5 crore, by this process.

IMTECH by appropriate genetic manipulations, has improved a strain of Saccharomyces cerevisiae resulting in characteristics superior to the strain currently used in various distilleries in India. IMTECH strains shows greater osmotolerance and ethanol tolerance and could metabolise sugars upto 28 to 30 per cent concentration (w/v) and produce 12 per cent (v/v) and more of ethanol at pilot plant level in batch fermentation as opposed to 7 to 8 per cent in industrial practice. This strain has worked satisfactorily with a variety of cane sugar molasses obtained from climatically differing geographical regions of India. The development of the commercial process was assigned to the Vittal Mallya Scientific Research Foundation (VMSRF), based on MoU signed in March 1989. VMSRF in collaboration with IMTECH scientists have now been successful in optimising the commercial process at the factory level; the process gives about 12 per cent alcohol using molasses as the starting material, but the level of 10 per cent has been found to be economical. The process results in a net saving of 0.8 kg/steam/litre of alcohol distilled. This package is being adopted by several distilleries/breweries of the United Breweries. Other distilleries, both in India and abroad, have shown keen interest in acquiring this technology.

DNA fingerprinting has so far been used only in individual identification and establishment of biological relationships. The Bks probe, developed at CCMB (CSIR Technology Award for Biological Science & Technology, 1992), has now been used to carry out DNA fingerprint analysis of 18 species of crocodiles whose phylogeny is still a debated issue. It has been possible thereby to infer generic affinities among the different species and genera. This observation is of great importance as it establishes, for the first time, the potential utility of this technique in animal husbandry and plant breeding.

2.5.2 Floriculture

The commercially viable gladiolus cultivars, suitable for cutflower trade, such as, *'American Beauty', 'Big Time Supreme', 'Day Dream' 'Snow Princes' 'Tropic Sea' 'Venetie', 'Video', 'Vinks Glory'* and *'White Prosperity'*, have been multiplied by NBRI. This has helped in assessing a large number of gladiolus cultivars, besides providing authentic and healthy plant material to the prospective growers venturing to take up gladiolus cultivation on commercial-scale. NBRI has also passed on the technology to a large number of florists. The impact may be assessed by the acreage under gladiolus cultivation, which is now 140 acres on the outskirts of Lucknow alone with an annual turnover of around Rs. 10 million.

2.5.3 Pisciculture

A pelleted fish feed, costing only Rs. 4.00 per kg, has been developed by CCMB from ingredients readily available throughout India. The feed is suitable for the intensive culture of Tilapia and common carp. In laboratory trials, the yield was 1 kg of fish per 3 kg of feed. The process is ready for commercial exploitation.

2.5.4 Marine Biotechnology

A technique for farming of fin fishes culturing them in cages was standardized and demonstrated on a pilot scale by NIO. The cage culture gives a profit of about 118% on low investment with a fairly high rate production. The advantages are: increase in seafood production and utilisation of untapped water bodies. This kind of fin fish farming can generate more employment in coastal areas.

2.6 Medicinal Plants

A variety of opium poppy *(Papaver somniferum)* called *Vivek* has been released by CIMAP for cultivation in the farmers' field under the supervision of the Narcotics Department, Govt. of India. *'Vivek'* yields about 11 kg/ha of morphine as compared to about 5kg/ha morphine obtained from the previously released varieties, *Shweta* and *Sanchita*. The increased harvest of morphine from *Vivek* results from use of both fruits (capsules) and straw for extraction. In the existing varieties, *Shweta* and *Sanchita*, morphine used to be extracted from crude opium obtained from the fruits (capsules). Because of this development and impact on the production of opium and its alkaloid is expected to be considerable.

Pyrethrin is an insecticide extracted from the flowers of the pyrethrum plant. The pyrethrin insecticide is harmless to man and animals; it is biodegradable too. CIMAP has developed a variety of pyrethrum plant that gives higher yield of flowers as compared to the existing variety. It has also developed technology for processing of pyrethrum flowers to extract the oleoresin for use as an insecticide.

2.7 Leather

A process for utilising poultry feathers, wasted hitherto, has been developed at CLRI for manufacture of keratin hydrolysate to be used as a retaining and filling agent. This could be useful for upgrading lower grades and thin sides of leathers. This environmentally 'clean' process has been standardised at the pilot plant level and transferred to a private party at Madras. The firm has already commercialised it at a 2 tonnes-feather-per-day level.

Using its computer aided design (CAD) and the recently established gait analysis facilities, CLRI developed and transferred seventy types of designs to shoe manufacturers.

CLRI has developed the technology for manufacturing synthetic fatliquors based on polyurethane, under a sponsored project from Kothari Sugars. The know-how has been successfully developed and the product is being tested for market evaluation.

2.8 Electronics & Instrumentation

NPL has developed a laboratory scale model of glucose biosensor. This device essentially consists of an enzyme (glucose oxidase) immobilized in a suitable matrix that is coupled to an electronic circuit. Amperometric method of detection has been employed. Screen printing technique has been used to fabricate strip type glucose electrodes. Calibration of disposable type electrodes has been carried out as a function of glucose concentration. The response time sensitivity, range, and shelf life of strip glucose electrodes have been experimentally determined as 30 seconds, 40 mg/dl to 700 mg/dl, and six months respectively. A large number of samples (both serum and blood) have been tested with these strip type glucose electrodes. Electronics Corporation of India Ltd., (ECIL), Hyderabad, Systronics, Ahmedabad, and Span Diagnostics Ltd., Udhna have approached NPL for the licensing of the technical know-how for this products.

An Energy Meter has been developed by CEERI to continuously monitor, supervise and control power consumption and meet the needs of energy conscious electricity consumers. The system measures voltage, load current and phase angle and calculates instantaneous values of active power consumed and apparent power consumed and prints out all rules along with a history of forty days, trip history, pre and post-trip. The system has been tried successfully in railways. The annual demand is expected to be over a thousand meters.

A 4000 Gate complexity CMOS Gate array chip has been designed by CEERI for C-DOT. The design has been fabricated at VTI, USA. Fabricated Chips have been extensively tested by C-DOT in their telephone exchanges successfully. This chip is an improved version of commercially available very low power chip and can be used by C-DOT in their telephone exchanges in non-a.c. environment.

II. 5. Land Based Digital Seismic Telemetry System

II. 6. Electron Beam Controlled Evaporation System

The following systems have been designed and developed at CSIO:

- Molecular Beam Epitaxy (MBE) System
- Electron Beam Controlled Evaporation (EBCE) System
- Reactive Ion Etching (RIE) System
- RF/DC Sputtering System

These equipment have been developed using system integration approach with the state-of-art technology. Efforts are under way to transfer the developed equipment to the user organisations in India.

CSIO has developed an eight-channel Seismic Data Telemetry System meant to monitor and analyze micro-earthquake/earthquake data telemetered from a network of seismic remote stations via digital ground telemetry down to a central recording station. The system is useful for monitoring of earthquakes and microearthquakes and can also be put to use to monitor seismic activity at dam sites; to detect nuclear explosion; to locate the site for a new hydro-dam, a nuclear power station, or an industrial complex and township.

The Stack Smoke/Opacity/Monitor instrument developed by CSIO is based on the principle of

light absorption, having the specific facility of audio and visual alarm if exceeding the permissible limit of dust/smoke level determined by the Central Pollution Control Board (i.e., 40% opacity). This instrument gives a digital display of optical opacity from 0 to 100% and thereby the dust concentration level from 100 to 5000 mg per cubic m of the air at ambient temperature. This instrument can find use in cement plants, thermal power plants, paper mills and other kilns and stacks. The know-how has been released to M/s. Envirotech, Delhi.

CECRI has developed a supervisory control and data\acquisition system for monitoring the protection level during cathodic protection. The existing telecom line can be adopted for data communication between the Remote Terminal Unit (RTU) and the monitoring PCI. The unit has a data logging facility and can be used for any electrochemical system where the potential has to be controlled. This unit has been tested at the Madras Port Trust for cathodic protection of steel jetty and the system is also being put into use in the ONGC platform at Bombay.

CMRS has developed a high set remote prop for use in mines. It is a robust mechanical telescopic steel prop (40t) which can operate at a load of 10t. The range of telescopic effect is more than 1m and axial loading is uniform throughout the prop. It can be remotely withdrawn from any distance, even if it is under heavy load and sheltered roof. This prop can be used as an immediate front roof support and a breaker line support inside mines. It can be separated in two pieces; so its transportation is easy in underground mines. The know-how has been released to NRDC for commercial exploitation.

2.9 Energy

On the basis of studies carried out at CFRI for physical and chemical assessment of lower seam coals of Jharia coalfield (Goluckdih Colliery), it has been indicated that clean coals (at 17 per cent ash level) from V/VI/VII seams possess properties similar to prime coking coals. Based on these findings, the Chari Committee decided to conduct pilot plant tests at CFRI on washability and coking properties of these coals to establish the actual qualities and physical strength of the coke that can be produced from these coals after beneficiations. It has been possible to achieve levels upto 17 ± 0.5 per cent with yields varying from 30-35 per cent. These can be sucessfully used as coal blend component in steel plants. The coke produced has good coking properties. Currently 1200 tonnes of bulk samples from V/VI/VII seams of Goluckdih Colliery are being tested in the coal washing plant of CFRI for testing in the experimental coke oven of the Bokaro Steel Plant.

RRL Jorhat, has optimized the conditions for the production of biogas by the anaerobic fermentation of sugarcane press mud. Using this method a demonstration plant was set up at the Nagaland Sugar Mills Ltd., Dimapur, Nagaland. The demonstration plant was of 2 cu.m. gas per day capacity. The performance of the plant was followed for 12 months. Now the Nagaland Sugar Mills Ltd., is planning to set up two 60 cu.m. gas per day capacity plants based on the RRL work.

2.10 Transportation

2.10.1 Air

NAL has won two software export contracts from the Civil Aviation Authority, UK, on projects concerned with the construction and implementation of a mathematical model for the vortex wakes trailing behind aircraft and helicopters. This problem plays a key role in determining separation distances between successive aircraft taking off or landing from a given runway, and is intended to provide rational criteria for maximising the rate at which aircraft can use a busy airport like Heathrow without jeopardizing safety.

A major project of NAL has been the design and fabrication of the prototype of a Light Transport Aircraft. Work continued on the project with a major milestone being the agreement which NAL reached with Myasishchev Design Bureau (MDB), Russia on collaborative work on LTA. A 1/10th scale wind tunnel model of revised LTA configuration - LTA-6 with Fowler Flaps System, slightly larger size tails and control surfaces and a different afterbody, has been designed and fabrication is nearing completion.

2.10.2 Roads

A procedure has been developed by CRRI for design of semi-dense cold mixes using cationic bitumen emulsions for pollution - free construction of bituminous roads, as heating of aggregate, bitumen and preparation of mixes by conventional method result in pollution. Experimental test sections have been laid at three different locations using cationic bitumen emulsions in collaboration with the Indian Oil Corporation Ltd.

2.11 Materials

Surface modified high density poly-ethylene (HDPE) containers and bottles have good market potential for use in automobile industry as fuel tanks and in packing industry as bottles to store pesticides, paints and other solvent-containing materials, for which metal containers are used at present. A method for offline sulphur trioxide was developed by NCL to improve solvent barrier properties, under the sponsorship of Polyolefin Industries Ltd., Bombay.

Functionally grafted cable compounds were developed by NCL by grafting vinyl trimethoxysilane onto indigenously-available polyethylene, in a project sponsored by Cable Corporation of India Ltd., Bombay. Laboratory trials have shown them to be capable of meeting the stringent specifications of the cable industry. The process was demonstrated on a 100-kg-scale, and is expected to be commercialized soon.

CSMCRI has succeeded in improving the purity of magnesia obtained from the Kharaghoda bittern to 97%. By using a two stage precipitation technique with recycling, highly pure caustic calcined magnesia could be obtained by processing debrominated bittern in the laboratory scale. A continuous pilot plant (capacity 5 kg/hr) has been fabricated, installed and operated. Samples of the magnesia were sent to the Tata Iron & Steel Company, (TISCO); their test result is favourable. Complete feasibility reports for a 3 TPD demonstration plant and a 25 TPD commercial plant were prepared.

Sintered alumina grains are high purity, high density, low porosity materials comprising mostly alpha-alumina crystals. NML has developed a technology for the production of sintered alumina grains from indigenous raw material under the NML-TISCO interactive programme. This technology, after demonstration, was transferred to M/s. Tata Refractories Ltd. Belpahar. The firm has plans to produce 600 tpa of sintered alumina grains based on this know-how. It is possible that sintered alumina grains would gradually replace the costlier fused white alumina grains in the manufacture of special refractory products such as slidegate plates, low cement castables, nozzles, and high alumina bricks.

Coal tar pitch of the required grade is one of the critical raw materials for impregnating graphite electrodes for the steel industry. About 3000 MT/annum of this pitch costing more than Rs. 4 crore in foreign exchange are imported for this purpose. A novel process has been developed by NPL for the production of high quality impregnating pitch. Such a pitch is also useful in the fibres, and high density-high strength isotropic graphite required for widely ranging applications. A patent has been filed for the novel process.

Long length multimode optical fibre for use in low to medium dose redioactive environment was successfully developed by CGCRI along with the standardisation of the process parameters. The induced loss of the developed fibres was found to be only 17.0 dB/Km, a degree better than the loss values of commercially available radiation hardened multimode fibres of foreign manufacturers. The radiations response behaviour of the fibres was related to the fibre composition and temperature of fabrication of the precursor glass.

A new technology was developed by CGCRI for melting of optical glass and design of vessel for drawing it out by bottom pouring technique. This is an improvement over the three-decade old ceramic pot melting in batches. The yield by the improved technology is over 60% with considerable saving in cost. Radiation resistant K-108 type glasses have been prepared by this novel technique.

A process for the preparation of high purity silica glass has been developed at CGCRI by using sol-gel processing technique. This technique of glass making is non-melting in nature, and is based on viscous sintering of porous silica gels under controlled atmosphere to drive out volatiles and assist sintering. The final product, which corresponds to melt-route silica glass in all respects and contains very little or no hydroxyl groups, is obtained at a maximum temperature of 1450°C, much lower than that required for commercial silica glass of similar properties. The glass contains very little transition metal impurity, and has good ultraviolet and infrared transparency.

The Bharat Heavy Electricals Ltd. (BHEL) R&D Centre at Hyderabad sponsored a project on the development of reaction bonded silicon carbide (SiC) tubes. This material is to be used in the form of tubes for heat recovery at high temperatures (> 900°C) in the recuperator assembly. Not only does this replaces costly heat resistant metallic tubes, it also performs better. The process know-how for 400 mm x 40 mm dia tubes was demonstrated to the sponsor by CGCRI. Extrusion of SiC tubes was also completed. BHEL now prposses to set up a plant at Bangalore.

Glass-ceramic coatings - a new engineering material has been developed by CGCRI. Amongst its manifold use, the increase in service life of costly alloy components of advanced jet aeroengine plays a prominent part. Its potential to protect the parent materials and components from the effects of high temperature, corrosion and abrasion has been evaluated by HAL, Koraput Division at its test bed under actual service conditions. The process has been used by HAL, Koraput Division on commercial scale as substitute of costly imported coating materials.

Process demonstration and technology transfer of (a) Rice husk ash insulating refractories to M/s. P.P.Refractories, Bhadrak, Orissa, (b) Synthetic high Alumina aggregate (54-86% Al_2O3) to M/s. Tata Refractories Ltd. (TRL), Belphar, Orissa; (c) High alumina cement (45-75% Al_2O3) to M/s. Tata Refractories Ltd. were completed by CGCRI.

Joint collaborative programmes were taken by CGCRI for dolomite and magdolo refractories with M/s. Associated Cement Co. (ACC) Ltd Bombay. Pilot plant erection was completed and trial production commenced at CRS Complex, Thane. Low cement castable based ceramic pots of 600 litre capacity for melting optical glass were manufactured at the premises of M/s. Tata Refractories Ltd., Belphar, and despatched to M/s. Bharat Ophthalmic Glass Ltd., Durgapur.

2.12 Building Materials

Consequent on the decision of Central Public Works Department (CPWD) of the Government of India to discontinue use of wood in their construction activities w.e.f. 1.4.1993 the Technology Advisory Board (Mat. Sci. & Tech.) of CSIR formulated an interlaboratory programme on development of wood substitutes. The objective of this programme is to save timber (wood) to check environmental degradation. The programme which began in july '92 has enabled formation of close links between the capabilities of CSIR and potential of exploitation of technologies of the user, CPWD.

Through continuous interaction amongst CSIR labs and CPWD, the following potential candidates were identified for substitution of Wood Shutters.

Materials	Laboratory
Glass reinforced gypsum shutter with frame	CGCRI
Expanded polystyrene composite door shutter	CBRI
Ferrocement shutter with frame	CBRI, SERC, Ghaziabad
Red mud polymer hollow core shutter	RRL, Bhopal
Inter-penetrating Polymer Network (IPN) rigid foam core shutter with red mud polymer facing	IICT, and RRL, Bhopal

CPWD and CSIR worked in close collabora-

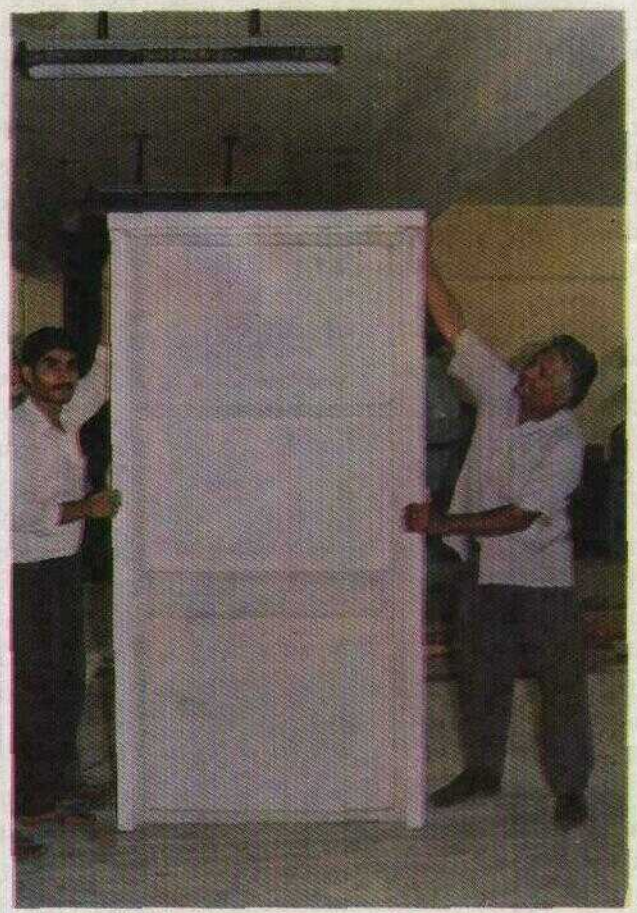
tion in formulating specifications for the materials as well as the doors. A detailed networked programme was carried out on production of prototypes and supply to CPWD for performance tests and field trials, and CBRI, Roorkee for type tests and fire performance. A large number of prototypes sent by the participating laboratories were subjected to these tests. The successful completion of the programme would give fillip to large scale adoption of CSIR technologies in this important sector. CSIR has also associated agencies like HUDCO, BMPTC and NRDC to plan effective technology transfer.

2.13 Food Technology

India is a leading producer of turmeric, contributing to 90% of world production. Turmeric is valued mainly for curcumin, the colouring matter. The demand for curcumin is increasing in the world market because it is safe to use. A process has been developed by CFTRI to obtain curcumin of 99% purity. The technology has been transferred to M/s. Kancor Flavours and Extracts Ltd., Angamally, Kerala.

Fruits and vegetables like mango, banana, capsicum, brinjal and okra are at present being exported by air cargo to Middle East and European countries. With the increase in air freight charges and availability of air cargo space during the season being a limiting factor, this trade is becoming uneconomical. It has been demonstrated that preharvest treatment, followed by cold storage at appropriate temperatures had increased the shelf-life of mango (Alphonso, Raspuri, Banganpalli) and banana (Rasthale and Nendran). With the increase in shelf-life, the commodities could be exported by ship. The technologies developed by CFTRI were made use of by M/s. Vadilal Industries Ltd., Ahmedabad and the Maharashtra State Agricultural Marketing Board, Pune to export Alphonso mango by ship to Middle East and European countries. The feedback received from these two agencies has indicated that the fruits were in good condition and ripened normally at the destination.

A protocol on pre-and post-harvest technology for exporting Banganapalli mangoes to Middle East and European countries by ship has been prepared and submitted to the Agricultural Marketing Board of Andhra Pradesh.



II. 7. Ferrocement Door Frame and Shutter Fitted Together

2.14 Machinery Development

The conventional cutting tools, using carbides and coated carbides, suffer from drawbacks like lack of adequate hardness which restricts the application of such tools for high speed machining. To overcome these drawbacks, CMERI has developed high-performance ceramic cutting inserts. The base materials, alumina and ziroconia, being readily available in the country, the ceramic inserts are less cost-intensive; and high-speed machining at 450m/min or more is possible with these inserts leading to higher productivity, high metal removal rate, better surface finish and subsequent reduction in

overall cost. The know-how has been released to M/s. Fine Metal Pressing Pvt. Ltd., Calcutta, on a non-exclusive basis.

The operating principle and flexible design of the harmonic drive transmission system make ideal for a wide range of applications like Robots, CNC machines, Printing machines, Medical equipment, Missile launchers and Communication equipment. The chief advantages of the harmonic drive developed by CMERI are: high single-stage reduction; high output torque; light weight; compact size; extremely low backlash. Further, there is scope for modification of the operating parameters to suit the specific requirements of the customer.

3. SOCIETAL PROGRAMMES

3.1 Drinking Water

CECRI has installed an array of solar stills for conversion of brackish water into potable water in a remote rural area near Layangudi in Tamil Nadu; the programme was funded by the Govt. of Tamil Nadu.

RRL-Jorhat launched a programme of providing germ free drinking water to the villagers of N.E. India by supplying water filter candles to community organizations. The candle manufacturing process has already been standardized and released to different private entrepreneurs all over India. As a part of the extension programme of the above societal project, water filter candles for providing bacteria-free drinking water were made in the laboratory and distributed to six rural schools in the nearby villages.

Commercial single pass seawater reverse osmosis (RO) desalination plants employ thin film composite (TFC) membranes. The technique to make TFC membranes as continuous sheets for making spiral elements was developed using support casting and thin film coating devices designed, developed and fabricated at CSMCRI. Parametric studies to develop polysulfone-polyamide composit membranes were carried out. Long term performance studies and development of spiral elements from these TFCs are being carried out in addition to the testing of chemical stabilities and organic separations.

In an effort to reduce the capital cost of RO plant, the design was changed by CSMCRI. The new design replaces stainless steel by plastic and other cheaper materials. Inside lining is also changed from rubber to epoxy and the design is such that assembling time is reduced. All these changes have resulted in considerable saving in the cost of pressure vessels of RO system.

About 250 water samples from Allahabad, Gorakhpur and Meerut (UP), Doda, Udhampur and Rajouri (J&K), covering about 1245 villages, were analysed by ITRC to assess the water quality. About 80% samples were found to be bacteriologically contaminated and about 15% showed high level of chromium (32%) and cadmium (42%).

ITRC organised five (5) Hands-on-Workshops on water quality assessment/technology awareness-programmes in Midnapore (WB), Coimbatore (TN) and U.P. These helped rural masses become aware of the health hazards associated with consumption of unsafe water, the methodologies and simple device available for safety assessment and disinfection of water.

The studies by NEERI involved critical analysis of existng facilities vis-a-vis desired service levels in the sectors of water supply and water treatment, sewerage, sewage treatment and solid waste management reorganisation with the state-of-art design methods to enable most cost effective system with emphasis on resource recovery, decentralised water supply and sanitation systems, etc. Distinguished citizens, charitable organisations and school children were involved in the study to ensure maximum participation of the beneficiaries in the decision making process.

3.2 Waste Management

RRL-Jorhat contributed to the programme on development of tribal and backward areas, through utilization of 18 hectares of wasteland in which cultivation of Java citronella was introduced. One training programme and 3 demonstrations were

conducted at farmers' fields to apprise the farmers of the benefit of cultivation of aromatic plants.

Cultivation and processing of Java citronella is gaining momentum among the tribal people of Arunachal Pradesh. An additional area of 100 acres of land were covered under Java citronella cultivation. Another distillation unit of 1200 kg/batch capacity is being installed to cope with the increasing volume of biomass in Pasighat. About 125-130 tribal families have benefited.

Funded by the International Development Research Centre, Canada, Phase I of this project was completed by CLRI in 1992. A report was brought out on the status of the present systems, marketing practice and meat production and distribution in selected States viz. Tamil Nadu, Andhra Pradesh, Karnataka and Rajasthan. This study also covered wastages occurring in the transportation of live animals to the urban slaughter house, mark-up prices at different points, right from the farm until the meat reaches the urban consumer, and extent of recovery of by-products.

A totally indigenous and commercially Red Palm Oil Mill with a capacity of one tonne fresh fruit bunch per hour has been successfully erected and commissioned at Pedavegi, Andhra Pradesh to cater to the needs of plantations of 200 ha area. This plant, owned by the A.P. Oil Growers Society Ltd., has been processing the fruits grown in the surrounding areas and the process has generated high confidence among farmers for entering the agro-processing co-operative sector. With the indigenous development of a 2-3 tonnes per hour capacity screw press, RRL (T) is now offering turnkey plants with 5 tonnes per hour capacity; this should be adequate for processing fruits from 1000 ha area plantations.

4. RURAL DEVERLOPMENT

A short-term training programme in leather goods making was organised by CLRI at Kallakurichi, a village in Manamadurai district, Tamil Nadu. Intensive training in pattern cutting, hand clicking, hand skiving, hand stitching, sewing machine practice, assembling techniques, production of small, medium and large goods using simple tools and machines was given for a period of 3 months. In addition to this, the villagers were given training to produce synthetic goods footwear.

The Rural Technology Institute, (RTI), Gandhinagar has approached CGCRI Naroda Centre to develop the artistic tablewares from agricultural common clay available near Balasinor as well as to improve the quality by giving training to rural potters. After giving bench scale trial of the final composition of various artistic wares developed in the Centre from Balasinor clay, the final conclusion was conveyed to the Institute, for implementation of the findings for the benefit of village potters at Balasinor under the supervision of the Centre. A detailed programme has been worked out in this direction in collaboration with RTI.

A complete protocol was developed by NBRI for rapid production of cloned plants of *Populus deltoides,* clones G48 and G3 through tissue culture. The tissue culture-raised trees grew normally under field conditions. The technology has been transferred, through the Department of Biotechnology (DBT)., to the Tata Energy Research Institute, (TERI), New Delhi for large-scale production. TERI proposes to produce about 30,000 trees of *Populus deltoides* for the afforestation programme.

II. 8. Palm Oil Extraction Plant Interior View, Pedavegi, Andhra Pradesh

5. BASIC RESEARCH

5.1 Polypeptides (NBRI)

During the previous year NBRI had initiated a major project on sequencing the chloroplast genome. During the period under report, NBRI completed sequencing of about 5 Kb chloroplast DNA. Included in this sequence is the most important gene designated as psb A which encodes the 32 KDa polypeptide for binding several herbicides. The complete nucleotide sequence and predicted amino acid sequence have been compared with sequences of this gene from other species.

5.2 Molecular biology, biochemistry and immunology of leishmania parasites (IICB)

A modified method has been developed for preparing the water-solution isothionate salt of pentamidine using p-hydroxy benzaldehyde as the starting material. Pentamidine is considered as the *diamidine drug of choice for leishmaniasis and* African trypanosomiasis.

A method has been developed for the isolation and purification of KDNA network from Leishmania donovani promastigotes, while a KDNA mini circle fragment has been identified and found to be able to discriminate different leishmania strains. Using permeable fluoroscent calcium indicator, methods have been standardized to measure the cytoplasmic concentration of calcium in L.donovani promastigotes under various stress conditions. The technique will be helpful for understanding the calcium homeostasis in the parasite. Doxorubicin (DXN), a powerful anti-neoplastic agent, has been found to be a very potent leishmanicide. The evaluation of the efficacy of neoglycoprotein-conjugated DXN in leishmaniasis is under way.

5.3 Protein Engineering and Biocatalysis (IICB)

Conditions have been established whereby UDP glucose 4-epimerase has been completely denatured and dissociated into its constituent molecules. Renaturing conditions have also been established when the enzyme refolds almost to its native state.

5.4 The Regulation of Sex Determining Chromosomes (CCMB)

A sex - and tissue-specific DNA-binding protein that binds specifically to the GATA repeats of banded krait minor satellite (Bkm) DNA, predominantly concentrated along the sex determining chromosomes (W in snakes and Y in mouse), has been isolated and purified at CCMB. It is a single 57.5 kDa polypeptide, designated BBP (Bkm binding protein). In the ovary, from which BBP was isolated, the W chromosome becomes extensively decondensed and transcriptionally active, whereas it remains in a highly condensed, inactive state in other tissues. BBP has been found in several species of snakes and mice. A model has been proposed implicating BBP in bringing about coordinated decondensation and, therefore, functional activation of the sex determining chromosomes. This is the first report describing the role of conserved Bkm (GATA repeats) in regulating the activity of sex determining chromosomes.

5.5 Protein Phosphorylation as a Molecular Switch (CCMB)

A protein tyrosins phosphatase (PTP-S), cloned earlier at CCMB, was found to bind to DNA through the C-terminal non-catalytic domain. The native protein has been identified as a 44 kDa polypeptide, localised in the cell nucleus as well as the cytoplasm of fibroblasts. It appears that at least a part of the PTP-S in the nucleus is associated with chromatin. PTP-S in the nucleus is the growth state of the cells, suggesting that this polypeptide may be one of the components of the "molecular switch" regulating cell division.

5.6 Molecular aspects of cataractogenesis - the smoke-cataract connection (CCMB)

Epidemiological studies have indicated that smokers as well as people who use cheap, smoky cooking fuels run an increased risk of cataract. Studies on the molecular epidemiology of the smoke-cataract connection at CCMB indicate that the damage is oxidative in nature and is caused by the steady state generation of reactive oxygen radicals by constituents present in the smoke that is

inhaled, dissolved in body fluids and transported to various tissues, including the eye lens. While the risk of cataract increases with increasing cigarette usage and exposure of smoke from low efficiency fuels, the saving grace is that it decreases upon quitting smoking or on using less smoky cooking media.

5.7 Development of a PCR Method for the Diagnosis of Hepatitis-C (CCMB)

The discovery of the major parenteral non-A, non-B hepatitis agent (Hepatitis C Virus of HCV) in 1989 has led to an explosion of research on this virus and the realisation of its importance in causing chronic hepatic diseases, at times leading to hepatocellular carcinoma. Nothing was known about the Indian strains of the virus when work was begun at CCMB in this area, under the Indo-US Vaccine Action Programme. Initial attempts to detect the virus, using primers routinely utilised for the US and Japanese strains were not successful, since the Indian strains were apparently different. Sensitive methodologies were, threfore, developed at CCMB, using polymerase chain reaction (PCR) techniques with specially designed primers from the maximally conserved regions of the HCV sequences. This technique cannot only detect all cases found positive with commercially available ELISA kits for the US and Japanese strains, but also those which cannot be detected using these kits.

5.8 Toxicology (ITRC)

At ITRC, using specific radioligands, the presence of both D-1 and D-2 sites were characterized in human blood platelets. Assay of the dopamine D-2 receptors in Parkinson's patients revealed two subpopulations, one exhibiting an increased binding of spiroperiodol and responsive to L-DOPA and the other exhibiting a decreased binding and not responding to the treatment.

The study of the clastogenic effects of diuron at ITRC revealed a dose dependent change in the induction of micronuclei in bone marrow of mice following single i.p. administration of the herbicide. These results are important since diuron is considered by the International Agency for Research on Cancer, Lyon, France, as a high priority chemical to be tested for its carcinogenic/ cocarcinogenic effects.

5.9 Biosynthesis and biotransformation of phytochemicals from plants (CCMB)

The biosynthesis of azadirachtin, a very potent natural insecticide with almost no side effect, has been initiated by CIMAP using labelled precursors. Establishment of firm biogenetic pathway and biogenetic correlation of azadirachtin with other compounds would enable us to produce it through biotransformation of other intermediates and precursors.

5.10 Catalytically Active Materials (NCL)

For the first time, value addition of sensor materials like metabolized zirconia was carried out by NCL by incorporating several metal ions of variable valence. These compounds were also found to have catalytic properties and have potential applications such as auto-exhaust catalysts (catalytic activity equal to the value reported in literature), oxygenative dehydrogenation catalysts (more than 70% selectivity at 480°C) and catalysts for oxygenation of cyclohexane to cyclohexanol to cyclohexanone (30% conversion and more than 70% selectivity). Tubes of these materials for use as potentiostatic and potentiomeric catalysts were successfully prepared. The oxygen and ion conductivity vs electromotive force relationship was taken advantage of for designing catalysts with specific selectivity.

5.11 Lagmuir-Blodgett (LB) films (NCL)

Langmuir Blodgett (LB) films of different anionic complexes picked up with long chain amines having novel structures have been grown and characterized by NCL. This has opened up a new area of inorganic Langmuir Blodgett films. Excellent quality, ultra-thin metal oxide films have been obtained by the decomposition of such LB films. A new structural model has been proposed for metal salts of fatty acids and this replaces a 20-year-old model. Using LB films as model systems, improved quantitative analytical techniques of X-ray photoemission

spectroscopy have been developed.

5.12 X-Ray Crystallography (NCL, NPL)

An approach worked out at NCL, based on pattern recognition strategies, to relate the input-output behaviour in a manner analogous to those in neural networks, has made it feasible to carry out fault diagnosis, process modelling, identification and process control protocols. Another approach reduces the dimensionality of the available model while retaining the model's prediction abilities in the likelihood of incomplete process state specification. The applicability of the methods has been tested for chaotic behaviour of systems and newer strategies for servo and rgulatory control of the chaotic dynamics of nonlinear processes have been proposed.

A five-crystal X-ray diffractometer designed and developed at NPL has been employed in a three crystal configuration. A new technique developed by the group has enabled separation of forward diffracted beam from the residual direct beam. Well defined peaks are observed in the diffraction curves. There is substantial reduction in the value of mt around Bragg angle. Both these results suggest that dynamical features which are expected only from thick perfect crystals can be observed even with thin and imperfect crystals if the state-of-the-art level facilities and techniques (developed indigenously by NPL) are employed.

5.13 Synthesis of Fredericamycin-A (IICT)

Fredericamycin A, an anti-tumour antibiotic has been the target of much synthetic interest the world over not only due to its anti-tumour properties but also because of its structural complexity. Several schools in the USA and Europe have initiated work on the synthesis of fredericamycin A and till this date only two schools from the USA have successfully completed this project. IICT is the third to achieve total synthesis.

On the basis of earlier model reactions carried out at IICT for building the spiro system, the two main segments, the pentamethoxy benzphthalide and the isoquinoline part were chosen for completing the work. In the synthesis of fredercamycin A the key step involved was the building of the spiro system by an unusual 5-*endo* trigonal radical cyclisation.

5.14 Synthesis of Glycopeptides (IICT)

The family of cyclic peptides containing oxidatively coupled aromatic nuclei ranging from tyrosine derived peptides such as K-13, the structurally complex glycopeptides, and antibiotics representing vancomycin, are the synthetic targets because of their impressive biological profiles. For example, K-13 is known to be an inhibitor of angiotension converting enzyme. Vancomycin is a clinically important antibacterial drug, particularly useful for staphylococcal infections. IICT has initiated a major programme on the synthesis of such glycopeptides containing tyrosine units. The synthesis involved building up isodityrosine derived units and the strategy reported by various groups focuses mainly on the Ullmann ether synthesis or thallium (III) nitrate promoted oxidative coupling.

5.15 Taxol (IICT)

Taxol is recognised as an important clinical drug for the management of epithelal ovarian cancer. Unfortunately, the limited supply of taxol has hampered further clinical treatment. The current source of Taxol is the bark of the aged yew tree where the plant has to be sacrificed to isolate the compound. To obviate this problem, IICT has initiated the work to find out an alternate source of taxol. IICT has initiated the work on its synthesis and a novel method has been devised for the construction of central 8 membered rings. This is the first report which states that the fully functional central ring can be obtained. Work is in progress towards its total sysntesis utilising Diel's Alder reaction and free radical reaction.

5.16 Marine Geology and Geophysics (NGRI)

Analysis of magnetic data on the southwestern continental margin of India between Coondapoor and Kasargod reveal that the depth to the top of the basement varies from 1.0 to 4.0 km and provides evidence for the presence of Graben below the

innershelf and a basement ridge of continental type and precambrian in age below the outer shelf.

Bathymetric and shallow seismic surveys along the north western continental margin of India reveal the presence of a fascinating deep, (active large-scale submarine canyon) stretching from 21° 20'N to 22° 40'N. The canyon commences from the continental slope at a water depth of 1230 m and extends up to 3200 m. It is about 8 km wide in the northern proximal end, about 13 km in the centre, which constricts to about 6 km towards the distal downstream. The canyon is 350 m deep in the north, and shallows down to 195 m towards south with steep faulted flanks.

5.17 Satellite Payload (NPL)

RPA aeronomy experiment was designed and developed at NPL and was deployed in space onboard an Indian satellite SROSS-C on May 20, 1992. Coinciding with a SROSS-C pass a rocket flight with electron RPA and Langmuir probe payloads was also conducted from Sriharikota on July 3, 1993 for scanning the ionosphere vertically, to complement the satellite data. The satellite data was collected from three ground stations - Lucknow, Bangalore and Mauritius to cover a wide latitude and longitude belt. The data processing is in progress.

5.18 Fullerenes (NPL)

The advent of 'Buckminster' fullerenes (C60), and occurrence of superconductivity at appreciable temperature in their alkali metal doped system, have raised enormous topical interest throughout the world. Several theoretical and indirect experimental studies such as neutron diffraction and X-ray diffraction have shown that the C60 solid has face centred cubic (FCC) structure and each molecule comprises an intricate arrangement of carbon atoms distributed over a sphere in the form of pentagons and hexagons closely resembling a 'soccer ball'.

The main obstacle to the direct observation of the carbon cage of C60 molecules is believed to be their rotational motion at ambient temperature which would smear out the image details. High resolution scanning tunnelling microscopic (STM) studies carried out at NPL on C60 films have, for the first time, revealed the characteristic carbon cage structure of the molecules showing well resolved hexagons and pentagons. The bond lengths are close to 0.14 nm in accord with the neutron diffraction data. It has been possible to image the face centred cubic lattice, corroborating the lattice parameter of 1.4 nm. The fact that the fine details of the carbon cage are visible in the STM images and are not smeared out shows that the rotational motion is frozen. The causes of freezing are likely to be the close proximity of silver atoms on the substrate and of higher fullerene molecules in the sample whose presence has been indicated by STM studies.

6. RESEARCH SUPPORT ACTIVITIES

6.1 Coal

Detailed washability studies probing sulphur distribution through size-wise specific gravity fractions of high sulphur Assam (Makum) coals were performed by CRFI on the basis of Coal India's interaction with Prof. Y.P. Chug of Carbondale University, U.S.A. A consolidated report of all available data on Makum coals (size and specific gravity fraction) was prepared.

Quality upgradation work comprising sampling, characterisation and beneficiation of 10 bulk samples of M.P. coals was completed by CFRI in a record time of 80 days for M/s. Bechtel Inc., Los. Angeles, U.S.A who were approached by the Madhya Pradesh State Electricity Board with a view to improving performance of Korba and Satpura Power Plants.

With a view to studying the feasibility of practising longwall mining at a depth below 50m, behaviour of strata and support at mechanised longwall faces has been investigated at the Jhanjra colliery of the Eastern Coalfield Limited (ECL). It was found that longwall mining at such a low depth is feasible provided the hard cover in between the coal seam and the unconsolidated surface alluvium is such as to ensure complete filling of the goaf by itself. Alternatively, longwall mining is feasible un-

der any depth below 50m, in case the support resistance is adequate to withstand the total depth pressure. The results of these studies by CMRS would help ECL to organise their longwall mining operation over a greater stretch of the leasehold area.

At Sayal-D colliery of the Central Coalfields Limited (CCL) a fire broke out between the 2nd and 3rd levels of incline I. It was controlled using hydrogel of silicic acid infusion through 200 boreholes all around the fire area along with the application of a sealant developed by CMRS.

6.2 Aromatic Plants

CIMAP supplied a project report to M/s. Punjab Phytochemicals Ltd., Bhatinda, a joint sector company promoted by M/s. Punjab Agro-Industries Corporation, Chandigarh, for a project costig over three crores of rupees. The project envisages the establishment of a nucleus farm and nursery in 16 hectares where planting material of high yielding varieties of different mint species and aromatic grasses will be multiplied and distributed to the farmers. The company plans to bring about 400 ha of land under these crops progressively. The company has approached CIMAP for technical consultancy for implementation of the project. This project will be a good example of farm-factory linkage involving setting up of manufacturing facilities and introduction of cultivation of new crops by the farmers of the State of Punjab.

6.3 Transportation

The CSIR Centre for Mathematicl Modelling and Computer Simulation (C-MMACS), located at NAL, has analysed the explosive growth of transportation in India, highlighting the problems likely to be encountered in the near future if greater attention was not paid to the sector. The study has attracted considerable attention all over the country.

A Road Goemetric Measuring System has been developed by CRRI. The system can measure, on board, road surface roughness, vertical gradient and curvature at normal traffic speeds. Two units of this system are under fabrication for supply to M/s. Rail India Technical and Economic Services (RITES) and the Gujarat Public Works Department.

To combat the prevailing and expected traffic congestion on the roads, a study on the Road Development Plan Priorities for Delhi urban area (2001) sponsored by the Delhi Administration was carried out by CRRI to enhance the carrying capacity of the road system of Delhi. The study was completed and recommendations given.

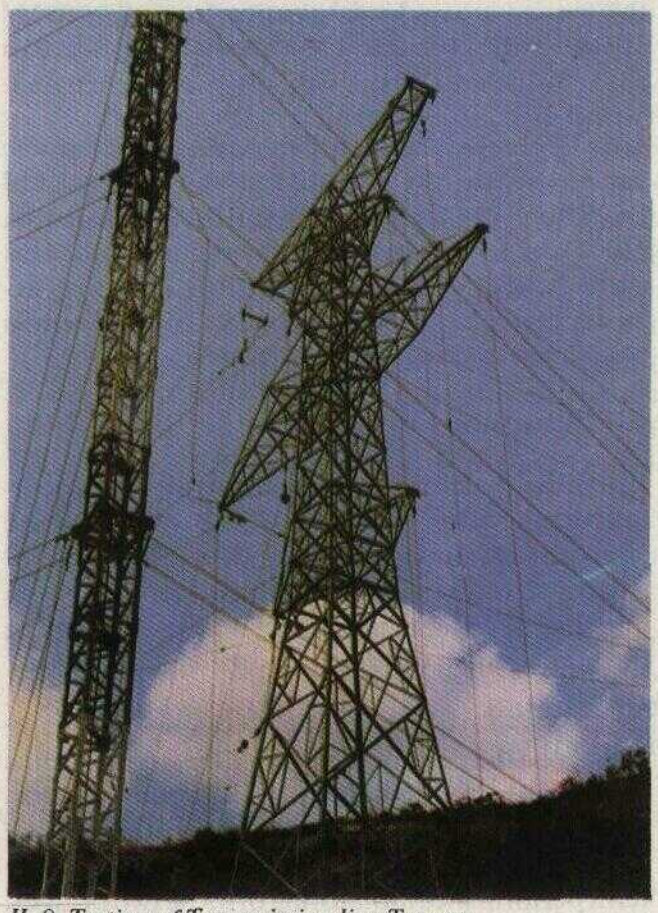
6.4 Structural Engineering

A set-up known as the CSIR bridge Engineering Consultancy Services (CBES), wherein the strengths of four laboratories, CBRI, CRRI, CECRI and SERC (G) would be combined to provide an integrated service in the area of bridge engineering through a single window, has been constituted.

SERC-(G) has successfully completed a major project on the instrumentation of the new as well as the recommissioned old bridges on the Mandovi river at Panaji, Goa. The project, sponsored by the Ministry of Surface Transport, was aimed at long-term performance monitoring of these two bridges. The systematic monitoring is expected to provide vital information on the health of the bridges and create a data base for the evaluation of the performance of bridges. This technical support is the first of its kind in the country.

The Tower Testing & Research Station (TTRS) facility of SERC, Madras, bagged an international order for structural testing of two transmission-line towers of M/s. Locweld Inc., Canada, well known tower fabricators in North America. The two towers, each 56 meters tall and weighing roughly 20 tonnes, were assembled and erected at test site during Feb.-Mar. '93 for conducting the required load tests.

Gas Authority of India Limited (GAIL) approached the Structural Engineering Research Centre (SERC), Madras seeking assistance for design of a profile for lowering the HBJ gas pipeline below the bed of the proposed Narmada canal crossing the pipeline near Baroda. This pipeline serves many gas-based industries upstream. GAIL wanted SERC



II. 9. Testing of Transmission line Towers

to design a profile for lowering the pipeline safely (without stoppage of gas) in stages below the canal bed. After a careful study of the existing profile of the pipeline, detailed strctural analysis was carried out to arrive at a safe design for stage-wise lowering of the pipeline using the contour profile method. To ensure safety of the pipeline during the lowering operation, GAIL approached SERC again to assist them in the measurement of residual stresses in the pipeline and also the stresses during the lowering operation. With the technical support provided by SERC, GAIL executed the lowering operation successfully in a short period of time. This is the first time in the country that a lowering operation of such an inservice pipeline was carried out successfully. This has resulted in considerable economy as against use of a stopple and by-pass operation recommended by experts from abroad.

At the instance of M/s. Indian Rare Earths (IRE) Ltd., Cochin, a study was undertaken by RRL (Tvm) for utilisation of garnet sand for development of nonskid surfacing material. Specifications were developed using 20-80% garnet sand, a by-product of the IRE mineral processing plant in Tamil Nadu and Orissa. Decorative red coloured surfacing materials have been developed with garnet ore and iron oxide and thermoplastics for use in municipal gardens.

6.5 Electroforming of Nickel

CECRI has undertaken a feasibility study for the development of a process for electroforming of Nickel for fabrication of cryogenic thrust chamber. This programme was sponsored by the Liquid Propulsion Centre (LPSC), ISRO, Thiruvananthapuram. CECRI has already developed a one tonne capacity thrust chamber and got it successfully tested by LPSC. Presently a C12 cryogenic engine thrust chamber is under an advanced stage of electrofabrication by the electroforming process at CECRI. This development will help the country in indigenous fabrication of cryogenic engine for Space Programme.

6.6 Dissemination of Scientific Information

A number of special issues of PID journals on contemporary advances in different fields were brought out. These related to subjects like "Mathematical Modelling in S&T Studies", "Fullerenes";

II. 10. Lowering of HBJ Gas Pipeline

and "Structure, Activity & Dynamics - Advancing Frontiers", "High Tc superconductors", "Microcalorimetry & Its Applications", "Contraception and Reproductive Biology", and "Structure - Function Relationships in Proteins and Peptides".

The modern printing and computer facilities available at PID enable the Directorate not only to carry out in-house composing/printing of its own publications but also take up similar specialized jobs for outside agencies. PID continued to act as a national node of the Asian Pacific Information Network on Medicinal & Aromatic Plants (APINMAP). The activities of APINMAP include the development and use of integrated bibliographic and factual databases by sharing of information among member countries of the network. Training courses on "Writing a Scientific Research Paper", "Designing and Illustrating Scientific Publications", "Science Writing" and "Herbarium Techniques" were organised.

The Government of India has decided to setup a SAARC Documentation Centre (SDC) at INSDOC for exchanging S&T information among the SAARC nations. The functional modalities of SDC including budget, manpower, finance etc. have been worked out in a meeting of the Documentation Expert Committee of the seven nations organised jointly by the Ministry of External Affairs and INSDOC.

7. NTAF CELEBRATES SILVER JUBILEE

When CSIR established NAL in the late 1950's it accorded high priority to the setting up of a transonic/supersonic wind tunnel to serve as the nucleus for undertaking research and development programmes in aerospace engineering. Thus a 1.2 m Trisonic Wind Tunnel (H1) along with its auxiliary facilities viz., compressor systems, electrical substation, design office and model fabrication shop was set up and commissioned in 1967 to be a part of the National Trisonic Aerodynamic Facilities (NTAF)

Over the years several improvements have been incorporated at NTAF to meet the wide ranging needs of aerospace organisations in the country. Some of these are: computer-aided model design capabilities including associated software for NC machining, computer-based data acquisition/processing system, PC-based control systems and special test rigs and techniques. A 0.6m transonic tunnel (H2) was indigenously designed and commissioned in 1989 to meet the anticipated increase in test requirements.

NTAF is operated as a national facility funded by four major users viz., ISRO, DRDO, HAL and CSIR. The H1 tunnel with its associated support facilities has now completed twentyfive years of useful service (logging over 17,000 blowdowns during the period) and contributed significantly to practically every major aerospace project of the country.

8. CSIR GOLDEN JUBILEE CELEBRATION ACTIVITIES

The period from September 1991 to September 1992 was observed as the Golden Jubilee year of CSIR. Various activities were held to celebrate the Golden Jubilee Year; some of them have been reported in the Annual Report for 1992-93.

8.1 Golden Jubilee Scientific Conferences:

Two more golden jubilee conferences were organised viz:

(i) National Symposium on Recent Advances in Chiral Synthesis at IICT, Hyderabad, 2-3 April 92 and

(ii) National Symposium on Ocean Technology at NIO, Goa 27-29 August 92

8.2 International Conference of Heads of Scientific Agencies (ICOHOSA)

A three day International Conference of Heads of Scientific Agencies (ICOHOSA) was organised in Delhi during 23-25 September 1992 on the eve of the conclusion of the Golden Jubilee Year. The Conference was inaugurated by Shri K.R. Narayanan, Vice President of India. About 35 foreign delegates from 16 countries with which CSIR has bilateral

scientific cooperation agreements and representatives of international agencies besides 50 Indian delegates participated in the Conference. The Conference had three technical sessions, viz.

(i) Scope for International Cooperation in environmental science and technology;

(ii) Public funded R&D, prospects and management models and

(iii) Commercialisation of R&D results, problems and policy instruments.

A specially designed golden jubilee memento prepared from materials developed by CSIR laboratories optical glass slab (CGCRI), medallion of nickel alloy derived from polymetallic nodules (NIO & NML) and a carbon fibre composite base (NAL) was presented to each delegate.

Shri P.R. Kumaramangalam the then, VP, CSIR, in his valedictory address complimented the gathering for its recommendations, which inter alia suggested striking a right balance between the need for market oriented research and basic and socially relevant research.

8.3 Golden Jubilee Memento

On this historic occasion, CSIR presented a gold plated pure silver memento to every regular employee of the CSIR network.

8.4 Special Issue of Petroleum Asia Journal

Petroleum Asia Journal, with the assistance and inputs provided by CSIR, brought out a special issue on '50 years of CSIR' highlighting CSIR's achievements and contributions to the diverse sectors of the economy.

8.5 Concluding Function

The concluding function of the golden jubilee celebrations was held at the National Physical Laboratory, New Delhi on 26th September 92 when the President of India Dr. Shankar Dayal Sharma was the Chief Guest, Shri P.R. Kumaramangalam, the then Minister of State for Science and Technology and Vice President of CSIR presided and Shri Rajesh Pilot, Minister for State for Communications was an invitee. Shri P.V. Narasimha Rao, Prime Minister of India and President, CSIR, could not be present on the occasion, but, had sent his felicitations and the following message:

"The Golden Jubilee of the Council of Scientific and Industrial Research is an occasion to celebrate the outstanding achievements of the leading research organisations in our country. CSIR has a proud record in the fields of scientific research and industrial application. It is an institution that has lived up to the expectations of the nation. It must now gear itself for still more arduous tasks ahead as the country opens up to greater global competition and its industry and agriculture pace the frontiers of human knowledge to meet the demands of rapid economic growth. I am confident the scientists of CSIR will rise to the occasion and lead the R&D effort of the country to new heights.

India cannot afford the luxury of spreading its R&D allocation too thinly over numerous projects. We have to prioritise carefully and concentrate on schemes which can take the benefits of science and technology to the underprivileged. I am confident the scientists of CSIR will orient their effort to this goal and bring more laurels to their institutions and prosperity to our country. On this happy occasion, I congratulate all the scientists and other employees of CSIR".

The President unveiled a Golden Jubilee plaque that was to be installed in the new wing of the CSIR Headquarters building. The President also released a specially designed encyclopaedia entitled "Golden Treasury of Science and Technology" brought out as a part of the Golden Jubilee activities.

Dr. Shankar Dayal Sharma, in his very thought provoking address lauded the CSIR on its contribution on the material, intellectual and spiritual planes.

8.6 Postal Stamp and Cover

The Department of Posts issued a Re. 1 postal

stamp and a First Day Cover (FDC) to commemorate the CSIR Golden Jubilee. The stamp and first-day cover were released by Dr. Shankar Dayal Sharma, President of India on February 28 - the national science day. The Stamp and FDC were designed by CSIR. The Stamp depicted CSIR's contribution to industrial and rural development, social welfare through science and technology besides its efforts in nurturing scientific manpower, and the FDC depicted the wheels of progress powered by the CSIR emblem of a wheel and a lamp.

III. RESEARCH AND DEVELOPMENT BY INDUSTRY (RDI)

The scheme on Research and Development by Industry covers the following activities:

(A) In-house R&D in Industry

(B) Scientific and Industrial Research Organisations

(C) Fiscal Incentives for Scientific Research

Activities and achievements in each of above are presented here.

III. (A) IN-HOUSE R&D IN INDUSTRY

1. RECOGNITION OF IN-HOUSE R&D UNITS

A strong S&T infrastructure has been established in the country. This covers a chain of national laboratories, specialised centres, various R&D and academic institutions, training centres, which continuously provide expertise, technically trained manpower and technological support to the industry. Various policy measures and organizational structures have also been evolved from time to time to meet the changing industrial and technological requirements of the country. The Government have been giving special attention to promotion and support to industrial research in Industry. Several tax incentives have also been provided which encourage and make it financially attractive for private sector industrial units to establish their own In-house R&D units.

A scheme for granting recognition to In-house R&D Units in industry is operated by the Department of Scientific & Idustrial Research in the *Ministry of Science & Technology. One of the* objects of this scheme, when it was initiated was to provide liberal import facilities to recognised In-house R&D units under Open General License (OGL). This has been absorbed in the liberalised trade policies announced by the Government in 1991. The incentives and support measures presently available include: Income Tax relief on R&D expenditure; Weighted Tax Deduction for sponsored research; Customs Duty Exemption for SIROs; Accelerated Depreciation Allowance on plant and machinery setup based on indigenous technology; Exemption from Price Control for bulk drugs produced based on indigenous technology; International R&D collaborations; Financial Support for R&D Programmes; National Awards for Outstanding In-house R&D achievements, and few other indirect benefits.

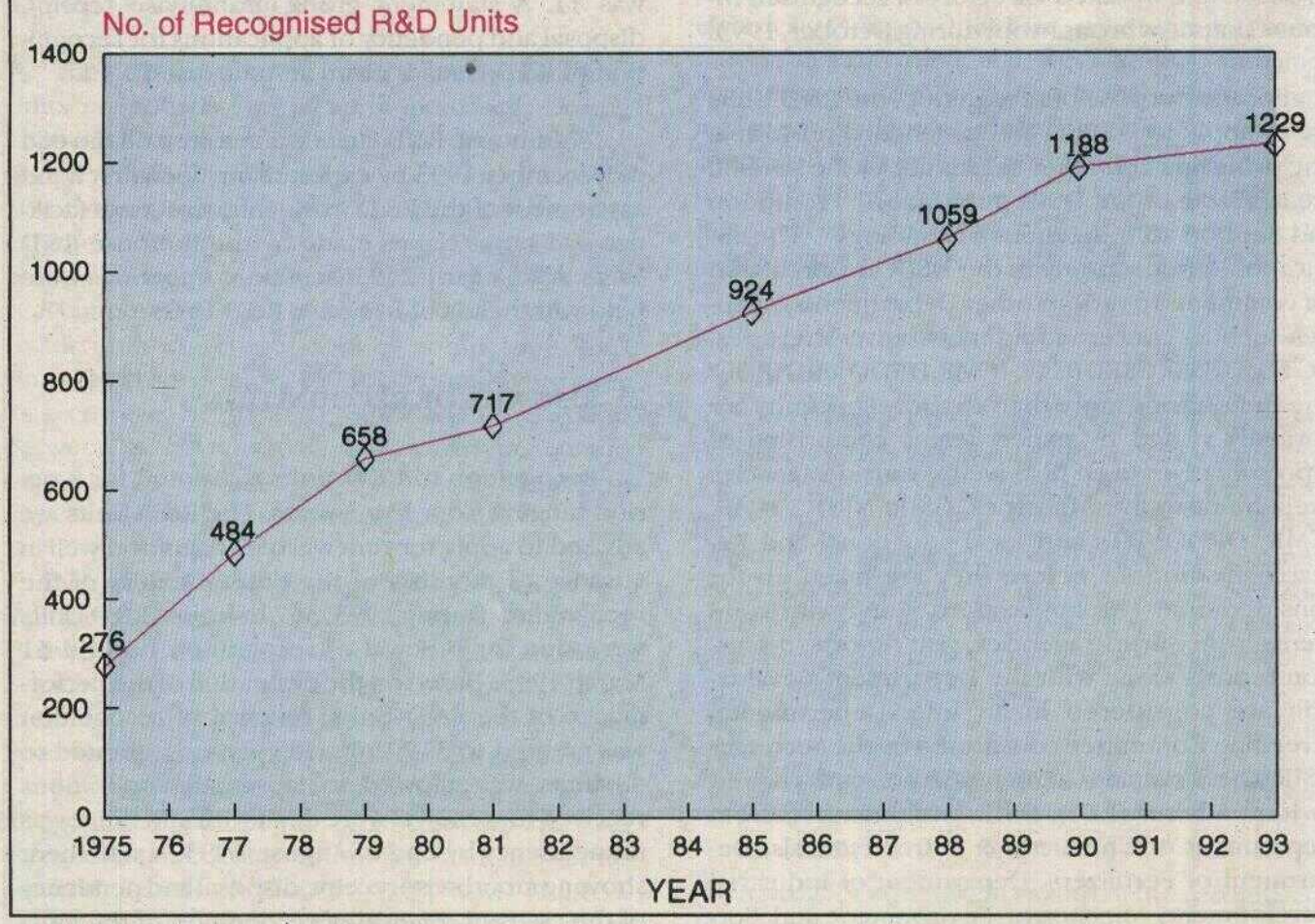
The In-house R&D Units qualifying for recognition are expected to be engaged in research and development activities related to the manufacturing *activity of the firm. For this purpose, R&D* would include: efforts for development of new technologies, design and engineering, process/product/design improvements, export promotion, testing and analysis related to these efforts, development of new products or discovering new methods of analysis, productivity research for increased efficiency in use of resources, capital equipment and materials, fuel efficiency, recycling of wastes and research for efficient use fo scarce materials.

The R&D activities are expected to be separate from routine activities of the firm such as production and quality control. It is not necessary to have

In-house R&D in Industry

Incentives and Support Measures

* Income Tax Relief on R&D Expenditure
* Weighted Tax deduction for Sponsored Research
* Financial Support for R&D Programmes
* Accelerated depreciation allowed on Plant and Machinery set up based on Indigenous Technology
* Exemption from Price Control of bulk drugs manufactured based on Indigenous R&D
* National Awards for Outstanding In-house R&D achievements



III.A.1 Growth of In-house R&D Units

all the R&D activities segregated and located in a separate building. It is appreciated that In-house R&D activities are likely to be intermingled with the activities related to manufacturing in the factory and often part of the production equipment and infrastructure would be utilisd to carry out certain aspects of their R&D activity. The In-house R&D Units would have at least some staff exclusively engaged in R&D and there would be full-time Head for the R&D who would have direct access to the Chief Executive or to the Board of Directors depending upon the size of the unit.

Number of In-house R&D Units recognised by DSIR has increased steadily from about 100 in 1973 to about 250 by 1975, to over 600 by 1980, over 900 by 1985, and 1229 as on 31 December, 1993. The growth is also represented in Figure III.A.I. Of these 1229 units, about 160 are in public sector and joint sector and the remaining are in private sector. A revised and updated Directory of recognised In-house Units was brought out during October, 1993.

For the purpose of recognition, the R&D Units are to apply to DSIR as per a standard proforma. The proforma and other details about the scheme are available in the DSIR publication "Promotion and Support to Indigenous Technology". The applications after scrutiny in the DSIR are circulated for comments to various other Departments/Agencies such as concerned administrative Ministries, DGTD, DCSSI, CSIR, ICAR, ICMR, DRDO and NRDC. The Units having more than 26% foreign equity are normally visited by expert teams comprising of representatives of DSIR as well as outside agencies like administrative Ministries, CSIR, NRDC, ICAR, ICMR, DRDO, IITs and local eductional and Research Institutions before they are taken up for consideration. The applications along with comments from outside agencies, visit reports, discussion reports along with the Department's evaluation are considered in an Inter-Departmental Screening Committee constituted by the Secretary DSIR. The Screening Committee is presently chaired by Joint Adviser (RDI), DSIR, with members from Department of Chemicals & Petrochemicals, Department of Fertilizers, Department of Industrial Development, Ministry of Environment and Forests, Department of Coal, Department of Electronics, DOT, DGTD, CSIR, DCSSI, and NRDC along with the DSIR representatives. The Committee meets every month to consider the applications along with other relevant data put up and makes recommendations to the Secretary, DSIR for: (a) Granting recognition for a specified period ranging from 1 to 3 years, or (b) for rejecting the applications, or (c) for deferring the case for obtaining further details, discussions with the company or visit to the unit for clarification of various points.

During the year 1993, the Screening Committee met 12 times and considered 79 applications for recognition; 55 R&D Units were granted fresh recognition, 3 R&D Units were endorsed on the existing letters of recognition in respect of other R&D units of their company and 21 applications were rejected.

The pendency at the end of December 1993 was 11. A statement giving monthwise receipt, disposal and pendency of applications for recognition of R&D Units is given at Annexure III.A.I.

77 In-house R&D Units were visited till the end of December 1993 by expert teams for a first hand assessment of the R&D work, infrastructural facilities and other claims made by the In-house R&D Units. Also, nearly 200 discussions/meetings were held with heads of In-house R&D Units.

2. RENEWAL OF RECOGNITION

Recognition to R&D Units is granted for a period ranging from 1 to 3 years. The R&D Units are advised to apply for renewal of recognition well in advance (3 months) of the date of expiry of the recognition. During 1993, 367 In-house R&D Units were due for renewal of recognition beyond 31 March 1993. Based on the evaluation of the performance of the R&D Units, renewal of recognition was granted to 319 Units. Recognition granted to 48 units was allowed to lapse. All applications received for renewal were dealt with and there was no pendency by end of August, 1993. A statement showing monthwise receipt, disposal and pendency of the cases of renewal of recognition of the R&D Units is given at Annexure III.A.2.

3. ZONAL DISTRIBUTION OF IN-HOUSE R&D UNITS

The In-house R&D Units are distributed throughout the country. There are nearly 200 units in the Northern Zone comprising of Delhi, Haryana, Punjab, Uttar Pradesh, Jammu & Kashmir, around 100 units in Western Zone covering Rajasthan and Gujarat, over 450 units in the Central Zone covering Maharashtra, Madhya Pradesh and Orissa, over 325 units in the Southern Zone covering the 4 Southern States and around 150 units in the Eastern Zone covering Bihar, West Bengal, Assam etc.

Majority of the In-house R&D units are located in and around major cities. There are about 325 units in and around Bombay; over 100 in and around Delhi; over 100 around Madras, 75 in and around Bangalore, 75 near Hyderabad, nearly 50 in and around Ahmedabad.

4. R&D EXPENDITURE

The expenditure incurred by In-house R&D Units in industry has steadily increased. During 1980-81 it was estimated to be Rs. 200 crores for over 600 units. By 1985-86, it was of the order of Rs. 500 crores. It is estimated that the present R&D expenditure of the 1229 recognised R&D Units is of the order of Rs.1100 crores and about 45% of it is accounted by over 160 public sector and joint sector units and about 55% by about 1060 R&D Units in private sector. 159 R&D Units spend over Rs.1 crore each on R&D, 304 R&D Units spend between Rs. 25 lakhs to Rs. 1 crore each per annum on R&D. The list of these R&D Units is given in Annexure III.A.3 and III.A.4 respectively.

The major R&D Units in public sector undertaking are Hindustan Aeronautics Limited, Bharat Heavy Electricals Ltd., Bharat Electronics Ltd., Steel Authority of India Ltd., Indian Telephone Industries Ltd., Oil & Natural Gas Commission, Indian Petrochemicals Corporation Limited, Indian Oil Corporation Limited, HMT Limited. Some of the major R&D Units in the private sector are Tata Engineering & Locomtive Company Ltd., Bajaj Auto Limited, Larsen & Toubro Ltd., MRF Limited, Hoechst India Limited, Ashok Leyland Ltd., Tata Iron & Steel Company Ltd., Lupin Laboratories Ltd., Ranbaxy Laboratories Ltd.

5. R&D INFRASTRUCTURE

The In-house R&D Centres have impressive infrastructural facilities including sophisticated instrument facilities and equipment as well as pilot plant facilities for carrying out high level R&D work relating to the areas of manufacturing activities of the firms. It is estimated that the R&D assets possessed by the In-house R&D Units are over Rs. 1200 crores at present. Some of the sophisticated equipment facilities available are: scanning electron microscope; computerised X-ray diffraction and X-ray fluorescence analyzers; UV-Vis, infrared, vacuum emission, nuclear magnetic resonance and atomic abosrption spectrophotometers; chromatographs; thermoanalytical equipment; creep measuring and high temperature evaluation equipment; microprocessor development systems; electronic and electrical testing and evaluation equipment; computers; custom built test rigs; colour matching computers; mechanical testing, fatigue testing, creep measuring equipment; programmable temperature controlled high temperature furnaces etc. Most of the R&D Units also have good library facilities of their own and subscribe to a number of periodicals and journals.

6. R&D MANPOWER

There has been steady increase in R&D manpower employed by the In-house R&D Units. By 1975-76 about 13,000 R&D personnel were employed by nearly 400 units. By 1981-82 the figure was over 41000 for about 750 units. The present estimated manpower for the 1229 In-house R&D Units is over 50000. Of this, there are 2600 Ph.Ds, 8400 post graduates, 17000 graduates and 22000 other qualified personnel.

7. SECTORWISE BREAK-UP OF IN-HOUSE R&D UNITS

A broad sectorwise break-up of the recognised In-house R&D Units is as below:

(i)	Chemical and Allied Industries	- 400
(ii)	Electrical and Electronics Industries	- 350
(iii)	Mechanical Industries	- 250
(iv)	Processing Industries (Metallurgical, Refractory, Cement, Textile, Paper and others)	- 150
(v)	Agro Industries and others	- 80

8. IN-HOUSE R&D UNITS: OUTPUT

(a) Contributions from the In-house R&D Units can broadly be summarised as under:

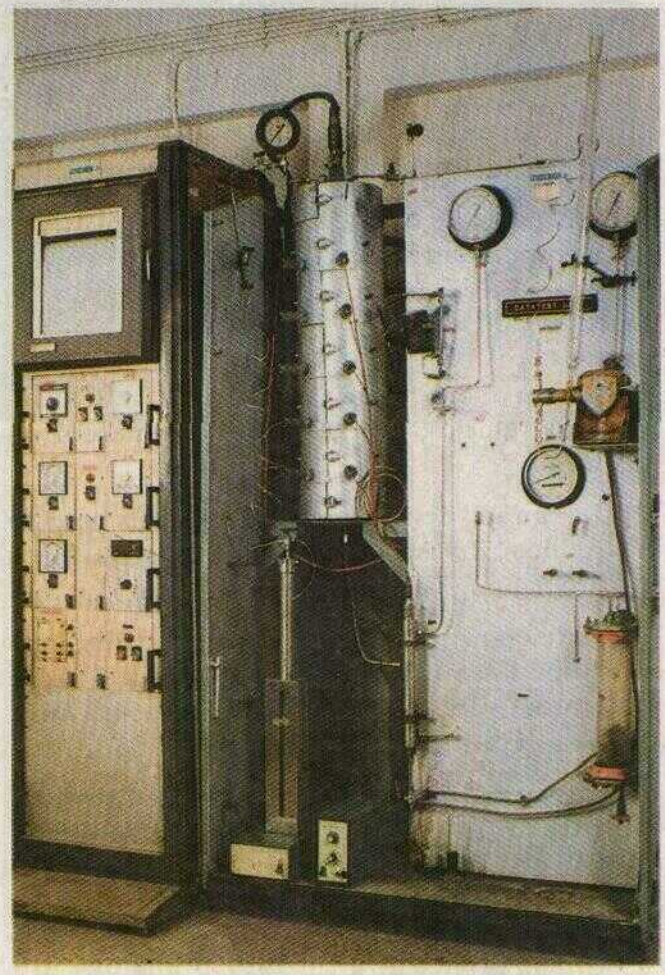
- Availability of R&D facilities.
- Availability of trained manpower for industrial R&D.
- Interphase with public funded institutions.
- Participation in national and international seminars and workshops.
- Papers published in journals/seminars; patents and designs.
- Joint research projects/programmes/sponsored research.
- Pilot plant and semi-commercial plant level investigations.
- Import substitution of materials/components.
- Assist in technology absorption.
- Diversification.
- Technology improvement/upgradation of technology.
- Assist in technology transfer/negotiations.

(b) Some of the R&D achievements reported by the recognised In-house R&D Units are listed below:

Chemical and Allied Industries

- Development of process for isobutyl benzene, a drug intermediate, involving use of a highly selective alkali metal catalyst, safe handling and disposal of the catalyst and further processing of the reaction-mixture to obtain high purity product.
- Development of thorium oxide catalyst for the manufacture of diphenyl oxide by high temperature vapour-phase, environment-friendly, chlorine free process.
- Development of technology for Carboxin and Dicofol at pilot plant level after successful testing at semi-commercial level for technical feasibility and economic viability.
- Development of pollution free process using novel catalyst for octyl phenol, para cumyl phenol and para tertiary butyl phenol.
- Development of process for 4-methyl 4-piperidone, an intermediate for Mebhydroline (INCIDAL).
- Development of process for Cyclopropylamine, an intermediate for Ciprofloxacin is developed, as an import substitution.
- Process Development for Famotidine from basic stage, a potent inhibitor of H-receptor site, used in treatment of peptic ulcer.
- Development of technology for production of Alprazolam, a tranquiliser, from basic stage.
- Development of technology for phenyl propanolamine hydrochloride from phenyl acetyl carbinol, an intermediate in ephedrine manufacture; by reductive amination in two stages.
- Development of technology for albendazole, an anthelmintic, from basic stage of meta chloro aniline.
- Development of technology for 2-acetyl 6-methoxy naphthalene (AMN) from B naphthol.
- Development of technologies for sodium perborate monohydrate (SPM) and tetra acetyl ethylene diamine (TAED).
- Development of a 7 step process for Cefaclor, a potential broad spectrum antibacterial drug and scaling up to 60 TPA.
- Development of process for recovery of uranium from wet process phosphoric acid which is jointly developed and commercialised by FACT and BARC.

- Development of process for diltiazem HC1 from basic stage.
- Development of Ceramic (Cordierite) Honeycomb by extrusion for use in Indian automobiles and thermal power station pollution control equipment to reduce emission levels.
- Development of compounds for use as filling, flooding, plugging and lubricants in tele-communication cables.
- Development of technology to convert solid waste lime sludge generated from the cold lime softening plant, into valuable products like calcium chloride.
- Development of calcium silicate bricks made from upgraded coal ash/unseparated fly ash, which is economical and has higher compressive strength in comparison to conventional bricks.



III.A. 2 Catalyst Performance Evaluation Unit

- Development of Pt-Alumina monometallic reforming catalyst for benzene and toluene production; and Pt-Re-Alumina bimetallic reforming catalyst for gasoline and xylene production.
- Development of rubber containers for submarine batteries as an import substitution and having export potential.
- Development of synthetic lubricant for rotary screw compressor with service life over 7300 hours as compared to 500/1000 hours obtained with existing mineral oil based products.
- Improvement in gasoline quality for fuel economy, increasing it by 2.9% and reduced emission.

Electrical and Electron cs Industries

- Development of Digital Mobile Tropo Equip-

III.A.3 Automatic Test Bench for Digital Transmission Analyser

ment, Navigational Radars, Air Traffic Control Radar Simulator, New Surgical Microscope, Power Line Carrier Communication Terminal.

- Development of Solenoid operated Inlet Valve for washing machine application.
- Development of 2 Micron CMOS double metal technology, 1.2 Micron CMOS technologies, CCD technology for imaging application 'BEACON' CAD system for VLSI design, Emergency Position Indicating Radio Beacon, 90 GHz Search and Rescue Radar Transponder Low Power Radar, Synthesized 1KW HF SSB Transmitter technology.
- Development of Connectors for Milan Missile & Launcher, Connectors for Defence and Telecommunications; Anti-aircraft missile launcher with 3 axis all electrical servo on AFV.
- Design and Development of Monitoring Link, 2 MB/s Optical Line Terminating equipment (OLTE) 8 MB/s OLTE, Optical Line equipment 34 MB/s, Optical Line Equipment, Automatic Service Protection Equipment, Optical Fibre, High Speed Data Optical Fibre - joint box, distribution frame, termination box, tool set;
- Development of Tactical Fibre Optic Link for Indian Army.
- Development of Microprocessors to control the level of liquid, temperature programming, winding machine for pre-set length indicator/controller, Weft accumulator for rapier/water and air jet loom, Running fabric temperature indicator/controller.
- Design and development of Electonic Trivector Energy Meter, 50 MHz oscilloscope, PC based Logic Analyser, PC based UV-VIS Spectrophotometer, Fluoride Meter, flame photometer, Avalanche Victim Detector.
- Development of Single Loop PID Controllers, Flow Computers, Digital Temperature Scanners.
- Development of Converters with fully-digital microprocessor based controls for variable speed running of three-phase AC motors, Arc chute for 12 KV Pole Mounted Load Break Switch 800 KV Prototype Capacitor Voltage Transformer.
- Development of 3900 KVA and 5400 KVA Aluminium Foil Wound Traction Transformers for Indian Railways.
- Development of Fault Tolerant System, EISA SCSI Disk Controller, Multilingual Electronic Teleprinter, Teleconference unit - Contel, Rural Messaging Terminal, Time division multiplexer Universal charge indicator.
- Development of TV with integrated satellite receiver 4-½". 7", 8", 9" monochrome CRTs., 140L Compression Type Chest Deep Freezer, 230L Visi Cooler, 90L Icelined Refrigerator, 310L Double Door 'No-frost' Refrigerator.
- Development of 200 KW Wind Electric Generators.
- Development of Microprocessor control systems for SP 180, SP 400, SP 130 and ST 50 used on blow moulding machines.
- Development of a generator set with 30-35% less noise level than the conventional sets.
- Development of low loss EHV shunt reactor by incorporating new feature in the new design.

Mechanical Industries

- Design and development of 207 family of car class vehicles, Tata 407 light commercial vehicle.
- Design and development of a hybrid scooter to reduce exhaust pollution; Diesel engine driven fire fighting pumpset package.
- Development of Champ 60 Power-Port Engined Moped, Astra VMX Variomatic Mokick, Shogun Motor Cycle, Bajaj Sunny; new Rajdoot 175CC motorcycle models 123E, 115E & 138E.
- Design and development of High performance tyres for airforce aircrafts, sophisticated tyres for new vehicles for TELCO, Hindustan, Maruti, Bajaj. Speciality conveyor belts for flame resistance and high rsistance, cut edge; Vee belts for automotive vehicles.
- Design and development of CNC Horizontal

Machining Centre, Integratd operating system for electrostatic precipitators, CNC Slant bed turning centre, Vertical machining centre, Precision chucker, Trainmaster machining centre, CNC special performance machines with subsystem like Index and NC Rotary tables tool Magazine and Precision high power spinning.

- Design and development of BEML 35 Ton Rear Dumper; Torpedo Ladle Cars.
- Development of Photovoltaics Cell cutting machine, Development of module tester, Development of Laminator for manufacture of large modules.
- Development of Fluidised Bed Combustion Technology for rice straw firing.

III.A.4 Sump Model Tests for Concrete Volute C.W. Pumps

- Development of Special Valves for Nuclear Power Plants, High Pressure Parallel Slide Gate Valves; Compressed Natural Gas Refilling Compressor.
- Development of 500 KW gasifier system, Grid paralleling of a 40 KW gasifier system, Development of a fast response gasifier system with automatic controls.
- Development of Lift actuator of Tractor hydraulic system, GT-51 Transmission for Tractor.
- Design and development of tubular reactors for high temperature application; boilers for high pressure and high temperature applications.
- Design and development of special fixture for experimental stress analysis for Helicopter landing grid testing.
- Development of Portable Fire Pump, Canned Motor Pumps Range, Marine Gear Box, Gear Box (for Wind Mill Application).
- Design and development of LPG Cylinder 19 Kg capacity, fermenting machines for tea industry, high speed spray machine for spray dryer.
- Design and development of 250 ton horizontal coal crushing pressure die casting machine.
- Design and development of Two for one twister for spun yarn, filament yarn (texturised) direct cables, jute twister, hollow, spindle and fancy twister with micro twister.
- Development of high energy efficient ratio compressor of 1.5 TR capacity for refrigeration and air-conditioning appliances.

Processing Industries

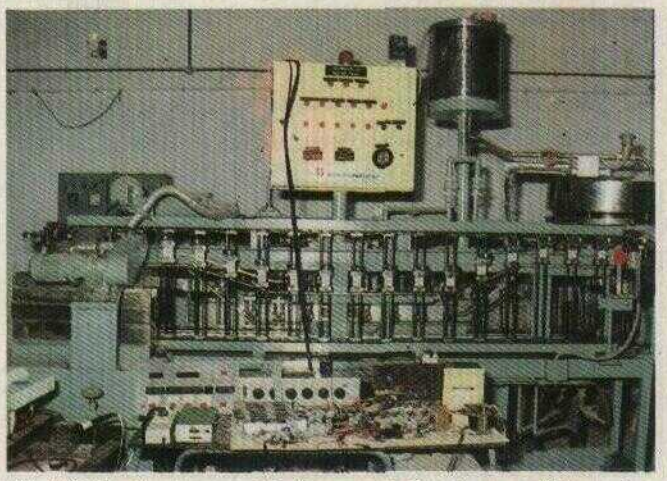
- Development of process technology for a novel high performance Nylon-6 Composite material based on indigenous minerals.
- Development of export oriented bogie castings for sub-zero (-60° C) temperature applications; low weight bogies for Indian Railways.
- Development of Casnub Railway Bogies of reduced weight and new design for Box Wagon for broad guage and High Cast Steel Bogies for meter guage Wagon, 14 ton axle load for Indian Railways.
- Development of short cycle spheroidisation as an advanced annealing technique for special steels.
- Indigenous development of Cold Heading Quality Wire Rods.
- Development of absorbent kraft paper, barrier paper, braille paper and tetrapak packing paper as import substitutes.
- Development of technology for utilisation of waste materials in mines.

III.A.5 Energy Efficient Endo Gas Generator

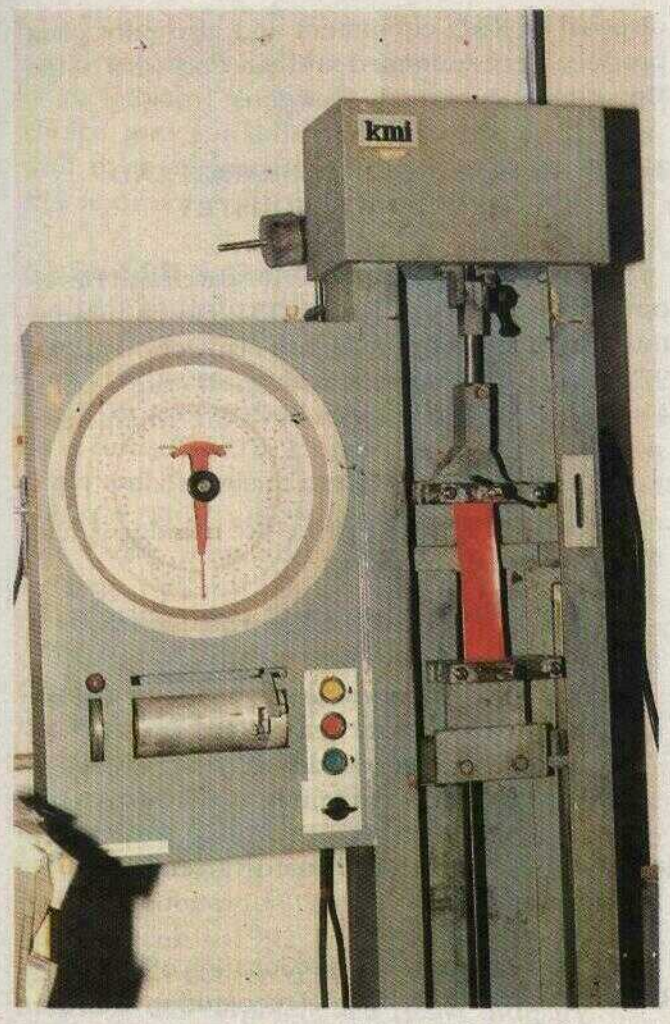
- Development of CUNIFER - an alloy (Mn 2%, Fe 2%, Ni 30% and Cu 66%) characterised by high strength, excellent ductility and corrosion resistance for heat exchanger applications as import substitution.
- Development and commercialisation of prebleach (linen) technology which is competitive at international level.
- Development of technology for controlled trajectory blasting.
- Development of technology for the utilisation of waste from sodium cyanide plant for the production of sodium ferrocyanide and control of cyanide pollution.
- Development of technology for reduction of sulphide in effluent from liquid sulphur black colour dyeing by replacing the use of sodium sulphide with hydrol.

III.A.6 Prototype 'On Board Oxygen Generating System'

- Development of high temperature grease, energy effecient industrial gear oil, synthetic lubricant for rotary screw compressor.
- Development of fuel effecient domestic lighting appliances (kerosene wick lamps and hurricane lanterns)
- Development of Technology for ATIRA-GSFC process for synthesis of polymers.
- Development of continuous devolatialiser for production of smokeless fuel, a substitute for soft coke.



III.A.7 Jet Analyser with Automatic Resistance Measuring System



III.A.8 Tensile Testing Machine

Agro Industries and Others

- Development of Neem based pesticides.
- Development of hybrid seeds of sunflower, castor, cotton, maize, bajra.
- Development of drip irrigation systems for banana, sugarcane and other crops.
- Development of "spot antibiotic sensitivity test" for the diagnosis and treatment of devastating bacterial diseases like colisepticaemia, fowltyphoid, fowlcholera and infectious caryza; "Mycotoxin Bioasay" in the diagnosis of Mycotoxicoses.
- Development of uterine irrigation pump a device for embryo flushing, and vagiono-cornual cannulator.

III.A.9 Helicopter Landing Grid Testing in a Special Fixture

- Development of improved mass production techniques for several important biological control of housefly; control of helicoverpa armigera; control of opisina arenosella.
- Development of bio pesticides.

9. IMPORTS MADE BY R&D UNITS

The recognised In-house R&D units have imported a variety of equipment, raw materials and samples for their R&D activities under the Open General Licence facilities available to them by virtue of the recognition. These include: Buchi Apparatus, pH controller, Chroma QC 3000, Karl Fisher Moisture testing Equipment, Moving Die Rheometer, Mooney Viscometer, Prep LC 4000

III.A.10 170 CK Bottom Dump Attachment Undergoing Quality Tests

system,Rotovapours, ACS colour control system, DRO system (Mitutoyo) for MITR Milling machine, UV-VIS Dual beam spectrophotometer, BYK paint testing instrument, Haze Gloss with standards, Microscreen digital opacity reflectometer, Automatic spray gun, Air velocity meter, Contact angel viewer, PIRA crease & board stiffness tester, Rheo viscometer, Tektronix oscilloscope with FFT model TDS-520, etc.

10. CERTIFICATE OF INDIGENOUS DEVELOPMENT OF TECHNOLOGY/ KNOW HOW FOR BULK DRUGS

The Department also examines the issues relating to the pricing for the products whose technology has been developed indigenously. The bulk drugs manufactured by process/know-how developed through In-house R&D are eligible for exemption from the Drug (Prices Control) Order (DPCO) for a period of 5 years after their first introduction in the market. The department examines the request of various In-house R&D units for claiming exemption and issues certificate of indigenous development of technology/process, in deserving cases.

During the year 1993 there was one request for issuance of such a certificate which is under process.

11. OTHER BENEFITS AVAILED BY THE RECOGNISED R&D UNITS

The Department provides assistance to recognised In-house R&D Units in a number of ways: cases of industrial R&D Units requiring remittance of foreign exchange for deputing experts to attend international symposia and seminars, exhibitions, trade fares, international R&D collaborations, engagement of foreign experts for R&D and for maintenance/commissioning of imported R&D equipment requiring such expertise; and allotment of special controlled materials for R&D are dealt with.

A number of cases regarding locational clearance with respect to expansion of R&D have been dealt with. A number of applications regarding disposal of R&D equipment and also pilot plant produce were examined and the decisions of the Department conveyed.

12 PLAN SCHEME ON RESEARCH AND DEVELOPMENT BY INDUSTRY

DSIR has a plan scheme on Research and Development by Industry. The EFC Memorandum for this plan scheme for the Eighth Plan Period (1992-97) was approved in 1992 with an allocation of Rs. 4 crores. The broad objectives of the scheme are:

- bring In-house R&D into sharper focus;
- strengthen R&D infrastructure in industry and SIROs;
- promote R&D initiatives of the industry and SIROs;
- ensure that the contributions made by the In-house R&D Centres and SIROs dovetail adequately in the overall context of technological and industrial development.

(a) Computerisation of Data on In-house R&D Units

Names, addresses and also location of In-house R&D units as well as validity of recognition of all the recognised In-house R&D units are computerised and updated. As on 31 December 1993, there were 1229 In-house R&D units recognised by DSIR and whose data are entered in the computer.

(b) In-house R&D - DSIR Interaction

The Department of Scientific and Industrial Research (DSIR) in association with the Federation of Indian Chambers of Commerce and Industry (FICCI) organised a one day Workshop on Technology Management in Industry on 3 August 1993 in New Delhi. Attended by over 75 senior representatives from Industry, Government Departments and Consultancy Organisations, the Workshop dwelt upon a number of issues of Technology Management in Industry, particularly in the new environment. The discussions of the Workshop centred around various issues and aspects of technology culture, attitudes, development of

technologies for exports, funds for demonstration of technology, contracting R&D to institutions, choice and suitability of technology, linkages with national laboratories and R&D institutions and so on.

(c) Seventh National Conference on In-house R&D in Industry

Department of Scientific and Industrial Research (DSIR) organised the Seventh National Conference on In-house R&D in Industry jointly with the Federation of Indian Chambers of Commerce and Industry (FICCI) during 26-27 November 1993 in New Delhi. Attended by over 500 delegates from industry, National Laboratories, IITs and Universities, Scientific and Industrial Research Organisations (SIROs), Consultancy Organisations, Government Departments, the Conference was inaugurated by the Minister of State for Science and Technology in the Convention Hall, Hotel Ashok. The Minister also gave away the 1993 DSIR National Awards for Outstanding In-house R&D Achievements to nine industrial units. The Hon'ble Minister also released the DSIR publication "Outstanding In-house R&D Achievements - 1992 & 1993". The Valedictory address was delivered by the Minister of State for Industrial Development and Heavy Industry.

(d) National Awards for R&D Efforts in Industry

In order to provide recognition to the efforts of the industry towards innovative research and technological development, the DSIR had instituted National Awards for R&D Efforts in Industry in 1987. These awards are in the form of trophies made of sterling silver and are presented along with citations at the inaugural session of the Annual National Conferene on In-hose R&D in Industry. During 1988, National Awards were presented to 7 firms; in 1989 to 9 firms; in 1990 to 12 firms; in 1991 to 8 firm; in 1992 to 9 firms and in 1993 to 9 firms for outstanding R&D Achievements.

III.A.11 Dr. S.K. Joshi, Secretary, DSIR addressing the delegates at the Inaugural Session

Following is the list of the award winners in 1993:

Chemical and Allied Industries

1. Herdillia Chemicals Limited, Bombay

Electrical and Electronics Industries

2. Bharat Electronics Limited, Bangalore

Mechanical Industries including Capital Goods Development

3. Tata Engineering and Locomotive Company Limited, Pune

Processing Industries

4. Mukand Limited, Bombay

Energy Conservation

5. Indian Oil Corporation Ltd., Faridabad

Technology Absorption

6. Sundaram-Abex Limited, Madras

Pollution Control and Environmental Protection

7. Gujarat Alkalies and Chemicals Limited, Vadodara

Agro Industries

8. Pest Control (India) Limited, Bangalore

Successful Commercialisation of Public Funded R&D

9. Indian Petrochemical Corporation Limited, Vadodara

(e) Compendium on In-house R&D Centres - 1993

At present there are over 1200 In-house R&D Units recognised by the Department of Scientific & Industrial Research. Efforts have been initiated to assess the contributions made by these In-house R&D units. While some of them have claimed achievements in the areas of import substitution, technology absorption and improvements to the technologies in use, a more qualitative and quantitative assessment of the same and appropriate corrections are necessary to ensure that the contributions made by the In-house R&D units dovetail adequately in the overall efforts of technological and industrial development. Since 1985, the DSIR has brought out publications highlighting the achievements claimed by the In-house R&D Centres. The first publication of "Compendium on In-house R&D Centres" was brought out during 1985 covering 193 In-house R&D Centres, a second one in 1986 covering 132 centres, third one in 1987 covering 209 centres, fourth one in 1988 in 4 volumes covering 589 centres, fifth one in 1989 covering 188 centres, the sixth one in 1990 in two volumes covering 448 centres, the seventh one in 1991 in two volumes covering 439 centres and the eighth one in 1992 in two volumes covering 384 centres.

The Compendium on In-house R&D Centres - 1993 was compiled by DSIR based on the information and material received from 291 In-house R&D Centres, whose renewal of recognition was due beyond 31 March 1993. This was released during the Seventh National Conference on In-house R&D in Industry on 26 November 1993 by the Minister of State for Science and Technology.

(f) Outstanding In-house R&D Achievements - 1992 & 1993

The first publication on Outstanding In-house R&D Achievements (1988-1991) was brought out during December 1991 covering 36 DSIR National Awards winning companies, giving an overview of the history of the company, its R&D set-up and the details of the developmental work carried out, pointing out the scientific and technological achievements as well as the economic potential of their innovation.

DSIR has now brought out another publication "Outstanding In-house R&D Achievements-1992 & 93". The present publication covers salient features of 18 DSIR National Awards that have been presented during 1992 and 1993. This publication

III.A.12 DSIR National Award Winners

III.A.13 Shri Krishna Sahi, Minister of State for Industrial Development and Heavy Industry Addressing the Delegates at the Valedictory Session

was also released during the Seventh National Conference on In-house R&D in Industry on 26 November 1993 by the Minister of State for Science and Technology.

(g) In-house R&D in Industry - Information Update

As the number of In-house R&D Centres has increased while the activities of DSIR have also diversified significantly with respect to In-house R&D Units, it was felt appropriate to devise a quick communication system between DSIR and In-house R&D Units. Accordingly, the DSIR started bringing out a quarterly Infromation Update on In-house R&D in Industry on a regular basis since April 1988. The Information Update is expected to provide a communication link between DSIR, In-house R&D Units and SIROs and serve to disseminate useful and important information relevant to R&D in Industry.

During 1993-94, four issues of In-house R&D in Industry were brought out in April, July, October, 1993 and January 1994. These have been well received by the Industry, Government Departments and other concerned agencies.

(h) Support for Joint R&D Projects

The DSIR under the plan scheme Research and Development by Industry considers providing catalytic support for industrial R&D projects taken up by recognised In-house R&D units jointly with National Laboratories/Universities/IITs. The projects shall be in high priority areas of importance to the nation.

The DSIR has approved partial financial support of Rs. 2.45 lakhs as project grant to Centre for Development of Electronic System (CDES), Madras for development of high performance TMS320C30 based DSP board for IBM PC-AT computers with relevant softwares. Design and development of hardware and development of testing softwares like TMS320C30 assembler and disassembler will be the responsibility of CDES. The applications softwares will be developed by M/s. Vi Microsystems Pvt. Ltd., Madras.

DSIR has also approved financial support of Rs. 11.50 lakhs as project grant to M/s B.V.Patel Pharmaceutical Education and Research Development Centre, Ahmedabad, for development of indigenous process for large scale synthesis of 2,4 - Dichloro fluorobenzene and 3 - Chloro - 4 fluoroaniline intermediates for the production of the broad spectrum anti-infective compound Ciprofloxacin.

DSIR has provided a grant of Rs. 5.0 lakhs to Ankleshwar Rotary Welfare Trust registered at Bharuch, Gujarat for purchase of Technical Books for UPL - Rotary Library for use of over 1200 industries located in the Ankleshwar Industrial Estate for their technical and R&D needs.

(i) Publications

Following 15 publications were brought out during the year 1993-94:

(i) Outstanding In-house R&D Achievements (1992-1993)

(ii) Compendium on In-house R&D Centres - 1993

(iii) Profile on Scientific and Industrial Research Organisations - 1993

(iv) National Awards for R&D Efforts in Industry (1993)

(v) Research and Development in Industry - An Overview (1993)

(vi) In-house R&D in Industry - Information Update - April 1993

(vii) In-house R&D in Industry - Information Update - July 1993

(viii) The Challenge and Role of Scientific Research in India's Industrial Development - August 1993

(ix) Guidelines for Recognition of Scientific and Industrial Research Organisations and Approval Under Section 35(1) (ii)/(iii) of Income Tax Act, 1961 - August 1993

(x) In-house R&D in Industry - Information Update - October 1993

(xi) Directory of Recognised In-house R&D Centres, October 1993

(xii) Directory of Recognised Scientific and Industrial Research Organisations, October 1993

(xiii) The Challenge and Role of Scientific Research in India's Industrial Development - December 1993

(xiv) In-house R&D in Industry - Information Update - January 1994

(xv) Proceedings of the Seventh National Conference on In-house R&D in Industry - 1993

III (B) SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS

1. INTRODUCTION

To promote the growth of research and development activities in industry and non-profit oragnisations, various measures have been evolved. Some of the provisions in the Income Tax Act have been designed to encourage research and development. The Department also considers modifications and amendments to various schemes and suggests amendments thereof to the Ministry of Finance in order to give stimulus to the growth of research in the country.

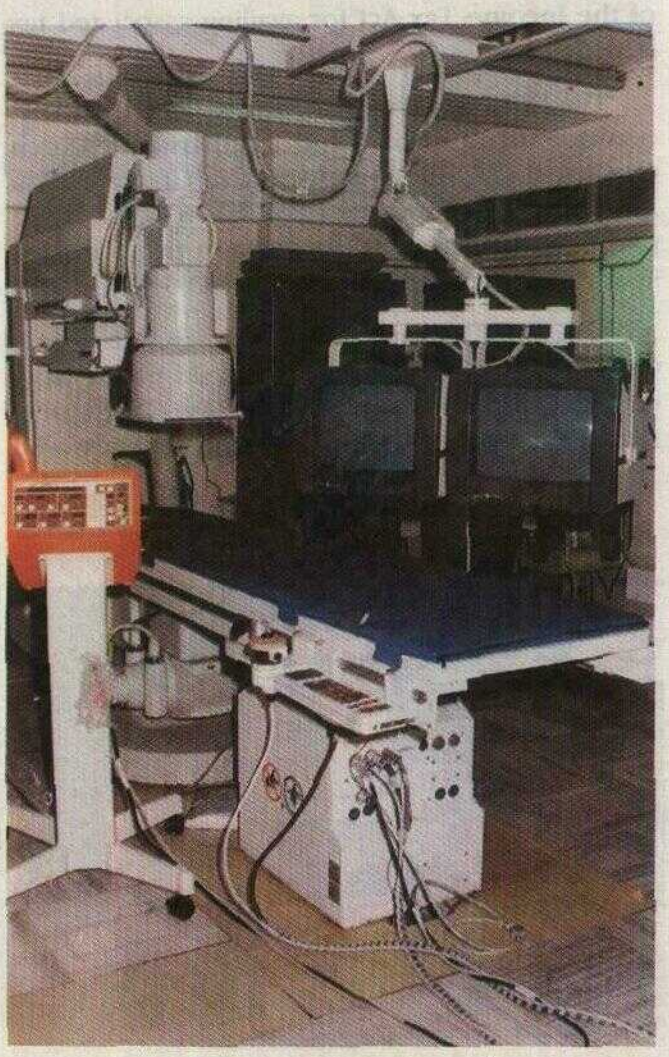
2. SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS (SIROs)

Scientific Research Associations, Institutions, Universities and Colleges which undertake research in the area of medical, agriculture, natural and applied sciences, and social sciences and seek approval under Section 35(1) (ii) or (iii) of the Income Tax Act if they wish to have donations from industries or other sources. The institutions notified under the section obtain benefit to the effect that any sum paid to them is wholly exempted from the levy of Income Tax. The donors who, pay sums to such notified institutions are allowed deductions from the profits and gains of their business. Prior to 1 June 1982, ICAR, ICMR or ICSSR were the Prescribed Authorities for making recommendations to the Ministry of Finance in the areas of agricultural sciences, medical sciences and social sciences respectively. With effect from 1 June 1982, Secretary, Department of Science & Technology was designated as the Prescribed Authority to deal with all the above areas. Consequent to the creation of Department of Scientific and Industrial Research, Secretary, DSIR has been designated as the single Prescribed Authority.

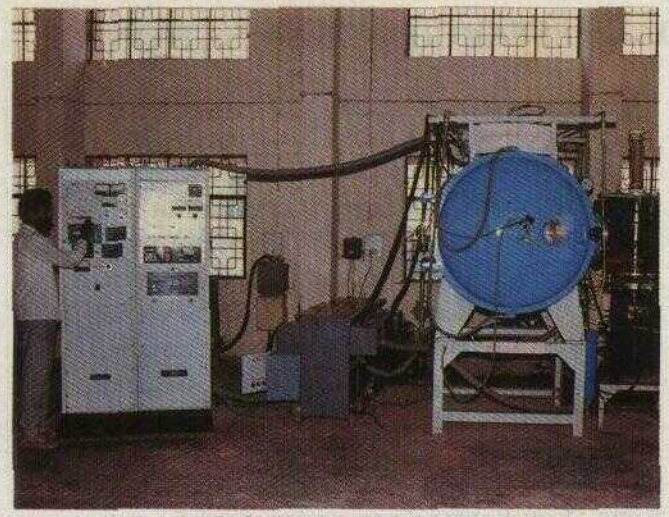
Through an amendment by the Direct Tax Laws (Amendment) Act, 1987, effective from 1 April 1988 Section 35 *inter-alia* was deleted. The DSIR launched a scheme of Recognition of Scientific and Industrial Research Organisations (SIROs) in 1988.

Government of India however, reintroduced Section 35 of the Income Tax Act with modifications by Direct Tax Laws (Amendment) Act 1989 w.e.f. 1 April 1989. The Prescribed Authority for Section 35 is the Director General (Income Tax Exemptions) in concurrence with Secretary, Department of Scientific and Industrial Research (Ministry of Science and Technology), Government of India.

SIROs recognised by DSIR are eligible for Customs Duty Exemptions on import of equipment, spares and accessories for R&D; they are also eligible for notification under Section 35 (1) (ii)/(iii)



III.B.1 D.F.-6000 with Advantax



III.B.2 Vaccum Annealing Furnace for Silver Brazing Alloy Products and OFE Copper Products

of the Income Tax Act for availing associated tax benefits.

The DSIR has brought out Guidelines for Recognition of Scientific and Industrial Research Organisations (SIROs) and Approval Under Section 35 (1) (ii)/(iii) of Income Tax Act, 1961 which gives procedural details and application proforma for seeking recognition under the SIRO Scheme.

Functional Scientific and Industrial Research Organisations (SIROs) having broad-based Governing Council, Research Advisory Committee, Research Personnel, Infrastructural facilities, well defined research programmes and clearly stated objectives of undertaking scientific research are considered eligible of recogniton by DSIR.

Applications for seeking recognition under the SIRO scheme are considered in DSIR by an inter departmental Screening Committee with members from Council of Scientific and Industrial Research (CSIR), Indian Council of Medical Research (ICMR), Indian Council of Agricultural Research (ICAR), Indian Council of Social Science Research (ICSSR), and Central Board of Direct Taxes (CBDT). The Committee is presently chaired by Joint Adviser (RDI), DSIR. The recommendations of the Screening Committee are put-up for approval of Secretary, DSIR, who is the concurrent Prescribed Authority. The recommendations of Secretary, DSIR, are communicated to the Director General (Income Tax Exemption), Calcutta, for notification under Section 35 (ii)/(iii) of IT Act.

During the year 1993, the Screening Committee met 12 times and recommended 39 cases for recognition as Scientific and Industrial Research Organisations. List of these SIROs is furnished at Annexure III-B.1. and III-B.2.

At present, there are 470 SIROs duly recognised by DSIR. Of these, 196 are in the area of natural and applied sciences, 149 are in the area of medical sciences, 28 are in the area of agricultural sciences and 97 are in the area of social sciences.

3. PROFILE ON SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS

The SIROs have taken up several research

III.B.3 Automated Cell Counter Measures Ten Parameters

III.B.4 220 KW Rice Husk Gasifier System

programmes and contributed to development of new techniques, methods, products, and processes.

In order to evaluate and bring out the scientific activities and achievements of these Scientific Research Organisations, a publication entitled "Profile on Scientific Research Associations" covering about 74 institutions was brought out in 1988. A second volume of Profile on Scientific Research Organisations was brought out in 1989, covering 180 organisations. A third volume covering 179 institutions was published in 1991. Fourth volume covering activities and achievements of 321 SIROs was published in March, 1993. This has enabled a better appreciation of the good work done by these organisations indicating therein the contribution they make in the overall scientific research activities in the country.

III. (C) FISCAL INCENTIVES FOR SCIENTIFIC RESEARCH

1. INTRODUCTION

Several incentives have been evolved for utilisation of the tehnologies based on the indigenous research and development efforts. These incentives include 100 per cent deduction of the expenditure incurred on scientific research, investment allowance at enhanced rate upto 31.3.1987 and customs duty exemption on the scientific equipment and consumables imported by the non-commercial SIRO. 100% deduction of expenditure on scientific research, on both revenue and capital expenditure is permissible and is availed of by many In-house R&D units in industry recognised by DSIR. Similar contributions made to approved scientific and research organisations are also entitled to 100% deduction under Section 35(1) (ii) and (iii) of the IT Act.

2. WEIGHTED TAX DEDUCTION FOR SPONSORED RESEARCH IN APPROVED NATIONAL LABORATORIES

Increasing the R&D effort by industry on technology upgradation and new technology development is a key element of the new economic policy of Government. Utilisation by industry of the National R&D Capacity in the form of the Government - funded laboratory system is an important component of that total element.

With a view to encouraging industry to make use of the National R&D Infrastructure, a Weighted Tax Deduction of 125% of the financial contribution made by industry on R&D projects and programmes sponsored by industry in approved National Laboratories was announced by the Finance Minister in his Budget speech in Parliament while presenting the Union Budget for 1993-94.

To operationalise that initiative, the Department of Revenue, Ministry of Finance has issued a Gazette Notification dated 15 September 1993 *bringing the Weighted Tax Deduction into force.*

As per that notification, sponsored research programmes by industry in any of the National Laboratories functioning under the aegis of the Indian Council of Agricultural Research or Indian Council of Medical Research or Council of Scientific and Industrial Research are eligible for the Weighted Tax Deduction.

Applications for obtaining approval for such Weighted Tax Deduction under the concerned section of the Income Tax Act are to be made by the sponsor to the Department of Scientific & Industrial Research in the Ministry of Science and Technology for technical and financial appraisal. Thereafter, projects and programmes found technically viable would be sent on to the Director General (Income Tax Exemptions) of the Finance Ministry for issuance of the necessary Weighted Tax Deduction Order.

3. DEPRECIATION ALLOWANCE ON PLANT AND MACHINERY SEP UP BASED ON INDIGENOUS TECHNOLOGY

Government have introduced a system of allowing accelerated depreciation in respect of blocks of assets and rationalised the rate structure by reducing the number of rates as also by providing for depreciation at higher rates.

Secretary, Department of Scientific & Industrial Research, Ministry of Science and Technology, is the Prescribed Authority for issuing certificates where higher rate of depreciation is to be allowed for the plant and machinery using indigenous know-how. Guidelines have been issued for making applications for obtaining the aforesaid certificate.

During the year 1993, 16 certificates involving Rs. 5043 lakhs as cost of plant and machinery were issued. Details of these cases are given at Annexure III.C.

4. CUSTOMS DUTY EXEMPTION

All Scientific and Industrial Research Organisations recognised by DSIR are eligible for

Customs Duty Exemption on the import of scientific equipment, instruments, spares, accessories as well as consumables for research and development activities and programmes.

The procedure for issuing the essentiality certificates to SIROs for obtaining the customs duty exemptions has been formalised. A Committee was set up which meets normally once a week to examine the proposals.

During the year, a total of 510 certificates were issued for the import of scientific equipment, accessories and components, including consumable items. The value of scientific equipment instruments and the consumables was over Rs. 52 crores.

Some of the major equipment for which essentiality certificates were issued were:

PPF 150 H2 Pulsed CO2 Laser System; A-0 Size Large Format Pinch Roller Pen Plotter; Shimadzu High Performance Liquid Chromatograph; Shimadzu Capillary Gas Chromatograph; UV-Visible Spectrophotometer; Recording Spectrophotometer; Atomic Absorption Spectrophotometer; Plasma Emission Spectrometer; GL-LC-MS Mass Spectrophotometer; Mettler Electronic Top Loading Balance; DNA Electrophoresis System; White Light Conversion Kit, X-Ray Generator; High Precision Measuring Unit; Echelle Diffraction Grating; High Range Activated Clotting time disposable test cartridges.

Film Processor, Image Setter System comprising Parkin Elmer Microprocessor Controlled Autosystem Gas Chromatographs, Sigma 2000 GC & HPLC System, Colour Scanner Processor (Agfa); OHGO Synthesizer for DNA/RNA Synthesis; Direct Reading Sequential Inductively Coupled Shimadzu Differential Scanning Calorimeter; Thermal Controller; Research Telescope Package; Microprocessor PC, Culture for Candida Cylindracea; Lipase Type-VII, Lipase Acrylic Beads for Candida Cylindracea; Multichannel Variable Volume Pipettes and Accessories; Servo Hydraulic Fatigue Machine; Corrosion Fatigue Test Machine; Creep Fatigue Test Machine; R&D System for Melt Grid Spinning Plant; Liquid Nitrogen Plant; Field 3-Force Measurement System.

Hydraulic Programmable leather band knife splitting machine; Hydraulic wet wheeling (Buffing) machine; Standard Size (Toga) Argos Reporting Drifters for Ship Deployment Units; Microbial Cultures; Ingold pH Measuring System; Hybridization Oven; Molecular Biological Kit; Sun Sparcstation 10 Model 30 Solaris 1.1 Operation System Media; Hydrogen Maser; Computerised Stress Test System; CD-Rom Hard Disc 382 MB, Tissue culture & molecular genetic work; Blood Gas Analyser plus Electrolyte Analyser, Oligos (Dry DNA samples); Corrosion Test Bundle Samples; Lung function test equipment, Cath Lab Monitors; Computerised Cardiac stress test system; *DIG DNA Labelling & Detection Kit*; Magnetotron; Vector Network Analyser; Sky Luminance Scanner.

5. SCIENTIFIC RESEARCH ASSETS AND ACTIVITIES UNDER SECTION 35(3) OF I.T. ACT

In the implementation of various incentive schemes for the promotion of science and technology, the Income Tax act inter alia provides that expenditures made on capital equipment and related to research activities should be written off 100% in the year in which the expenditures are incurred. The Government however, provided that in complex cases where the Income Tax Department of the Government is unable to appreciate the technical activity involved in research or the equipment are sophisticated and intricate and the Income Tax Department is unable to appreciate the use of equipment regarding research, then the matter should be referred to the technical authority referred to as the Prescribed Authority (Secretary, DSIR) through CBDT/DG(ITE).

On receipt of the reference, the office of the Prescribed Authority collects information/background regarding the description of the activity claimed as scientific research, date of commencement of the relevant projects, date of completion of research work as also the results obtained from the specific project. After obtaining all these details, the matter is examined in DSIR. In case where it is considered necessary, a team of technical experts is constituted for on the spot appreciation of the research work done at the premises of the company.

After receiving the appreciation from the technical team, a discussion is also normally held so that the point of view of the Company is taken into account before arriving at a decision. After completing the processing of the case in the above manner, the case file is placed before the Secretary DSIR for giving a decision. The Secretary DSIR gives a final decision setting out a reasoned order.

During the year 1993, there was no reference made by CBDT/DG(ITE) to Secretary, DSIR.

IV. PROGRAMMES AIMED AT TECHNOLOGICAL SELF RELIANCE (PATSER)

The scheme on "Programmes Aimed at Technological Self Reliance (PATSER)" covers the following programmes:

(a) Technology Absorption and Adaptation;

(b) Promotion and Support to Indigenous Development of Capital Goods;

(c) Technology Evaluation and Demonstration; and

(d) Programme to assist Talented Indian Engineers & Scientists.

The objectives of the scheme are:

(i) To catalyse absorption of imported technology and to assist in reducing technological dependence.

(ii) To promote indigenous development of capital goods.

(iii) To evaluate technology in use and to assist in demonstration of new or improved technology to bridge the technology gaps.

(iv) To assist Talented Indian Engineers and Scientists in preparatory activities concerning their industrial venture in India.

The activities under PATSER include the following:

(a) **Support to Projects:**

Under the Scheme of PATSER, Department's activities include partial support to approved Research, Development, Design and Engineering (RDDE) projects proposed by industry for:

- Absorption and Upgradation of imported technology
- Indigenous development of Capital Goods.
- Development and demonstration of new or improved technologies.

Bulk of the financial support to the projects is to be from Industry's resources. The Department's support is mainly to meet part of the developmental expenditures for:

- Prototype or pilot plant development.
- Raw Materials and components.
- Research consultancy and assistance from National Research Organisations.
- Consumables and other operational costs in experimental work and field/users trials.

(b) **Studies and Interactions**

The Department has commissioned a number of technology evaluation and status studies in different sectors. These studies have identified action plans to bridge relevant technological gaps. Preliminary industry profiles concerning several products have also been prepared. A number of Interaction meetings have also been organised to discuss various draft reports on technology status and technological trends.

(c) **Further Thrust of PATSER**

During the year, a major thrust has been given to Technology Absorption, Development and Demonstration Projects and the studies in the pipeline are being completed. Recently, the Department has invited proposals for technology absorption, development and demonstration projects from industrial units having DSIR recognised In-house R&D Units through advertisements in leading newspapers. Consequently, over 30 project proposals have so far been received and are being evaluated.

The activities in each of the above programmes are presented in the following paragraphs:

IV (A) TECHNOLOGY ABSORPTION AND ADAPTATION

1. OBJECTIVES

This is a continuing Programme after the Seventh Plan scheme "Technology Absorption & Adaptation Scheme (TAAS)". The major objectives of the Programme are:

- To reduce the necessity for further import of technology after having it in use over a long period.
- To upgrade the technology imported, incorporating improvements identified during its use.
- To study and evaluate the efforts in implementation and absorption of imported technology.

2. FUNCTIONS

The main functions in this Programme are:

- To provide a catalytic support to industry for undertaking projects related to absorption and upgradation of imported technologies.
- To evaluate the Industry's efforts in implementation and absorption of technology.
- To disseminate information related to implementation and absorption of imported technology through interaction meetings with industry and other concerned organisations.

3. ACTIVITIES

Details of the important activities covered during the period are given as under:

3.1 Support and assistance for the Technology Absorption and Upgradation projects.

The programme provides promotional support and assistance to the industry for technology absorption and upgradation exercises related to imported technologies. Financial support is essentially catalytic in nature and is directed to stimulate target oriented technology absorption and upgradation activities by the industry. The RDDE (Research Development Design and Engineering) projects supported include know-why studies, product/process optimisation and improvement.

Technology absorption and upgradation projects of 37 companies involving over 60 projects have been approved so far. Expenditures supported have been for aspects such as prototype/pilot plant build up, raw materials and components, testing, research consultancy from National Laboratories and Institutions and user/field trials. The progress of the various projects during the year is given below:

3.1.1 Southern Pesticides Corporation Ltd., Hyderabad

The project related to Gamma BHC pesticides (collaborator; M/s. Stauffers Chemicals, USA) was initiated with partial support of Rs. 19 lakhs, out of total project cost of Rs. 43 lakhs. The firm is being assisted by IICT, Hyderabad for reactor design, pilot plant work and debottlenecking of the plant. Work concerning pilot plant studies is completed. The project is in the final stages.

3.1.2. M/s. Andrew Yule & Company Ltd., Calcutta

The project related to heavy duty industrial fans (collaborator M/s Davidson & Co. Ltd., UK) was initiated with a partial support of Rs. 10 lakhs out of total project cost of Rs. 47 lakhs. The project deals with optimisation of energy efficiency of

industrial fans. Detailed engineering and fabrication of prototypes were undertaken by the firm based on design support given by Indian Institute of Science, Bangalore and IIT, Madras. Prototype development has been completed and testing/ user trials are underway. The project is nearing completion.

3.1.3 M/s Hindustan Machine Tools Ltd., Pinjore

The project concerns upgradation of diesel engines for 3511, 4511 and 5911 tractors based on technology imported for 25 HP diesel engine from M/s AVL, Austria. The project involves a partial financial support of Rs. 7.00 lakhs out of total project cost of Rs. 33 lakhs. The design engineering and prototype development are completed and the pilot batch of engines is under laboratory testing and field trials. The project is nearing completion.

3.1.4 M/s Hindustan Teleprinters Ltd., Madras

The project related to adaptation and upgradation of Electronic Teleprinters (collaborator M/s SAGEM, France) was given a partial support of Rs. 12 lakhs out of total project cost of Rs. 63 lakhs. The project involved upgradation of existing electronic teleprinter TX-30 by incorporating additional features like 32 K memory, real time clock, auto dialing, VDU (Video Display Unit) and add on FDD Floppy Disk Drive). The project is completed.

3.1.5 M/s Metallurgical & Engineering Consultants (I) Ltd., Ranchi

The project envisages development of hydraulic AGC (Automatic Gauge Control) system by undertaking simulation exercises, prototype development and commercial trials in a rolling mill. The DSIR support was for Rs. 10 lakhs out of total project cost of Rs. 75 lakhs. The project is in progress.

3.1.6 M/s Mining and Allied Machinery Corporation, Durgapur

The project concerns Development of Side

IV.A.1 Side Discharge Loader

Discharge Loaders (SDL's), based on the technology from KOPEX, Poland, and was approved with a partial support of Rs. 10 lakhs out of total project cost Rs. 25 lakhs. The project is completed.

3.1.7 M/s Keltron Controls, Aroor

The project related to indigenous development of 5 custom built IC's used in the Digital Distributed Control System (DDCS) and its associated computers, manufactured with the technology from Hitachi, Japan, was approved with a partial support of Rs. 10 lakhs out of total project cost Rs. 20 lakhs. Design work at ERDC has been completed for four IC's.

3.1.8 M/s Hindustan Cables Ltd.

The projects related to Plasma enhanced MCVD process and recovery of Nylon used in Fibre Optic Cables manufactured in collaboration with NKT, Denmark, were approved for a partial support of Rs. 15.50 lakhs out of a total project cost of Rs. 300 lakhs. The project for recovery of Nylon is completed and project related to Plasma Enhanced MCVD is closed.

3.1.9 M/s Hindustan Organic Chemicals, Rasayani

The project related to mathematical modelling and simulation studies undertaken by NCL for the Cumene distillation train in the Phenol plant at Cochin, set up in collaboration with Universal Oil Products Inc, USA was approved for a partial sup-

port of Rs. 4.50 lakhs out of a total project cost of Rs. 13.50 lakhs. The project is nearing completion.

3.1.10 M/s Swaraj Mazda, Chandigarh

The project related to design optimisation and reduction of specific fuel consumption of the Diesel Engines, manufactured with the technology from Mazda Motor Corporation, Japan, was approved for a partial support of Rs. 21.50 lakhs out of total project cost of Rs. 76 lakhs. The project is nearing completion.

3.1.11 M/s Bharat Heavy Plates & Vessels Ltd., Visakhapatnam

The project related to flexible super insulated piping used as a part of cryogenic system, manufactured based on technology received from L'Air Liquide, France was approved for a partial support of Rs. 16 lakhs out of total project cost Rs. 35 lakhs. The project is nearing completion.

3.1.12 M/s Bharat Earthmovers Ltd., Bangalore

The project related to technology upgradation of 50 ton dumpers and 200 HP Front End Loader based on technology received from Westinghouse Air Brake Co. USA and Komatsu, Japan respectively, were approved for a partial support of Rs. 35 lakhs out of total project cost of Rs. 205 lakhs. The projects are in progress.

3.1.13 M/s IBP Co. Ltd., Gurgaon

Four projects related to: (i) Development of Site Mixed Slurry (SMS) Explosives for deep borehole applications. (ii) Adaptation and Upgradation of Emulsion Explosive Technology (iii) Development of Detonating Card for shaped charges used for perforation of wells in oil fields and (iv) Development of Heat Resistance Explosives for use in fire affected areas (with the assistance of CMRS, Dhanbad), were approved with partial support of Rs. 41.50 out of total project cost of Rs. 137 lakhs. The firm has received technology from M/s Ireco, USA for slurry and emulsion explosives and technology from M/s Halliburton Logging Services/Jet Research Centre (JRC) Inc., USA for shaped charges. These projects are in progress.

3.1.14 M/s Triveni Structurals Ltd., Naini

The project related to development of 400 KV and 765 KV Self supporting and Guyed type transmission line towers based on technology received from M/s Voest Alphine, Austria, was approved with partial support of Rs. 20 lakhs out of total project cost of Rs. 86 lakhs. SERC, Madras is assisting the firm in design and testing of the towers. The project is in progress.

3.1.15 M/s Semiconductors Complex Ltd., Chandigarh

The project related to development of ASICs for Line Card and Conference Card of C-DOT Exchange was approved with partial support of Rs. 20 lakhs out of total project cost of Rs. 60 lakhs. The project is being executed by the firm in collaboration with C-DOT.

3.1.16 M/s FACT, Cochin

The project related to Mathematical modelling studies by IIT, Madras for optimising the process parameters of Caprolactum plant set up with technology from Stami Carbon and Chigoda, Japan was approved with a partial support of Rs. 3.5 lakhs out of total project cost of Rs. 7.50 lakhs. The project is in initial stages.

3.2 Technology Profile Studies

The Technology profile reports of imported technology in 18 States have been completed. The reports contain details of existing industrial units based on foreign collaborations, brief highlights of absorption of technology, and a broad analysis of foreign collaborations in the concerned States. The reports related to all the 18 States have been finalised based on interaction meetings organised by DSIR in collaboration with Confederation of Indian Industry during 1992-93 in various State capitals. These meetings were attended by the industrial units of the States, State Government officials and others concerned with import of tech-

nology. These State Profiles Reports such as those of Tamil Nadu, Maharashtra, Rajasthan, Gujarat, Kerala, Delhi, Himachal Pradesh, Haryana, Punjab, Madhya Pradesh, Karnataka etc. have been printed and are being sold through National Research Development Corporation, New Delhi.

4. TECHNOLOGY EVALUATION AND DEMONSTRATION

4.1. Objectives

Major objectives of the programme are:

- To evaluate existing technologies with a view to identify technology gaps, if any, and to suggest programmes to bridge the gaps.
- To promote development and demonstration of new or improved technology.

4.2. Activities

4.2.1 Technology Evaluation Studies

Under this programme, Technology Evaluation Studies were initiated in various sectors and areas of importance. These studies *inter alia* aim at identifying major elements of technological gaps and to formulate the time targeted projects/ programmes for technology acquisition, R&D modernisation and operational improvements in order to bridge the technology gradients existing between the present operations and international level of operations. Technology evaluation studies in 65 sectors/areas have been commissioned through professional consultants in their respective fields.

The reports on Electric Lamps, Non-Ferrous Castings, Aluminium, Mini Steel, Fertilizers (Phosphatic and Nitrogenous), Boilers, Forged & Portable Tools, Paper & Pulp Machinery, Steel, Drug Formulations, Ferrous Castings and Steel Forgings, Plastic Processing, Ceramics, Caustic Soda, Fire Fighting Equipment/Systems, Pumps, Medical Electronics Equipment, Packaging, Industrial Furnaces, Flour & Rice Milling, HT Fasteners, Cement and Ferro Alloys Industry have been finalised and printed. The reports on Railway Wagons, Leather Tanneries, Bicycles, Rubber, Edible Oils, Paints, Secondary Steel Refining, Refractories industry, Glass, Waste Recycling, Home Appliances, Fertiliser Granulation, Decorative Laminates, Plastic Furniture, Plastic Tanks, Textile Processing, Sulphuric Acid, Industrial Alcohol, Soda Ash, Marble Granites, Fruit Juices, Secondary Aluminium sector, Industrial Oils and Fatty Acids are under finalisation taking into account the deliberations of the interaction meetings.

The studies which are under progress include those covering Spinning and Weaving Technology in Textile Sector, Dye stuff and intermediates, Paper Mills, Hosiery & Knitting, Bakery Industry, Industrial and Control valves, Garments, Galvanizing, Calcium Carbide, Soap and Detergents and Leather Products industry. The completed reports are now being sold through National Research Development Corporation, New Delhi.

4.2.2 Interaction Meetings

17 interaction meetings concerning Technology evaluation in Railway Wagon industry, Refractories, Rubber Processing, Secondary Steel Refining, Bicycles, Paints, Secondary Aluminium Sector, Industrial Alcohol, Edible Oils and Industrial Oils, Fertilizer Granulation, Plastic Furniture and Plastic Tanks, Marble and Granite, Soda Ash, Leather, Home Appliances and Microwave ovens, Decorative Laminates, and Glass industry were organised. The reports in these areas are under finalisation taking into account the deliberations of the Interaction meetings. The reports are being sold through National Research & Development Corporation, New Delhi.

4.2.3 Technology Demonstration Projects

a) M/s Electrical Research & Development Association (ERDA), Vadodara

The project of ERDA on Evaluation of parameters of Indian and foreign energy efficient motors was approved with partial support of Rs. 8 lakhs out of total project cost of Rs. 10 lakhs. The testing on various ranges of indigenous and imported motors

has been compiled and results are being analysed at ERDA and IIT, Delhi. The project is in the final stages of completion.

b) M/s Central Electronics Ltd., Sahibabad

The Technology Demonstration project related to development of 25 KW Solar Photovoltaic (SPV) Pilot power plant for Rural electrification was approved in March 1993 with partial support of Rs. 35 lakhs out of total project cost of Rs. 70 lakhs. The project is completed.

c) M/s M.S. Swaminathan Research Foundation, Madras

The project related to demonstration of Solar Photovoltaic Power system for specialised laboratories was approved in March 1993 with partial support of Rs. 15 lakhs out of total project cost of Rs. 34 lakhs. The project is completed.

5. PROGRAMME TO ASSIST TALENTED INDIAN ENGINEERS AND SCIENTISTS (TIES)

Eighty Preliminary Industry Profiles on selected products have been prepared under this programme. The profiles have been disseminated to various NRI Investment Promoting Organisations and Indian missions abroad. The reports are now being sold through National Research Development Corporation, New Delhi.

IV (B) PROMOTION AND SUPPORT TO INDIGENOUS DEVELOPMENT OF CAPITAL GOODS

1. AIMS

The major aims of the programme are:

- Promoting indigenous development of capital goods by providing technological inputs and catalytic financial support for such development.
- Promoting interaction between producers and users, of capital goods, to enable unpackaging of capital goods import packages.
- Providing information base on: demand, costs, prices, impact of taxes, duties and export potential, on capital goods to help in formulation of policies for further growth of capital goods industry.

2. FUNCTIONS

The programme includes functions such as the following:

- Providing partial financial support to the R&D projects of capital goods manufacturing industry aimed at development and technological upgradation of capital goods so far imported and capital goods which have export potential.
- Providing assistance to users of imported capital goods to develop design and engineering infrastructure.
- To support R&D in academic institutions with a view to provide: technical, analytical and testing expertise for design and engineering of capital goods.
- Carrying out studies in focused areas on demand and other aspects of capital goods.

3. ACTIVITIES

3.1 Studies

Studies of CG requirements of man-made fibre sector, mouldable polymer sector, metal forming industry and electronic industry are in the process of finalisation. Printed reports are likely to be available in 1994-95. Studies of CG requirements of food processing industry, dies & moulds and gas & naphtha cracker projects are also in the process of the finalisation.

Reports of the following studies on demand of capital goods by some more major sectors have been commissioned and draft reports are available. These draft reports have been evaluated by expert committees:

- Requirement of capital goods for biotechnology sector.
- Requirement of capital goods for secondary steel sector.
- Requirement of capital goods for readymade garments and hosiery sector.

The studies brought out that: demand of capital goods for these sectors till the year AD-2000; the present scenario of indigenous production and imports of capital goods for these sectors; capability of indigenous manufacturers producing C.G. for these sectors; constraints on indigenisation of imported capital goods; possibility of further indigenisation in years to come; and recommendation of measures to be taken for expediting indigenous development of capital goods, for these sectors.

3.2 Progress of Projects and Studies

Development projects in the area of packaging machines and electrical motors which were commissioned during 1991-92, and 1992-93 are in progress. Brief description of the projects are given below.

3.2.1 Development of Packaging Machines

Indian Institute of Packaging, Bombay was assigned a project, for the development of 3 nos.

packaging, viz., High speed flow wrap machine, Form-fill seal machine for odd shaped articles, and special blister packaging machine, with partial financial support of Rs. 14.50 lakhs from DSIR, and in financial collaboration with industry. High speed flow wrap machine will be comparable to imported machine and suit Indian conditions. It will produce the same quality of wrapping but will be cheaper than imported machine, making it economically viable for the Indian industry. The Form-fill seal (FFS) machine will be developed for odd shaped products like nails, screws etc. The special blister packaging machine will have a preprinted backing card of large size for display. Presently, the industry depends on imports. Source for such machines and competitiveness of certain export product groups suffers from disadvantage of non-availability of such machines. Indigenous development of special blister packaging machines would help not only to bridge the void, but also, will have export potential. The indigenous development of all three machines is likely to be completed in 18 months time.

3.2.2 Development of Switched Reluctance Motor

The development project related to indigenous development of 7.5 KW Switched Reluctance motor drive system for variable speed applications, from 0 to 3000 rpm, was entrusted to Electrical Research Development Association (ERDA), Vadodara, with partial support of Rs. 10 lakhs from DSIR. Balance amount of Rs. 13 lakhs will be met through the financial participation of industry. The demand of such a system is presently met by imports only. Development of prototype of the 7.5 KW SR motor, will facilitate development of such systems of other power ratings, from 0-50 KW. The project would result, not only in import substitution, but also in export promotion. The project is likely to be completed in three years.

3.2.3 Development of Machines for manufacture of Conical open top steel drums

Balmer Lawrie & Co. Ltd., Calcutta was assigned a development project for the indigenous development of a set of machines for manufacture of Conical Open Top Steel Drums. A partial financial support of Rs. 18 lakhs was sanctioned from DSIR against an estimated total development cost of Rs. 72 lakhs. The Conical open top steel drums have been recently introduced in the global market and are, so far, not produced within the country. These drums will be extremely useful for aseptic filling of liquid and semi-liquid food products. When returning empty for recycling after use, the Conical drums can be stacked one above the other, thus facilitating cost effective transportation as they occupy, roughly one eighth of the space, compared to the conventional cylindrical steel drums. The project is in progress.

3.2.4 Development of CNC Cutter & Tool Grinder

The development project of CNC cutter and tool grinder was assigned to Praga Tools Ltd., Secunderabad with a partial financial support of Rs. 15 lakhs from DSIR, as against a total development cost of Rs. 65 lakhs. The indigenous development of CNC cutter and tool grinder will reduce the need for import of such machines. The likely requirement is about 15 to 20 machines per year and the machine is likely to fetch a price of about Rs. 30-40 lakhs, thus giving an additional turnover of about Rs. 6 to 8 crores per annum to the firm. The project is in progress.

3.2.5 Development of Side Arm Charger for Wagon Tippling Complex

The development project of Side Arm Charger for Wagon Tippling Complex was assigned to Mining & Allied Machinery Corporation, Durgapur with a partial financial support of Rs. 15 lakhs from DSIR, as against a total development cost of Rs. 70 lakhs. The Side Arm Charger (SAC) would be suitable for pushing or pulling a rake of 24 Wagons of 100 tonnes gross weight each and locate the wagons one by one on the tippler platform. The project is in progress.

3.2.6 Development of Process Technology and a Capital Goods Package for Manufacture of Synthetic Rutile

Travancore Cochin Chemical Ltd. (TCC),

Cochin was assigned a development project, in collaboration with Regional Research Laboratory, Thiruvananthapuram, for the indigenous Development of process technology and a capital goods package for manufacture of synthetic rutile by environment friendly method. A partial financial support of Rs. 35 lakhs was sanctioned by DSIR against an estimated total development cost of Rs. 90 lakhs. The process to be developed is environment friendly with substantial economic benefits in the form of reduced corrosion of the plant and reduced acid consumption. The project is in progress.

3.2.7 CG Studies

Studies of CG requirement of Pharmaceutical industry, automobile ancillary industry and packaging industry are in progress.

Directory of refrigeration and air-conditioning equipment manufacturers prepared in collaboration with Confederation of Indian Industry is in final stages.

V. SCHEME TO ENHANCE THE EFFICACY OF TRANSFER OF TECHNOLOGY (SEETOT)

The "Scheme to Enhance the Efficacy of Transfer of Technology (SEETOT)" covers the following programmes:

A) National Register of Foreign Collaborations (NRFC)

B) Industrial Technology

C) Transfer and Trading in Technology (TATT).

D) Linkages with International Organisations including Asian and Pacific Centre for Transfer of Technology (APCTT)

E) Promotion and Support to Consultancy Services (PSCS) which also include the Consultancy Development Centre (CDC).

Activities and achievements in each of the above are presented here. Although, the Industrial Technology is not a part of the plan scheme, SEETOT, the information emanating out of the activities under Industrial Technology is substantially useful for SEETOT and hence these are covered here.

V (A). NATIONAL REGISTER OF FOREIGN COLLABORATIONS

1. PREAMBLE

The "National Register of Foreign Collaborations" (NRFC) which is an ongoing plan scheme, continued its operations during the year 1993-94. It has completed a number of programmes that were targeted for the year.

2. OBJECTIVES AND ACTIVITIES

To gainfully facilitate acquisition of technology needed in the country through following major activities:

- Compilation and analysis of data on foreign collaborations approved.
- Undertake financial, economic and legal analysis of set of data on foreign collaborations.
- Carry out technology status studies covering state-of-the-art technology in use in the country, international trends and other related issues.
- Provide assistance in the effective transfer of technology process.
- Provide the basis for a National Science Strategy wherever possible.
- In the long run lead to unpackaging of imported technology and in generation of national strength in competitively purchasing only selected components of technology.
- Coordinate with Ministries of Industry, Commerce, Finanace and others by providing technology data inputs.

Activities initiated, so far, under the NRFC scheme can be put into following broad categories.

- Compilation and study of basic data on foreign collaborations (FCs) approved.

- Analytical study of technological, economic and legal aspects of foreign collaborations (FCs).
- Preparation of reports on technology status in identified sectors/products.

3. FOREIGN COLLABORATIONS DATA COMPILATION

The work of in-house compilation of primary data on foreign collaborations approved, continued during the year. The compilation for the year 1992 was brought out. It contained information such as names of Indian companies, the names of foreign collaborators, products covered under the collaborations, durations, nature and amount of payments involved. The compilations for the year 1993 is in progress.

4. ANALYTICAL STUDIES

4.1 A project on "Transnational Transfer of Technology-Legal Aspects with Special Reference to Arbitration" was assigned to Indian Council of Arbitration (ICA), New Delhi. The draft report which has since been submitted deals with legal aspects involved in technology transfer agreements. It covers details regarding arbitration agencies under whom the arbitration may be carried out, venue of the arbitration, applicable laws, aspects which need to be kept in view to avoid disputes and other related matters. The report also gives a model structure of the licensing agreement. To give final shape to the report, an interaction meeting was organised by the department jointly with the Indian Council of Arbitration. It was attended by a large number of representatives from Industry, Govt. departments, experts from the legal profession and other concerned organisations. Based on the suggestions made during the interaction meeting, the report has been finalised.

4.2 A project on "Implications of Applicable Law in Relation to Foreign Collaboration Agreements" was commissioned on the Law Faculty, University of Delhi. This project aims at analysing implications of applicable laws of India, as well as USA, UK, and Germany (who are major suppliers of technology to India) to technology transfer agreements, in order to make the perspective Indian importers of technology aware of implications of these laws. The draft reports relating to Applicable laws were received and have been discussed in an *evaluation committee meeting wherein representatives* from the concerned Government departments, industry, experts from legal profession, consultants and others concerned participated. The revised reports of these country laws has since been received and sent for further comments, if any, of the evaluation committee members. The report is under finalisation.

4.3 A project on "Impact of foreign collaborations on Indian Industry" was entrusted to National Council of Applied Economic Research (NCAER), New Delhi. The study aims to analyse the impact of foreign collaborations approved during 1984 on production value, foreign exchange and R&D activities in Indian industry. The study is in progress.

4.4 A project on "Australian Technologies of Relevance to India" was assigned to Consultancy Development Centre (CDC), New Delhi. The study aims to provide a compendium on Australian technologies which would be of relevance to India. This would ultimately serve as an information base to Indian entrepreneurs regarding availability of certain technologies from Australia. The study has since been completed.

4.5 A project to study the "System of Intellectual Property and Transfer of Technology including its Global Challenges and Problems" have been taken up. This is a four phased project. Phase First deals with the appraisal of the Indian Patent System and the current problems. The study would undertake critical appraisal and would concentrate on policy, legal and practical aspects of Indian Patent Systems. The 2nd phase deals with the normative framework in national and global perspective. The study would concentrate on problems relating to operation of the patent system particularly of arresting the trend of low level of and decline in patenting and of providing impetus to the growth of inventive activities. The dimension of intellectual property law system in national and global context will aslo be analysed. The 3rd phase involves comparative studies and appraisals of policies and prac-

tices in the international context. The 4th phase deals with the normative framework, reality and global perspective. In this study, the current challenges and emerging problems will be analysed and an indepth examination of the problems would be undertaken in national and global perspective with a view to answer some questions of key importance as regards technology transfer. The project has been entrusted to the Indian Society of International Law, New Delhi. The work on first phase of the project is in progress.

4.6 A project on "Effectiveness of Import of Design & Drawings as a Mode of Transfer of Technology" has been commissioned to the National Productivity Council (NPC), Bangalore. The study aims to evaluate effectiveness of import of design and drawings as mode of transfer of technology in the areas of cost effectivenes, time effectiveness, production, quality, failure rates, merit, demerits, limitations, etc. The study is under finalisation.

4.7 A project to study trade related laws of France and Japan with special reference to technology transfer has been commissioned on the National Law School of India University, Bangalore. The study would include analysis and implications of the various laws in these two countries *vis-a-vis* Indian laws. Special emphasis would be on the laws relating to technology transfer agreements between the Indian, French and Japanese companies. The work on the project is in progress.

4.8 A project to study the market and development prospects of plastic processing industry in the Eastern and North-Eastern regions and Andaman & Nicobar Islands has been taken up. This has been entrusted to West Bengal Consultancy Organisation Ltd., Calcutta. The main objective of the study is to analyse the availabilty of plastic raw materials, performance of existing plastic processing units, demand estimates for different products, sources of availability of technology (local and foreign) export tie-ups, preparation of project profiles and other related issues. The study is likely to be useful for industrial and technological development particularly of the North-Eastern Region. The work on the project has commenced.

4.9 Preparation of backgroung material on "Key issues related to transfer of technology from abroad" was assigned to the Industrial & Technical Consultancy Organisation of Tamil Nadu Ltd. (ITCOT), Madras. The report aims to provide information relating to importance of technology transfer, forms and channels of transfer of technology, sources of technology, Government policies on technology transfer, contents of technology transfer agreements, some legal aspects involved in technology transfer including intellectual property rights and strategies for negotiation for technology transfer. Certain relevant case studies are also included. The report has been completed.

5. TECHNOLOGY STATUS STUDIES

5.1 One of the main objectives of the NRFC scheme, is to carry out technology status studies covering state-of-the-art of technology in use in the country, international trends and other related issues. The task of preparation of status reports is entrusted to experts/organisations/professionals/consultants in the respective fields. More than 100 reports have been finalised. These reports have been priced and are now being sold through NRDC.

5.2 During the year, reports on technology status of 20 sectors/products were discussed by their respective evaluation committees. These are:

1. Sorbitol & Vitamin 'C'
2. Welding Electrode
3. MEK
4. Industrial Robots
5. Norfloxacin
6. Biopesticide
7. Biofertilizer
8. Wire Drawing Machine
9. Acetic Acid
10. Air & Gas Compressor
11. Polyol
12. Formaldehyde
13. Toluene
14. Paracetamol

15. Phenol
16. Polybutadiene
17. Radiators for Automobile
18. Copper
19. Mechanical Seals
20. Energy Meters

These reports deal, at length, with important aspects relating to these sectors/products. These aspects include: current status of technology, efforts by the industry to absorb and adapt technology, current international trends, technology gaps etc. The reports identify technology gaps in Indian industry. Recommendations for action by industry, R&D institutions, Government and other concerned organisations to bridge these gaps have also been made. Reports on studies under NRFC are being used *inter-alia* as inputs to the Technology Absorption and Adaptation Scheme (TAAS) and Promotion and Support to Indigenous Development of Capital Goods Scheme, operated by the Department.

5.3 The following are the major findings of reports.

Butanol

The report brings out that technologies for butanol manufacture are:

(i) Oxo synthesis, propylene hydroformylation

(ii) Crotonaldehyde hydrogenation starting from acetaldehyde or ethanol and fermentation.

Oxo synthesis is the widely commercialised technology. It is in use in developed countries (even two plants in India) having substantial Petrochemical feed stock. While for Oxo process the technology suppliers are Shell (Netherlands), Dow Chemical (USA), Union Carbide (USA), BASF (Germany) and Devy Mckee (UK), for ethanol based process one of the major supplier is Bersou and Consulatores Associados, Saupaulo (Brazil). Ethanol based technology in general is no longer a trade secret and is available in India. None of the national laboratories are in a position to provide butanol technology.

V.A.1 A View of Butanol Plant

Technology for the Oxo-synthesis is totally imported including that of hydrocarbon/naptha steam reformers. The reformer design technology is not available indigenously. On the other hand technology for ethanol, acetaldehyde, crotonaldehyde and hydrogenations are available indigenously.

In view of low domestic production, there has been always some import of butanol in the past and is likely to continue unless the alcohol based butanol plants produce enough butanol to compensate for the short fall.

Phenol

The report brings out that important technologies for manufacture of phenol are:

V.A.2 A View of Phenol Plant

(i) Cumene oxidation process

(ii) Toluene-Benzoic Acid process

(iii) Sulphonation process

(iv) Chloro benzene process

(v) Resching Hooker process

Cumene-oxidation process is the only commercialised technology and more than 90% of world phenol is produced by this process. In this process, acetone is produced as a Co-product. Cumene is oxidized with air to cumene hydroperoxide. This is concentrated and then cleavaged to produce phenol and acetone. Products are separated by fractional distillation.

The technology for phenol is not available in India and two plants are manufacturing phenol on imported technology. Herdillia Chemicals imported technology from BP Chemicals (UK) and Hindustan Organic Chemicals Limited from UOP (USA).

The present production of phenol in India is 60,000 TPA, in 1994-95 it is expected to be 65,000 tonne and in 1999-2000, 105,000 tonne.

Zinc

The study brings out that zinc is the fourth most widely used industrial metal and is used as a protective coating on steel, in die-casting as an alloy with copper and as a chemical compound in rubber and paints. The major manufacturing processes of zinc are: Horizontal retorts, Electrolysis, Vertical retorts,Electrothermic and Blast furnace. Analysis of energy use pattern of zinc refining process shows that the electrolytic process consumes the least energy at 66.33 x 10^6 BTU per tonne of zinc produced, followed by vertical retort process at 71.72 x 10^6 BTU and Electrothermic process at 79.99 x 10^6 BTU.

The total primary zinc smelting installed capacity is 169,000 TPA. The production in India has been increasing from 28,000 tonne in 1976 to 74,000 tonne n 1990-91. With the commissioning of Chanderia smelter the zinc production will go up to 1,52,000 tonne per annum. The industry has reached a fairly good level in technology absorption and the future thrust should be on technology upgradation. The most promising emerging technologies to be adopted would be pressure leaching, solvent extraction, electro-winding, bacterial leaching and others.

TDI/MDI

The study brings out that Toluene disocyanate (TDI) and Diphenyl methane disocyanate (MDI) are most important raw materials for the manufacture of polyurethanes. The present consumption of TDI and MDI is about 12,000 tonne per annum in India.

Commercially TDI and MDI are manufactured by phosgenation of toluene diamine and aniline polyamine respectively. On the international scene efforts are being made to manufacture TDI and MDI by the non-phosgenation route. World-wide, the production is basically controlled by seven large manufacturers: BASF, Bayer, Dow, ICI, Olin, Mitsui and Rhone Poulenc and total world production capacity stands over 2.5 million tonne per annum. These isocyanates are not being produced indigenously although LOIs have been issued to HOC (TDI), GNFC (TDI) Tirumalai (TDI), ICI (MDI) and MPL (TDI and MDI). HOC and MPL have finalised technical collaboration with AB Chematur (Du Pont) and Mitsui. Both proposed technologies are stated to have the required essential safety measures like snuffing systems, magnetic clutch pumps, simultaneous utilization of phosgene etc. Efforts have to be intensified for the indigenous production of these isocyanates.

Heavy Commercial Vehicle

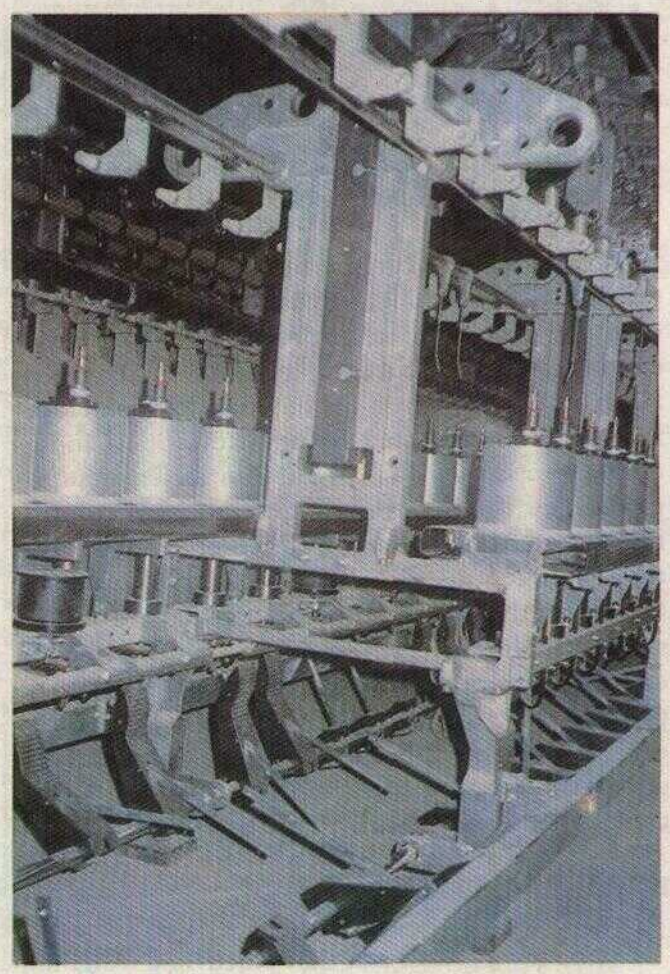
The study highlights that industry has fully absorbed the imported technology and manufacturers brought out new models based on their own research and development. The report further brings out that the fuel consumption per bhp hour

is around 200 gms for Indian vehicles campared to around 150 gms achieved in developed countries for similar models. Efforts are being made by the manufacturers to achieve higher fuel efficiencies. The report emphasizes that further developments are required by the manufacturers in the area of better power weight ratio for engines, improved fuel efficiency, better control of pollution level, use of electronic and latest materials such as ceramic, ceramic coating, composite materials and use of aluminium alloy for weight reduction to achieve the international level.

Servo, Micro, Stepper, Instrument and Control Engineering motor below 1 H.P capacity

The study suggests that by and large the industry is self-sufficient in larger motor for non-electrical applications. Technology for manufacture of DC micromotor used for audio equipment has been fully absorbed. Smaller motors (down to 10 mm dia), flat motors, higher torque motor etc. have not yet been developed. In case of stepper motor, AC single phase, synchronous and servo motors technology has been absorbed by small scale units to make certain type of motor by using reverse engineering. The report further brings out that the design capacity which exists with manufacturers is limited to modification of basic designs available with them. It is suggested that to improve the quality of small motors required for electronic industry, magnets of improved strength, Iron of high permeability and special self-lubricating bearing are required. Development efforts should be aimed at improvement in material and component design.

V.A.3 Heavy Commercial Vehicle



V.A.4 Two for one Twister

Two-for-One Twister

The study concludes that the range of two for one twister manufactured in India is wide enough to meet the various requirement of both spun and filament yarn. The report further brings out that technology absorption efforts made by most of the manufacturers has lead to indigenisation of most of the components. Technology gap exists in areas of mechanical speed of spindle which is 15% lower than those offered by foreign manufacturers and in the range of spindle diameters required to twist different yarns/counts at optimum energy consumption levels and speeds. Another area where technology gaps exist are in respect to operational aids and automation e.g. pneumatic threading unit, package conveyer belts, bobbin conveyer belts, package transfer robots, process data collection system. The report suggests areas for research and

development as low cost high precision, energy efficient spindle, spindle driving belts, ceramic guides and certain bearings etc.

Dump and Tipping Trucks, Loader, Excavator/ Loader, Dozers, Scrappers

The report brings out that most of the earthmoving machinery manufacturers have one or more than one collaborations with overseas manufacturers. All the companies have adequately absorbed and adopted the technology to suit local raw material and successfully developed indigenous substitutes for original imported components. The thrust is on indigenisation of components and import substitution rather than at developing indigenous technology. The report further brings out that technology gaps exist in the area of self hardening steel required for dumper bodies, energy consumption of engines, transmission, high pressure filters and seals for hydraulic cylinders, etc. The report suggests thrust areas for research and development as multifuel engines, hydrostatic transmission and tipping units, etc.

Electronic Weighing Equipment

The study brings out that electronic weighing equipment industry is dependent on imported technology. Various types of electronic weighing systems vis-a-vis in-motion weighing, conveyor belt weighing, weigh bridges, weigh feeders, batching control systems are being made in India. Most of the major units specialise in one or other type of weighing systems. The report further brings out that technology gap exists in the area of load cell, component manufacturing base and weighing system designs and software. The thrust in technology internationally is towards increasing accuracy level, improvement in load cell design/reducing number of components or utilised structure, deployment of electronic wieghing system for high speed weighing operations.

V.A.5 Wheel Loader

Uninterrupted Power Supply (UPS) Systems

The UPS system is a power conditioning equipment that takes care of mains supply problems like brown outs, voltage sags, voltage surges, impulses, noise and harmonic distortion and also allows for a smooth change over to mains operation on resumption of power. The main application areas include mini and micro computers, computer peripherals,electronic cash registers, electronic medical equipment and frequency sources. It thus finds application in railways, telecom, textile and glass industries too. Currently in India, the computer application is the maximum, catered to by around five large manufacturers. Although the export potential is large, lack of certain sophisticated features and the high cost have hindered exploitation of the world market. Almost all the large scale units have entered into a foreign collaboration but the smaller ones have relied on indigenous technology. In the international scenario, Application Specific Integrated Circuits (ASICs), Insulated Gate Bipolar Transistors (IGBTs), etc are widely used. The circuitry is so designed such that the overload current is very high. Also alternatives for battery based systems are now being developed wherein energy is stored in the machine's rotating mass and the motor generator rides through even when momentary power interruptions occur, without disturbing the load. The report brings out that the component base in the country is inadequate and the industry is therefore heavily dependent on imports for critical electronic components.

Inverters and AC Drives

Variable speed AC drive systems have several advantages and they consequently find application in a wide range of industries. In the Indian context,

although development is yet to catch up with the international scenario, a significant beginning has been made as an indigenous production base in respect of AC Drives of the PWM variety has been created. It is also envisaged that Gate Turn Off (GTO) devices, micro processors and advanced control techniques will be used extensively in the near future. The production of power electronics equipment and inverters & AC drives has registered a very large increase in the last few years but export figures have not been significant. The major sectors constituting demand of over Rs. 5000 million of such equipment during the VIII plan period are railways, steel, petrochemicals, fertilisers and the power sector. The profile of manufacturers in the country is diverse, consisting of the organised sector including foreign equity holding companies and the small scale sector where the last mentioned are predominantly involved only in manufacture of low power motors and related drive circuits, whereas the rest cater to design of drive systems, manufacture and supply of large motors as well as installation and commissioning. Internationally only a few countries like, USA, Japan, UK, Germany, France and Switzerland are predominant in the manufacture of inverters and AC drives. A large amount of R&D work is being carried out in the country at the Government research institutions, public and private sector companies. They related to the development of chopper drive systems, control systems for locomotives, AC motor drives for transportation, phase converters, applications in mining locomotives, converters for auxillary motors, etc. The report brings out that the major technology gaps related to development of large power drives for use in refineries, apart from AC winders, slip recovery systems, etc.

Shuttleless Looms

Manufacture of shuttleless looms has commenced in India fairly recently and currently there are three manufacturers. The major advantages are that they reduce the cost of production by almost 10% and the quality of cloth obtained is far superior. Shuttleless looms are generally of wider widths for simultaneous weaving of two or more widths varying from 400 to 420 cms in the case of air jet and rapair machines and upto 540 cms in the case of grippers. The weft insertion rates achieved are 1100, 1300, 1850 and 2050 mts/mt depending upon whether it is a gripper, rapier, air jet or water jet weaving machine. Sophisticated microprocessor controls are built into the machines to match the requirements of high insertion rates, shedding and beating operations as well as for let-off, take-up mechanism and weft monitoring. Projectile weaving machines offered in countries abroad are far more sophisticated with features like 540 cms width, insertion rates of 1100 mts/mt, 4 colour pick sequences, automatic pick finding, electronically controlled warp let-off, weft accumulator and feeder, electronically controlled lubrications systems as well as a choice of tuck-in, leno or fused selvedges. There are about 16 well-known manufacturers abroad, mainly from Japan and Europe. The R&D efforts of indigenous manufacturers have been directed towards development of machines with comparable quality standards as those of their collaborators. Development of prototype parts as well as application development have also been attempted. The lack of a research institute working consistently on R&D related to such machines has been acutely felt. It has been brought out in the report that textile machine design education facilities need to be strengthened in the country.

Seamless Steel Tubes

The major applications of seamless steel tubes are in the oil sector apart from bearings, boilers, superheaters, heat exchangers, gas cylinders as well as for various applications in the automobile sector and in structural engineering. At present seamless steel tubes in carbon and alloy steels are manufactured by three units. All the existing projects have sourced a major part of the equipment and technology from abroad, mainly from M/s Mannesmann of Germany. The techonology imported has been fairly well assimilated. The majority of such pipes are produced either by piercing and rolling or by extrusion. The current estimated annual demand of seamless steel tubes is 267,500 tonnes. Internationally, there are more than 150 manufacturers with a large concentration in USA, Germany, Italy and Russia among which USA is the largest manufacturer as well as consumer of seamless tubes and there again the bulk of the produc-

tion is consumed by the oil industry. There, the tendency to establish large integrated tube mills is now giving way to the setting up of small tube mills concentrating on restricted product mixes. Non availability of major indigenous equipment, high cost of inputs like power and steel and low volumes of production are the major constraints faced by the industry. The report brings out that there is scope for establishing a new project for manufacture of tubes in the diameter range greater than 2.5 mm. It also indicates that costs could be reduced by usage of concast billets as input feed stock in order to improve process yield. Extrusion process for steel, and technologies related to glass lubrication and die design need be developed in the country.

Printed Circuit Boards (PCBs)

Printed Circuit Boards are used in almost all types of electronic products and in complex equipment the cost of the PCB may be as high as 5 to 8% of the total equipment cost. There are a number of units both in the large and small scale sectors involved in manufacture of single sided, double sided and multi layer PCBs. For certain applications, multi layer PCBs of six or more layers are still being imported. The quality of the indigenously manufactured PCBs is close to international standards in some cases. Capacity utilisations has been very poor and although export opportunities exist, they have not been fully exploited. Over the world, with the increasing trends towards miniaturisation, a combination of subtractive and additive processes are used to obtain best results in respect of PCB fabrication. The report brings out that there is no major research activity undertaken in the research institutes in the country except for some facilities at the Indian Institute of Science, Bangalore. The principal gap in technology is in terms of the latest processes which are required for a high density board with fine line geometries. The impact of this gap would be more important as there is likely to be an increased demand for surface mounted technology (SMT) circuits in the near future. The technology gap in relation to materials and chemicals is rapidly diminishing but the principal problem faced by the industry is the non-availability of laminates, dry film resists, solder masks of international quality. Waste disposal of effluents like copper, cynamides, fluorides, halides etc. would also require special consideration.

Norfloxacin

Norfloxacin is one of the new 4-quinolone anti-bacterial agents introduced recently in the world market. Four more quinolone anti-bacterial agents have been subsequently introduced out of which ciprofloxacin is the most popular. The dominance of these quinolone drugs has grown very rapidly and the world market is likely to reach US $ 2500 million by 1995 which is 10% of the total anti-bacterial market. The popularity of norfloxacin stems from its wide in-vitro anti-bacterial spectrum and its great potency. The three major Indian manufacturers have developed the process for norfloxacin indigenously and are capable of competing in the world market. There are also some manufacturers in the small scale sector. The R&D efforts of the major manufacturers are commendable. The report brings out that the manufacturers should be cautioned that further expansions in relation to the quinolone compounds must be taken only after a careful analysis of their future potential. Export of the bulk drugs and formulations should also be attempted. The report stresses that the manufacturers will have to prioritize development of their own range of anti-bacterial agents, improve the efficiency of their processes and also expend greater efforts in import substitution programmes.

Industrial Robots

Robotics is a combination of many engineering disciplines like mechanical, electrical, pneumatic, hydraulic, electronic and computer fused together to create a functional robot. While they were earlier controlled by electrical analogue devices, today they are primarily programmed for conditional operation through microprocessors. The industrial robot industry is still at a nascent stage in India. Major developments in the country are restricted to R&D institutions apart from large automotive and electrical manufacturing companies for their captive consumption. Most of the critical components and system are being imported. Availability

of trained system engineering manpower as well as the initiative of the industry would help growth of industrial robots in the country. The world over, this technology is spear-headed by large multinational research organisations mainly in Japan, USA and Europe. Internationally, the major applications are arc welding, spot welding, metal cutting, assembling, etc. The report brings out that the important thrust areas that need be tackled include specificaitons of sub-assemblies, technology of local electrical and electronic components, systems design and application engineering capabilities, trained personnel, testing facilities, knowledge of FMS, CIM, etc. Establishing certification and promotional centers, creation of a dedicated educational institute, initiation of standardisation processes, etc; are other areas that need to be focused upon.

Sorbitol & Vitamin C

The world demand for Vitamin C had been increasing each year ever since it was first isolated in its pure form, at first very rapidly and now at a slower pace, and is presently of the order of 70,000 tpa. It is used in various pharmaceutical formulations, food, agricultural applications and some industrial applications. There are two manufacturers in the country catering to a demand of 1100 tpa. Their efficiency is in the range of 45% while the world standard is 51% but their utility consumption figures are on the higher side. In fact, the leading world manufacturers have been able to achieve efficiency of the order of 60%. Sorbitol, which is the main intermediate used in the manufacture of Vitamin C, has other applications in the manufacture of food and liquid pharmaceuticals, cosmetics, resins and explosives. Sorbitol is fermented to sorbose which is acetonised to diacetone sorbose which is oxidised to diacetone 2 keto L gulonic acid which is further lactonised and enolised to form Vitamin C. The latest developments in the world relate to the manufacture of Vitamin C by the action of hydrochloric acid on 2 keto L gulonic acid, purification of 2 keto L gulonic acid, etc. The latest route is the biochemical route. Sepcific areas wherein technology gaps exist are with reference to fermentations, acetonation, lactonisation, enolisation. The report brings out that long term measures need be initiated in areas like developing the process for recovery and reuse of the catalyst in the oxidation step, electrochemical oxidation to diacetone keto gulonic, air oxidation of diacetone sorbose and biochemical process to generate 2 keto L gulonic acid.

6. FINAL REPORTS

The following technology status reports have been printed/are under printing:

1. Two for one Twister
2. Dump Truck
3. TDI/MDI
4. PCB
5. Servomotor
6. Electronic Weighing Equipment
7. Invertor and AC Drive
8. Microwave Oven
9. Electronic Watch and Clock
10. Industrial Robots
11. Zinc
12. Butanol
13. UPS
14. Phenol
15. BOPP and Polyester Films
16. HCV
17. Seamless Steel Tube
18. Shuttleless Loom
19. Norfloxacin
20. Dimethyl formamide

7. INTERACTION MEETINGS

7.1 During the year 1993-94 interaction meetings with manufacturers, users, Government Departments, R&D Organisations Technical Institutes, Industry associations were organised to finalise the following technology status reports:

(i) Springs, - May 3, 1993

(ii) Microwave Oven, - September 24, 1993

(iii) Shock Absorber - December 12, 1993

(iv) Welding Electrode - December 15, 1993 at Baroda in association with GITCO, Ahmedabad

(v) Welding Equipment - December 15, 1993 at Baroda in association with GITCO, Ahmedabad

7.2 A one-day interaction meet on transfer of technology from abroad was organised at Calcutta on September 29, 1993 in association with the Confederation of Indian Industry (Eastern Region) and at Madras on 4th March 1994 in association with Central Leather Research Institute, Madras and Industrial & Technical Consultancy Organisation Madras. The main objective was to provide inputs to assist industrial units in enhancing the effectiveness of Technology transfer from abroad. It was attended by senior executive from a large number of Organisations.

V (B) INDUSTRIAL TECHNOLOGY

1. INTRODUCTION

The industrial technology group deals with the proposals received from Secretariat for Industrial approvals (SIA) for grant of Letter of Intent, foreign collaboration from India entrepreneurs, foreign entrepreneurs/organisations, from NRIs and those willing to set up 100% export oriented project.

The broad activities of the group are (i) receiving and examing proposals for grant of LOI, FC and import of CG, including those for 100% EOU and from NRIs (ii) participating in meetings for technical evaluation and Approval Committees/Boards such as Technical Evaluation Committee and Project Approval Board.

2. INDUSTRIAL LICENSING

About 660 proposals for grant of Letter of Intent were received during the year. The number of proposals have remained almost same as in the last year.

The group attended 48 meetings of Licensing Committee held by SIA. The following is an illustrative list of products approved for grant of Letter of Intent based on indigenous development of technology.

1. Ciprofloxacin Hydrochloride
2. Hepatitis B-Vaccine
3. Alpha Interferon
4. Nitrendipine
5. Glibenclamide

3. FOREIGN COLLABORATIONS

During the year the number of foreign collaboration and composite proposals received by the department dropped from 550 in the previous year to about 150, excluding such proposals involving foreign investment were considered by the Foreign Investment Promotion Board. The proposals involved technology transfer / or foreign participation.

V.B.1 Drag Chain Links for Cinker Conveyer

During the year the Department participated in the Technical Evaluation Committee meetings for consideration of the above proposals and to send recommendations to Foreign Investment Promotion Board, Project Approval Board and Board of Approvals for 100% EO Undertakings.

The Department also participated in the following meetings of the Approvals Boards/Committees:

	No. of Meetings
Technical Evaluation Committee	51
Project Approval Board (PAB)	19
Board Approvals for 100% EOU	16

4. INFORMATION/DATA PROCESSING

The Department has already created a database for Proposals for Letter of Intent, Foreign

Collaboration Proposals, Composite applications for the last four years. The Foreign Collaboration approvals data have been compiled since 1981.

These databases for proposals were updated for the year 1993. For the approvals the database was updated for the year 1992.

The Department has also developed software for updating, preparing summary, processing and quick retrieval of the desired information. The software has been prepared for above mentioned proposals as well as approvals. These database are continuously updated with the help of the above software.

V (C) TRANSFER AND TRADING IN TECHNOLOGY (TATT)

1. OBJECTIVES

The TATT scheme aims to promote and support activities directed towards the export of technologies, projects and services. The measures adopted are:

- Support to preparation of technology profiles of developing countries;
- Support to preparation of reports related to technology export capabilities and expericnces in select industrial sectors;
- Publicity and dissemination of Indian capabilities through workshops, trade fairs, delegations and video films;
- Study and analysis of Indian Joint Ventures abroad;
- Supporting live demonstration of exportable Indian technologies overseas as well as within India;
- Supporting activities leading to upgradation of technologies identified for export;
- Assistance for export of technology based services, such as: setting up R&D institutions, R&D collaborations, operation and maintenance of plants.

2. ACTIVITIES

The TATT scheme became operational during the year 1986-87 through the cell set up for this purpose and also by way of initiating and completing a large number of programmes and projects aimed towards its objectives. Eleven meetings of the Technical Advisory Committee on TATT were held during 7th Five Year Plan. Three meetings were held during the period April 1990 to March 1992. Since reorganisation of the schemes, when TATT scheme became a part of SEETOT programme, the Technical Advisory Committee was reconstituted and two meetings have taken place so far during the eighth plan. The thrust of the projects during the 1985-1992 has been towards documenting our technological expertise and capabilities, preparation of technology profiles of select developing countries, and to help the Indian exporters in enhancing their technology export efforts through seminars/workshops, and video films. The focus during the eighth plan shall be on commercialisation of exportable Indian technologies through setting up demonstration plants. Details of some of the projects/activities completed or in progress during the year under report are given below:

2.1 Technology Profile of Developing Countries

These reports highlight the country's economic structure, natural resources, government plans and policies, industrial growth pattern and infrastructure and technology development. The reports are disseminated to select export promotion organisations, R&D institutions and key industrial organisations so as to present to them, the potential areas for promoting India's exports. Additionally, the reports are available on sale (through National Research Development Corporation) for the benefit of industry at large. Some of the completed/ongoing projects during the year under report are described as under:

(i) Technology profile of Egypt:

A study on the subject was assigned to "India Trade Promotion Organisation (ITPO)" and the draft report was discussed in an evaluation committee meeting, wherein suggestions for improvement of the report were offered. Sectors identified for technology transfer from India are: agriculture and related machinery, food processing, fisheries, textile and engineering industries. Potential product groups in the engineering industries are: auto components, electrical & electronics products, chemical products, drugs & pharmaceuticals and small scale industry.

(ii) Technology profile of Zaire:

A study on the subject was assigned to

"M/s Dalal Consultants and Engineers Pvt. Ltd." and the draft report was discussed in an evaluation committee meeting, wherein suggestions for improvement of the report were offered. Sectors identified for technology transfer from India are: agro industries such as vegetable oil processing, preservation of fruits vegetables and fish/meat, processing of mangoes and tomatoes etc., leather such as tanneries, garments and shoes; bagasse based pulp and paper plants; pharmaceuticals such as Paracetamol, Chloroquin etc., plastic processing such as injection moulded plastic articles, plastic bags etc., consultancy services for rehabilitation of railways, construction of low cost highways, health services, telecommunications, water resource development etc., and small scale industry in product areas such as hand tools, animal glue, paper envelopes, domestic utensils, hack saws etc.

(iii) Technology profile of Singapore:

A study on the subject was assigned to "M/s Dalal Consultants and Engineers Pvt. Ltd." and the draft report was discussed in an evaluation committee meeting, wherein suggestions for improvement of the report were offered. Sectors identified for technology transfer from India are: herbal/ Ayurvedic medicines, jewellery, speciality Indian foods, paints, defence equipment, nuclear power plants, design of satellites, applications involving radio isotopes and services such as landscape planning, interior decoration, and computerisation.

2.2 Technology Export Capability in Select Industrial Sectors:

These reports are primarily aimed towards assessing and projecting our technological activities and experiences in a particular industrial sector. These are disseminated to the concerned organisations including Ministries/Departments, and Indian/Foreign missions. Additionally, the reports are available on sale (through National Research Development Corporation) for the benefit of industry at large. Some of the completed/ongoing projects during the year under report are described as under:

(i) Technology export potential of Computer Software Industry

A report on the above subject was got prepared through Tata Consultancy Services (TCS). The report is based on a survey of 82 software companies. According to the report, the domestic computer software industry has grown from Rs. 70 crores in 1985-86 to Rs. 490 crores in 1992-93. Exports touched a figure of Rs. 675 crores (US $ 225 million) in 1992-93. Indian software companies mainly provide three kinds of services i.e. (a) software development at site & training, (b) development of packages and (c) other services such as data processing & information service networks. A number of Software Technology Parks (STPs) have been set up to facilitate hardware facilities at nodal point, datacom links and accreditation of quality standards. The report projects that the estimated ratio of hardware to software in 1995 (worldwide) will be 40:60 implying a software spending of US $ 300 billion out of a total Information Technology spending of US$493 billion.

(ii) Technology export potential of Agro based Industry

A report on the above subject was got prepared through U.P. Industrial Consultants Ltd. (UPICO). The scope of the report covers industries that processes agricultural raw materials, marine livestocks and its products. According to the report, plant and machinery for a number of agro based processes can be made available from India. A few technologies which can be transferred are: dehydration and canning of fruits & vegetables, frozen foods, mango processing, pasteurised fruit juice plant, potato chips, tomato paste, baby milk powder plant, coffee processing, bread & biscuit making plant, flour & rice milling plants, solvent extraction of soyabean oil etc.

(iii) Technology export potential of Two Wheeler Industry

A report on the above subject was got prepared through M/s M.M. Suri & Associates Pvt. Ltd. The report covers Scooters, Motorcycles and Mopeds. According to the report, India manufactures two

wheelers in a wide range of capacities ranging from 35cc to 350cc. Vehicles employ two stroke as well as four stroke technologies and usually are based on 6V or 12V electrical system. The fuel consumption levels range from 40 to 108 Km. per litre of petrol. Leading Indian two wheeler manufacturer, M/s Bajaj Auto Ltd. currently enjoys the distinction of being the second largest scooter manufacturer in the world, behind M/s Honda of Japan. Average percentage share of Scooters, Motorcycles and Mopeds in the total Indian production of two wheelers is 48%, 25% and 27% respectively. Estimated value of exports of two wheelers from India was Rs. 25.72 crores (US $ 7.97 million) during 1990-91. As regards technology transfer, assembly units for manufacturing 3600 mopeds have been set up by Indian manufacturers in Mauritius and Egypt and CKD packs for assembly of three wheelers have been supplied to Bangladesh.

2.3 Live Demonstration of Exportable Indian Technologies

Under this activity, technical as well as partial financial support is extended to those industrial organisations which have developed technologies having potential for commercialisation abroad. Some of the ongoing projects during the year under report are described as under:

(i) Pilot plant demonstration of Re-refining of used lubricating oil by the non acid process.

The pilot plant for re-refining of used lubricating oil based on non-acid process is set up by M/s Balmer Lawrie & Co. in Calcutta. The department provided partial financial support for the project. Trials have been conducted on the used oil obtained from Dubai and oil collected from a number of Maruti service stations in the country. The final product conforms to the Indian standard for re-refined based oil (IS 9048:1979). Samples of used oils from other sources are being procured to establish the versatility of the process. A detailed analysis of the sludge (left over after treatment) has been done and its conversion into a viable by-product is being explored.

V.C.1 Distillation Tank in M/s Balmer Lawrie Pilot Plant

(ii) Global commercialisation and technology demonstration of Cell Type Air Washer (CTAW) system for humidification of textile mills.

The project was commissioned, jointly to Ahmedabad Textile Industry's Research Associa-

V.C.2 Computer Aided Generation of Textile Design

tion (ATIRA) and National Research Development Corporation (NRDC) at a total cost of Rs. 30 lakhs. The project consists of the following elements: (a) Fabrication and commissioning of CTAW system in a textile mill abroad; (b) Preparation of promotional material, viz., video film and brochure on the CTAW; (c) Organisation of seminar in India to publicise the advantages of CTAW system of humidification; (d) Inviting foreign technical missions (the potential importers of CTAW system) for participation in seminar and taking them around Indian mills deploying CTAW system; and (e) Filing patents in India and abroad. A monitoring committee meeting to review the progress of project was held. An Indian patent for the process has been already registered. Besides, patent applications in a number of foreign countries have been filed. Discussions with prospective textile mills in Tanzania and Kenya are in advanced stage for installation of the CTAW system for demonstration purposes. A leading organisation has been assigned the task of preparation of a video film on CTAW (to publicise and market the process). The seminar is scheduled to take place during mid-1994.

(iii) Commercialisation of Iono-Oxidation technique for effluent treatment.

The project was commissioned, jointly to ATIRA and NRDC at a total cost of Rs. 45 lakhs. The project consists of the following elements: (a) Filing patents in India & abroad; (b) Fabrication and commissioning of a 30 Kilolitre per hour capacity effluent treatment plant based on the Iono-Oxidation technique; (c) Fabrication and erection of a mobile demonstration unit of an Iono-Oxidation effluent treatment plant of 3-5 Kilolitre per hour capacity. A monitoring committee meeting was held to review the progress of the project. An agreement has been signed between ATIRA, NRDC and a mill in Bombay where the demonstration unit of 30 KL per hour capacity is being set up. An Indian patent for the process has already registered. Besides, patent applications in a number of countries have been filed. The mobile demonstration unit shall be mounted on a suitable light commercial vehicle. This would be utilised for demonstrating, treatment of effluents of various compositions.

(iv) Export promotion of technologies/ products developed by ATIRA.

The project was jointly commissioned to ATIRA & NRDC for marketing of technologies/products developed by ATIRA, at a total cost of Rs. 1.96 lakhs. The marketing mission would be conducted in the South-East Asian countries as well as the African countries. The 16 items included are : Cationic starch, 3 - Chloro - 2 Hydroxypropyl Trimethylammonium Chloride, Glycidyl Trimethylammonium Chloride, Sodium Carboxymethyl starch. Hydroxyethyl starch, Catalysts LCP, Synthetic thickner and Stanfree-L in the Chemical sector; Yarn Evenness tester, Electronic slub catcher, Digital splice strength tester, Computer aided textile design packages and Stenter production analyser in the Electronic Instrumentation sector; Nilometer in the area of Process Control; Cell Type Air Washer in the Energy Conservation area; Iono-Oxidation technique in the Pollution Control areas.

2.4 Interaction Meetings

An interaction meeting was organised in collaboration with the "Oil Technologist's Association of India (Eastern Zone)" on September 11, 1993 in Calcutta to discuss and finalise the draft report. "Technology Export Potential of Solvent Extraction Industry". The meeting was attended by around 100 delegates from the industry.

3. LIST OF REPORTS PRINTED UNDER TATT

(i) Technology profile of Thailand
(ii) Technology profile of Nepal
(iii) Technology profile of Indonesia
(iv) Technology profile of Malaysia
(v) Technology profile of Botswana
(vi) Export of technology for medicinal plants and their derivatives
(vii) Technology export potential of Dairy Industry
(viii) Technology export potential of Electrical Industry
(ix) Technology export potential of Rice milling and By-products Industry

V (D) LINKAGES WITH INTERNATIONAL ORGANISATIONS

During the year, the Department continued to participate in the activities of various international organisations such as UNCTAD, WIPO, UNIDO, ESCAP and APCTT at various levels and forums on issues related to Technology Development and Technology Transfer in coordination with other concerned Ministries.

APCTT AND ESCAP

The matters pertaining to the Asian and Pacific Centre of Technology (APCTT) under ESCAP, were dealt with in cooperation with Ministry of Commerce. The Department of Scientific & Industrial Research continued to play the role of a focal point for the APCTT. DSIR helped in preparing a brief covering technological issues for the use of Indian delegation to the 49th Annual Session of ESCAP held in Bangkok during April, 1993.

The host country agreement on the headquarters of APCTT was finalised in a meeting taken on June 18-19, 1993 in the Department. A representative of United Nations New York, Chief of Administration, ESCAP, Bangkok and representatives of DSIR, Ministry of Commerce, External Affairs, and Director APCTT, participated in the meeting.

The construction of the APCTT building was taken up by CPWD in April, 1991 after taking clearance from the various related authorities in Delhi. The building was completed in July, 1993 and the centre shifted its activities from Bangalore to New Delhi. The permanent Headquarters building for APCTT was formally inaugurated by Shri Pranab Mukherjee, Minister for Commerce and Deputy Chairman of the Planning Commission on 18th November, 1993. Shri Ashok Parthasarathi, Additional Secretary, DSIR participated in the Ninth Technical Advisory Committee meeting of APCTT and was elected Chairman of the Committee. The Technical Advisory Committee meeting was held in New Delhi on 16-17 November 1993. The 8th session of the Governing Board of APCTT was held in New Delhi on 18-19 November 1993 and was attended by participants from Bangladesh, China, India, Indonesia, Japan, Kyrgyzstan, Nepal, Pakistan, Republic of Korea, Russian Federation, Thailand, Vietnam and by observers from Afghanistan, France, Malaysia, Macau and United Kingdom.

V (E) PROMOTION AND SUPPORT TO CONSULTANCY SERVICES

Promotion and support to Consultancy Services is one of the initiatives in the Seventh Five Year Plan.

1. OBJECTIVES

The objectives of the Scheme are:

- Providing incentives to Consulting Engineering Firms to document their useful experience in major projects, particularly abroad and upgrade their capabilities.
- Support to Consultancy Development Centre and other promotional organisations related to consultancy.
- Empanelling Eminent Engineering Professionals on retainer basis for consultancy.
- Human Resource Development including fellowships to bright and promising engineers as apprentice with eminent consultancy organisations, arrange training etc.
- Support R&D efforts of consultancy organisations and commercialisation of indigenous technology.
- Organise Seminars, Workshops, etc.
- Create awareness among users of consultancy.

2. ACTIVITIES

The activities under the scheme were reviewed in December, 1992 in the light of the new policy environment. It was decided that the emphasis should be now on support for consultancy for development and commercialization of indigenous technologies, besides continuing the ongoing activities. Some of the programmes/activities carried out during the year till October, 1993, are briefly indicated below.

(a) Documentation of Consultancy Capabilities and Experiences

With a view to assess the status of consultancy capabilities in important sectors of economy as well as in each of the States in the country, studies have been commissioned through experts/consultancy organisations and reports are prepared after detailed interactions and discussions with the concerned agencies. These reports include profiles of consultants, facilities and infrastructure available and recommendations for strengthening consultancy capabilities in the concerned sector or the State. Two studies relating to consultancy capabilities in Fertilizer Industry, and Civil Engineering and Construction Management Services were completed and final reports were under print. Another two studies relating to Consultancy Capabilities in the States of Orissa and West Bengal were complete and the final reports were under print.

(i) Consultancy Capabilities in Fertilizer Industry

The study concentrated on the major groups of fertilizers i.e. nitrogenous and phosphatic. Apart from industrial scenario, it covered consultants in main process plant, foreign consultants serving in India, off-site utility plant consultancy firms, fertilizer industry and R&D institutions providing services to fertilizer industry. According to the study, there are over 60 major consultants and 19 R&D/Academic institutions.

The study has brought out that Indian consultancy firms have a strong base in detailed engineering of main fertilizer plants, project construction services, commissioning assistance and catalyst manufacture besides pre-investment studies. Their services are reported to be comparable to that of their counter-parts elsewhere. However, know-how gap is reported in production of low energy ammonia, urea, phosphoric acid, ammonium phosphate and nitro-phosphate technologies and environmental pollution control technology especially in bio-technology. It is also revealed that ample opportunities are available to Indian consultants in rendering services such as revamping of old plants, integration of steam power system

with total energy concept, export of consultancy, pollution control and catalyst development and manufacture. It is noted that the India is one of the largest producers of fertilizers in the world and has imported technologies from several sources supplied by consultants abroad. At the same time *Indian consultants have not been able to develop* adequate technological capabilities though they have been associated with the prime consultants.

(ii) Consultancy Capabilities in Civil Engineering and Construction Management Services

The report is in two parts. The report in its first part has brought out the current status of civil engineering & construction management services in India and has recommended measures and mechanisms to strengthen the same. In addition, the report contains information on growth, constraints and problems of this sector of consultancy and brief details of surveys carried out by World Bank, Asian Development Bank, African Development Bank as well as other international sources of information on consulting engineers. 282 independent INDIAN CE & CM consulting firms have been identified out of which profiles of 157 firms have been prepared.

The second part is a Directory of the CE & CM Consulting firms in India profiling their areas of expertise, projects handled in India and abroad, in-house R&D facilities and general information. Findings of the study revealed that Indian consultants have limited experience in handling large and complex projects and in mechanized construction; inadequate knowledge in latest developments in technologies and specialised construction machinery equipment and project management; lack of back-up data, inadequate financial and marketing support and weak organisational structure. At present the Indian share in total construction project exports is insignificantly low at 0.6 per cent. The reasons identified for this status include small size of contracting firms, marginal involvement of consultants at construction stage of the project that being monopoly of the client, construction management consultancy being in nascent stage and frequent fragmentation of the consulting firms. However, in view of the large demand for CE & CM consultancy services in India and abroad, these are opportunities for this sector of consultancy to grow in terms of international competitiveness and share in project exports. A multi pronged approach has been suggested to strengthen the capabilities of CE & CM consultancy firms. This includes the actions to be taken by the consulting firms, institutional mechanisms and promotional measures.

(iii) Consultancy Capabilities in the State of Orissa

Forests, minerals, sea-food, rivers and lakes are some of the gifts of nature in Orissa. Agriculture is still the key sector contributing about 50% to the State Domestic Product. However, these resources are under-utilised for industrial growth going by the number of industrial units and investments made. The study reveals that textiles industry had a share of 18.7% in the cumulative investment made during 1980-89, followed by metallurgical industry (10.74%) and paper & pulp sector (10.74%). It has been estimated that the Consultancy turnover was of the order of Rs. 10 crores in 1991-92 when the annual production was around Rs. 3000 crores and exports touched over Rs. 700 crores in 1989-90. Vast opportunities for exploiting the resources of the State exist in Agro-based industries, marine products, Cement & Granite and metals & mineral processing sectors. However, the study reported highly inadequate consultancy services available within the State, mainly serving the small scale sector. Medium and large industries engage consultants from outside the State. Encouraging factor is the State's potential for export of raw materials and finished products from mineral, marine, metallurgical, textile/handloom and agro-based sectors. Export earning in 1990-91 was of the order of over Rs. 500 crores. The study focused on the need to strengthen promotional measures such as creation of data base; linkages of the consultants with R&D institutions and reputed consultants outside the State; fiscal incentives and recognition of consultants, for development and growth of consultancy profession in the State.

(iv) Consultancy Capabilities in the State of West Bengal

The report identified 240 consultants/

consultancy firms and 54 R&D/Academic institutions. Estimated consultancy turnover of the order of Rs. 150 crores with a manpower engaged in consultancy services at around 7000 in 1992-93. Some of the problems being faced by the consultants operating in the State are inadequate data base, high establishment cost, lack of coordination between consultants and R&D/Academic organisations, lack of training facilities for upgradation of consultancy skill and lack of fiscal benefits available to the consultancy sector.

The Study with a view to promoting and upgrading the consultancy capabilities, keeping in consideration the existing weaknesses as also the thrust areas of consultancy services have put forward certain suggestions and recommendations like forming a panel of approved consultants after duly assessing their capabilities, identification of new business opportunities, strengthening of consultancy capabilities through upgradation of skills, establishing linkages between Research/Educational organisations and consultants, increasing users' awareness towards the importance and efficacy of consultancy services through workshop/seminars; strengthening marketing network of the consultants/firms through syndication and setting up to State level Consultancy Development Centre. Some areas such as jute, food processing (sea food) electronics, petro based industries, pollution, energy have been identified for strengthening of consultancy capabilities.

(b) Technology Business Incubator Centres in India

A Technology Business Incubator (TBI) is essentially a shared physical facility to promote new technology based enterprises particularly the small ones by way of providing a package of low cost facilities and services for the first few years, thereby reducing the initial risk for the entrepreneurs. DSIR started a programme for setting up of TBIs in the country, based on the recommendations of an UNFSTD supported study in 1990-93. Presently three TBIs, one each at Shri Ram Institute for Industrial Research at Delhi; Central Electronics Engineering Research Institute at Pilani; and Maharashtra Industrial and Technical Consultancy Corporation (MITCON) at Pune; had been started on experimental basis. A Programme Advisory Committee has been constituted by DSIR to review and advise on the TBIs. The TBI at SRI, New Delhi is an attached model of TBI to promote enterprises in chemical and fine chemcials and five incubatees have taken advantage of the facility including the present two entrepreneurs. The TBI at CEERI, Pilani is also an 'attached' model of TBI in the area of electronics and this incubator is still in an infancy stage and its functioning is being reviewed closely. The third incubator at MITCON, Pune, is an 'independent' model of incubator in general sectors of non-polluting manufacturing and services. 4 incubatees in the service sector have already taken advantage of the TBI facility and another 4 applications have been recently approved in the manufacturing sector. Each of the TBIs has set up its own Management Committee.

(c) Consultancy for Commercialization of Technologies

With a view to accelerate the commercialization of indigenous technologies developed in our R&D organizations and to strengthen technological capabilities of our consultants, a new programme has been evolved to provide support for consultancy needs for above activities. Guidelines and application proforma have been framed and proposals are being invited from the consultants as well as R&D organizations. This programme is to be implemented in cooperation with NRDC/CDC.

(d) Institutional and Programme Support

DSIR has been substantially supporting the capital and recurring needs of Consultancy Development Centre (CDC). Partial Programme support has been provided to Institute of Management Consultants of India (IMCI) for preparation and printing of their information brochures and to Federation of Indian Export Organizations (FIEO) towards preparation and printing of a Directory of consultants engaged in exports.

(e) Interaction Meetings

Following interaction meetings were supported:

(i) Technology Business Incubator Programme in Cooperation with Shri Ram Institute for Industrial Research, New Delhi.

(ii) Three interaction meetings to discuss and finalise the draft reports on consultancy capabilities in the States of Bihar, Gujarat and Tamil Nadu held at Patna, Ahmedabad and Madras respectively.

(iii) Interaction meeting on Consultancy Capabilities in Sugar Industry.

(iv) Evaluation Committee Meeting for draft report on consultancy capabilities in water resources.

3. REPORTS/PUBLICATIONS

Following reports/publications were brought out during the period under reporting.

(i) A brochure on Management Consultancy in India prepared by IMCI, Bombay.

(ii) A report on Consultancy Capabilities in Civil Engineering and Construction Management Services in India.

(iii) A report on Consultancy Capabilities in Fertilizer Industry in India.

(iv) Six reports on Consultancy Capabilities in the States of Rajasthan, Union Territory of Delhi, Madhya Pradesh, West Bengal, Orissa, Maharashtra and Goa.

4. ADVISORY SERVICES

Advisory services were made available to various Departments and Organizations in relation to evaluation of their project proposals and other activities. Following are examples of participation.

4.1 Committees

(i) Governing Council, Membership, Steering and CDPA Committees of CDC.

(ii) Consultancy Committee of FIEO.

(iii) Programme Committee of WASME.

(iv) Organising Committee on Workshop on "Environment Management" organised by Centre for Research Planning and Action, Nov. 93 at New Delhi.

(v) Board of Directors of UP Industrial Consultants Limited, Kanpur.

(vi) Management Committees of Technology Business Incubators.

(vii) Management Committee of ACCE for International Conference on Value Engineering in Project Management, held in Dec. 93 at New Delhi.

4.2 Seminars/Workshops/Meetings

(i) A national workshop on Consulting Engineers - statutory recognition, organized by Association of Consulting Engineers (India) at New Delhi.

(ii) Seminar on Trade, Technical and Economic Cooperation between India and Sub-Saharan African Region, organized by FIEO, at New Delhi.

(iii) A workshop on export production, organized by confederation of 100% of exports units, at New Delhi.

5. CONSULTANCY DEVELOPMENT CENTRE (CDC)

(i) Consultancy has been recognised as an important knowledge-based input for technical, industrial and economic development in the country. The Government has evolved various measures from time to time to support and encourage the consultants and consultancy organisations. The Technology Policy Statement of the Government of India and subsequently the Technology Policy Implementation Committee emphasized the need for evolving necessary measures and mechanisms to support and strengthening the consultancy capabilities in India. As a follow up of these recommendations, DSIR is implementing a scheme relating to Promotion and Support to Consultancy from April 1985. This scheme essentially aims to catalyse consultancy activities for domestic and export markets. Among

the various programmes and activities undertaken by DSIR in this scheme, a Consultancy Development Centre (CDC) at New Delhi has come into being with the support and active cooperation of Consultancy Promotion Organisations such as Association of Consulting Engineers (ACE), National Association of Consulting Engineers (NACE), Federation of Indian Export Organisations (FIEO). The main objective of Consultancy Development Centres is to promote, strengthen and develop consultancy profession in the country and to assist DSIR in implementation of some of its programmes relating to Consultancy and other related areas.

(ii) CDC came into being as a registered society in January 1986 and initially started operating from the premises of FIEO at PHD House, New Delhi and was subsequently shifted to rented apartments at Qutab Hotel, New Delhi in mid 1987. The Centre is managed and guided by a Governing Body consisting of representatives of Consultancy Organisations, R&D Institutions, Government Departments, Academic Institutions, Public Sector Units etc. CDC has a membership of over 120, representing various types of consultancy organisations and individuals connected with the consultancy. The CDC has concentrated mainly on development of human resources, providing computerized data/information services and strengthening of technological and managerial consultancy capabilities through a scheme known as "Consultancy Development and Promotion Assistance (CDPA) Scheme.

(iii) Since the inception of CDC in January 1986, DSIR has been providing support for its capital and recurring expenses, in addition to programme support, amounting to a total of about Rs. 360 lakhs till Sep. 1993. CDC has been allotted 1000 sq. mtrs. build-up space for its office at India Habitat Centre, Lodi Road, New Delhi, at an estimated cost of Rs. 2 crores. DSIR has paid entire amount to CDC for onward payment to Habitat Centre (IHC). The interior furnishing work at IHC is in progress, and CDC is likely to move from Qutab Hotel to IHC office in first quarter of 1994. The capital assets at CDC include a computer system with peripherals and accessories as well as some software. This facility is used for collection, analysis and dissemination of data, for training of engineering graduates and for small consultants. It is estimated that these investments have resulted in useful activities for nurturing consultants and users of consultancy for better returns on investments and enhanced earnings of foreign exchange directly and indirectly, besides several other qualitative advantages bringing long-term benefits to the country.

(iv) The Committee of Secretaries had decided in its meeting held on 1.1.1987 that CDC should be developed into a "Certifying Agency" for screening the activities and certifying the capabilities of Design Engineering Consultancy Companies in the country. Accordingly CDC had planned to initiate a 'Registration Scheme' for registering consultants based on certain criteria and then providing referral services to the users of consultancy. Such a scheme will be useful to improve the credibility and quality of consultancy services.

(v) In order to enhance technological and managerial capabilities as well as export capabilities of consultants, interactions with international organisations - (World Bank, Asian Development Bank, African Development Bank), International Trade Centre (ITC), UNIDO ESCAP have been developed and several programmes have been arranged for consultants at national and international levels which have proved to be useful to promote consultancy businesses. CDC has been identified to be an Apex body for Technical Consultancy Development Programme for Asia and the Pacific (TCDPAP) by ESCAP. Besides, ITC, ESCAP and other agencies have supported CDC training programmes in the past.

(vi) CDC is implementing some projects and programmes sponsored by DSIR under its various Plan Schemes and other organisations/ Departments.

(vii) Some of the salient features of the activities carried out by the CDC during 1993 are:

(a) Under the Consultancy Development Promotion and Assistance (CDPA) Scheme, which primarily aims to support and encourage small and independent consultants and the consultancy profession as a whole, the following activities were continued in operation.

- National Awards for Consultants 1991 & 1992 were given away and applications for Awards for 1993 were received and were scrutinized. Necessary action was taken for presentation of annual awards for 1993 in January 1994.

- Use of Principal Consultants: Six consultants were retained at CDC mainly to provide services to small units. Their services were being utilised by some small units as well as for programmes at CDC.

- Support for participation in Seminars/Workshops/Conferences, Trade Fairs etc. Support was provided to four Consultants/Consultancy organisations to attend various overseas workshops, seminars, etc.

- Trainee Consultants: Eight engineers completed their one-year consultancy training at CDC during 1992-93 and another batch of twelve trainees was undergoing training at CDC during 1993-94 and more training programmes are being planned on continuing basis. Also, the number of trainees are likely to be increased.

- Regional Training/Contact Programmes: Following nine programmes were organised in association with consultancy organisations/ agencies.

  (i) 18-23 January, 1993 at Trivandrum
  Workshop on "Refresher Course for Practising Consultants" at Trivandrum.

  (ii) 8-11 February, 1993 at Hyderabad
  Programme on "Value Analysis & Engineering" in association with Engineering Staff College of India.

  (iii) 16-18 February, 1993 at Delhi
  Workshop on "Energy Conservation and Audit" was held at New Delhi.

  (iv) 17-18 March, 1993 at Delhi
  Workshop on "Environment Management & Pollution Control" at New Delhi.

  (v) 19th March, 1993 at Bangalore
  Interaction Meet on "Dispute Resolution between Clients and Consultants" in association with Asian and Pacific Centre for Transfer of Technology.

  (vi) 25-26 March, 1993 at Ernakulam
  Workshop on "Various Opportunities available for Consultants" at Ernakulam.

  (vii) 14th May, 1993 at Delhi
  Interaction Meet on "Role of Consultants in Export of Technology & Manufactured Products".

  (viii) 23rd June, 1993 at Delhi
  Interaction Meet on "Consultancy for Higher Productivity & Profitability".

  (ix) 16th July, 1993 at Delhi
  Interaction Meet on "Quality Management for Consultancy & Services".

(b) Computerized Information and Computer Aided Design (CAD) facilities were created at CDC and the Centre is now equipped with these facilities to help the small industries/ consultants in this area. Special Computer Training Programmes were organised for computer personnel and consultants. This facility is mainly for the trainees at CDC.

(c) CDC has been designated as the coordinating agency for the implementation of networking of the Date Base Programmes of the Asian and Pacific Centre for Transfer of Technology (APCTT).

(d) A scheme for Registration of Consultants and Referral Services to help consultants and users was operationalised. 66 applications were received out of which 38 were registered.

(e) According to an IDBI report on Technical Consultancy Organisation (TCOS), CDC has been identified to play a major role in their functioning.

(f) A computerized data base is available for about 2500 consultants as against 500 in 89-90.

(g) Indian Renewable Energy Development Agency (IREDA) entrusted a job of preparation of a Directory of Consultants in the area of New and Renewable Energy Sources.

(h) CDC is likely to make an agreement with the Ministry of Environment & Forest for undertaking work related to Ozone Cell established by the Ministry for implementation of projects related to ODS.

CDC has made serious efforts to generate revenues on its own towards becoming almost self supporting in the long run. The above assignments have been received by CDC after considerable efforts.

VI. NATIONAL INFORMATION SYSTEM FOR SCIENCE & TECHNOLOGY (NISSAT)

1. INTRODUCTION

The increasing role of science and technology in the economic and social development of the country has generated a pressing demand for faster technology transfer to the industry. Apart from access to information generated within the country, it is also necessary to draw from the externally generated information to support internal efforts on research and development. Information centres that have come up to serve the needs of different industries and R&D units, need to be coordinated and organised into an integrated system to avoid a haphazard growth and duplication of activities in conformity with national and international standards.

The National Information System for Science & Technology (NISSAT) programme envisages promotion and support to the development of a compatible set of information systems on science and technology and interlinking these into a network. The approach adopted is to bring the existing centres, systems and services to a higher level of operations so that the interests of the national community of information users could be better served. For the purpose, the programme also contemplates experimentation with and introduction of modern information handling tools and techniques and the development of endogenous capabilities.

1.1 Objectives

NISSAT functions with the following objectives:

- Provision of national information services to meet the needs of users, generators, processors and disseminators of information.
- Optimum utilisation of existing information services and systems and the development of new ones.
- Promotion of national and international cooperation and liaison for exchange of information.
- Provision of encouragement for the development of facilities for education and training in information science and technology.
- Promotion of application of information technologies in research & development, innovation in information science & technology and communication to enhance both the efficiency of information services and quality of the information provided by these services.

2. INFORMATION CENTRES

An information centre is the major instrument for information resources development and dissemination. It provides bibliographic as well as factual and numeric information on a product, discipline or mission. Following information centres were established with the objectives to create information awareness and to meet information needs of academicians, scientists, technologies, entrepreneurs, management executives and decision makers.

Information Centres

No.	Subject Area (Acronym)	Host Institution
1.	Leather Technology (NICLAI)	Central Leather Research Institue, Madras
2.	Food Technology (NICFOS)	Central Food Technology Research Institute, Mysore
3.	Machine Tools & Production Engineering (NICMAP)	Central Manufacturing Technology Institute, Bangalore
4.	Drugs and Pharmaceuticals (NICDAP)	Central Drug Research Institute, Lucknow
5.	Textiles & Allied Subjects (NICTAS)	Ahmedabad Textile Industry's Research Association, Ahmedabad
6.	Chemicals & Allied Industries (NICHEM)	National Chemical Laboratory, Pune
7.	Advanced Ceramics (NICAC)	Central Glass and Ceramics Research Institute, Calcutta
8.	Bibliometrics (NCB)	Indian National Scientific Documentation Centre, New Delhi
9.	Crystallography (NICRYS)	University of Madras, Madras
10.	CD-ROM (NICDROM)	National Aerospace Laboratory, Bangalore

2.1.1 Sectoral Information Centres

Sectoral Information Centres (the first seven) were built around the existing information resources and facilities. They maintain extensive collections of published and unpublished documents in the form of books, periodicals, research reports, development and trade reports etc., in the relevant subject areas. Apart from providing documents and preparing bibliographies on request, they also offer SDI, CAS, reprographic, micrographic, industrial and technical enquiry, translation and other services. They conduct training programmes for their staff; organise workshops and seminars to create awareness of modern tools and techniques; and also participate in exhibitions to publicise their products & services. In respective cities, they function as focal points for resource sharing.

Regular monthly publications from these centres include Current Awareness, Industry Highlights, Current Highlights, Patent Awareness, Current Indian Titles in respective sectors and also semi-technical and popular ones in the form of digests. The centres have also developed information management tools like thesauri, data collection, input procedures and so on.

Sectoral information centres maintain several databases to cater to the information requirements of their clientele. For example, NICDAP maintains databases on Natural Products, Folklore database, Letters of Intent & Industrial Database, Research Projects database, Union Catalogue of periodicals in Lucknow city etc., NICLAI maintains database on Leather Science Abstracts (LESA), Periodical Holdings (PERHOL), Leather Thesaurus (LETHAS, Leather Catalogue (LEACAT) etc.; NICFOS maintains Food Science & Technology Abstracts (FSTA), Indian Food Technology Abstracts (IFTA), Food Patents; NICMAP maintanis database like Metal Working Abstracts, Patents, World Machine tool production statistics & Import/Export statistics; NICTAS maintains World Textile Abstracts and NICHEM publishes Monthly Indian Chemical Patents.

2.1.2 Information Analysis Centres & Data Centres

In contrast to sectoral information centre which provide mainly bibliographic support, NISSAT has established Information Analysis and Data centres (NICRYS, NCB, NICDROM) for undertaking the task of acquiring, evaluating, integrating, consolidating and analysing factual and numeric information.

The National Information Centre for Crystallography (NICRYS) is the first hard data centre established at the University of Madras, Madras in 1981. NICRYS receives the Cambridge Crystallo-

graphic data on organic & organo-metallic compounds on magnetic tape. Presently, The University Grants Commission (UGC) provides complementary support to NICRYS activities.

The National Centre for Bibliometrics (NCB), established at INSDOC, New Delhi in 1988, has been creating a S&T citation database on Indian contributions appearing in Indian periodicals.

The NICDROM centre at NAL, Bangalore established in 1988, supplies information on CD-ROM hardware, software and their suppliers reference tools and databases available on CD-ROM and also provide information from NTIS.

3. ONLINE AND SDI SERVICES

To bring the information support services to the scientists and technologists in India at par with those avilable to their counterparts in the developed countries, NISSAT has established five NISSAT Access Centres to International Database Services - NACIDS.

NISSAT Access Centres to International Database Services (NACIDS)

S. No.	Place	Host Institution
1.	Bangalore	National Aerospace Laboratory
2.	Calcutta	Indian Association for Cultivation of Science
3.	Madras	Central Leather Research Institute
4.	New Delhi	Indian National Scientific Documentaion Centre
5.	Pune	National Chemical Laboratory

The NACIDS use PSTN telephone lines upto the local PAD of Videsh Sanchar Nigam Limited (VSNL) and there onwards, the international carriers via the Gateway Packet Switching Services (GPSS) at Bombay. Online access by Telex is stand by. NACIDS have trained intermediaries to assist or conduct online searches. The centres are gaining popularity considering that there is an increasing number of users and full search costs are recovered from them.

Selective Dissemination of Information (SDI) is provided regularly to users on the basis of their information profile. Such services are offered by NICMAP/CMTI, Bangalore using the COMPENDEX database and by NICDROM/NAL, Bangalore using NTIS, Discovery Preview and Janes All the Worlds Aircrafts databases, IACS, Calcutta & NPL, New Delhi using INSPEC (Physics) database, NICHEM/NCL using CHEMBANK database, NICDAP/CDRI using Drug Information Source database, CALIBNET, Calcutta using BNB and BOOKFIND databases. Other CD-ROM databases like ADONIS, BNB, BOOKFIND, ISSN Compact, World Research Database are available at NISSAT HQ.

In order to assess the present situation, promote the technology in the country and facilitate exchange of notes, NISSAT has organised the Second National Meet of CD-ROM/ONLINE Users and Service Providers, during July 15-16, 1993 in Technology Bhawan, New Delhi.

4. LIBRARY NETWORKING

NISSAT has taken the initiative for the development of metropolitan library networks

- to ensure better utilisation of S&T information resources through resource sharing,
- to moderate functional load of information centre management, and
- to take care of motivational factors to a large extent by better means of communication.

The implementation of Calcutta Library Network (CALIBNET) has been taken up in two phases. In CALIBNET Phase - I, the Network Services Centre at the Regional Computer Centre (RCC), Calcutta and 7 participating library/information centres are being networked. Meanwhile, in collaboration with the RCC and Regional Centre INSDOC, Calcutta. NISSAT has taken up manpower development activities as well. CALIBNET was formerly inaugurated on Septmeber 22, 1993.

MAITRAYEE, the CALIBNET Library Automation and Networking Software, has been developed and demonstrated to the library and information professionals in the country. NISSAT signed an MOU with CMC Ltd. for future development of MAITRAYEE. Activities related to database creation and retrospective conversion are being carried out at IACS and other prticipating institutions. CALIBNET is now a registered society.

On similar lines, the Delhi Library Network (DELNET) aims at connecting over 30 libraries in Delhi. So far, 38 library/information cen. have been connected through Electronic mail. As in the case of CALIBNET, DELNET is now a registered society. NISSAT regularly organises computer courses for the operational level professional from the participating institutions.

NISSAT has initiated the development of Bombay Library Network (BONET), BONET was formally inaugurated on November 6, 1992. The feasibility study for Madras Library Network (MALIBNET) has been completed. Similar metropolitan networks are contemplated for Ahmedabad (ADINET), Hyderabad (HYLIBNET), Pune (PUNENET) and Bangalore in the immediate future.

NISSAT has established E-Mail facilities through ERNET to the various NISSAT information centres dispersed in the country. This connectivity greatly enhances the resource sharing capabilities among these centres and also the provision of user services more efficiently. The ERNET group of the Department of Electronics, Government of India has provided the overall knowhow in these venture.

5. COMPUTER BASED BIBLIOGRAPHIC INFORMATION PROCESSING

The demand for use of computers varies from automation of routine management functions in libraries to information retrieval or analysis of global databases. NISSAT give a high priority to all aspects of computer based bibliographic information processing.

NISSAT acquired proven software packages like CDS/ISIS Mini-Micro version, SUPERDOC and IDAMS (Statistical package) from UNESCO. On behalf of UNESCO-PGI, Paris, NISSAT has the official rights for the distribution of these in India.

At present, CDS/ISIS ver. 3.0 is distributed to libraries, information centres and non-profit institutions along with adequate training support. There are 981 installations in India (as on December 31, 1993). The implementation of CDS/ISIS in these institutions is monitored regularly through exchange of information, user's group meetings and periodic surveys. NISSAT has also acquired the CDS/ISIS VAX version, tested and distributed to 14 user institutions. The statewise & yearwise distribution of Micro-ISIS is given in Figure VI.1 and VI.2 respectively.

In collaboration with Defence Scientific Information and Document Centre (DESIDOC), New Delhi, NISSAT has helped the development of a software for Library Automation on CDS/ISIS (now called SANJAY). The package is capable of interlinking two or more databases for a single application, handling numerical calculations and of carrying out several other library house-keeping activities. As a model application, SANJAY is implemented in the DST Library, Technology Bhawan, New Delhi. A Generalised version of SANJAY (Version 2.0) for application in a library with a medium size document collection and user clientele is now under alpha and beta testing.

TRISHNA, another CDS/ISIS based package has been developed in collaboration with National Institute of Science Technology and Development Studies (NISTADS), New Delhi. TRISHNA supports database in Devnagri and several other Indian scripts using a GIST CARD. This package was distributed to ASTINFO member countries like Nepal & Bangladesh during 9th ASTINFO Consultative Committee Meet, New Delhi, 1993.

The 5th National Meet of CDS/ISIS Users was conducted in February 10-13, 1994 at National Academy of Agricultural Research Management (NAARM), Hyderabad, to assess the status of the package in the country, to provide technical solu-

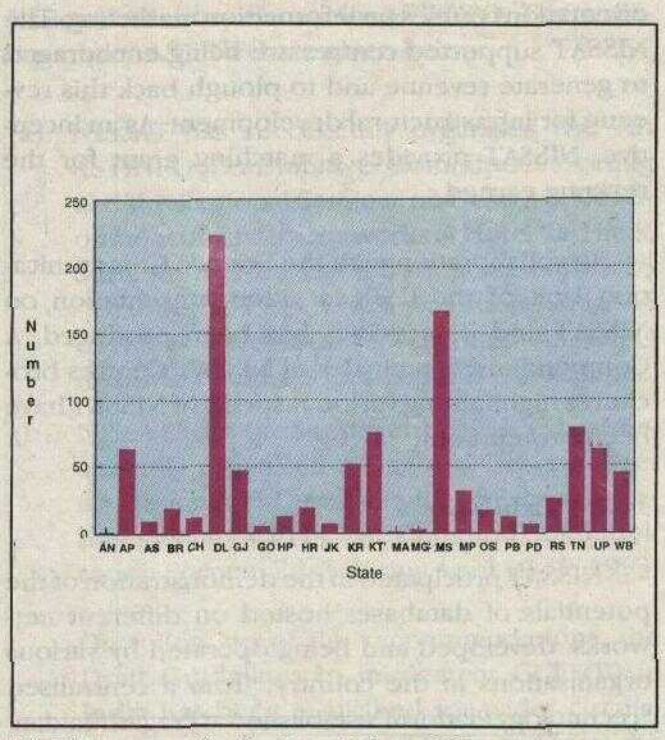
tions to the problems faced by the users and to facilitate the exchange of experiences.

6. RATIONALISATION OF PERIODICAL ACQUISITIONS

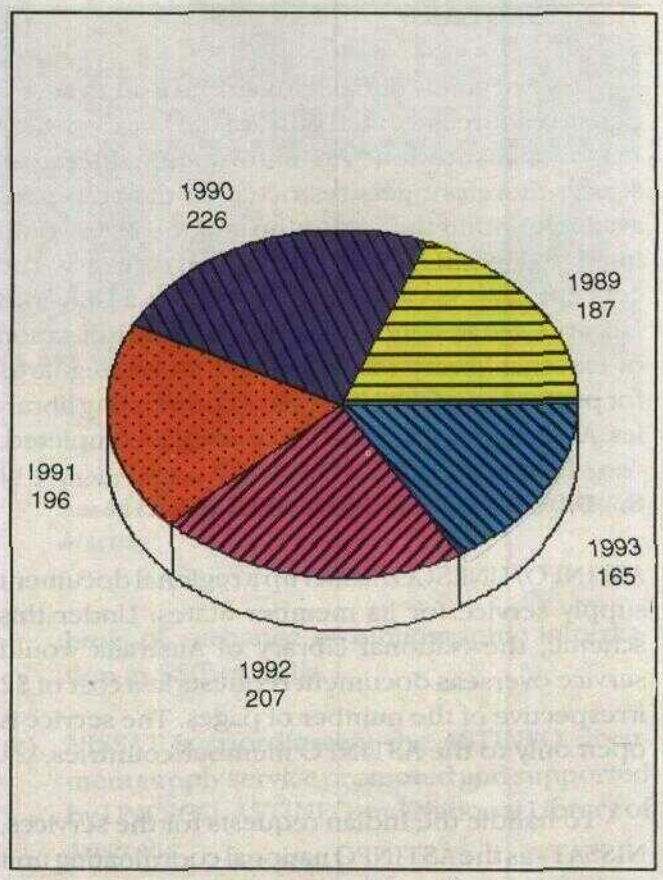
The cost of S&T periodicals increases at a rate of 15-20% per annum. As the library budget in most institutions tends to remain static, the net result would be a reduction in acquisition of journal titles. On the other hand, our scientists and technologists are delving into newer areas. Their activities naturally would demand acquisition of periodicals in those newer areas.

The aim of the consultative committees being promoted in 16 cities, is to get librarians in a city together and to discuss their acquisitions especially renewal of subscriptions for periodicals, and explore resource sharing possibilities. Such an exchange of notes is expected to lead to a rationalised acquisition effort and considerable savings to the group of cooperating libraries.

Such mechanisms are already operational in Ahmedabad (NICTAS/ATIRA), Bangalore



VI.1 State-wise distribution of Micro ISIS



VI.2 Year-wise distrybition of Micro ISIS

(NICMAP/CMTI), Bombay (IIT), Calcutta (NICAC/CGCRI), Delhi (DELNET), Lucknow (NICDAP/CDRI), Mysore (NICFOS/CFTRI), Nagpur (NEERI), Pune (NICHEM/NCL) and Trivandrum (KLA). Efforts are underway to set up these mechanisms in Bhopal, Chandigarh, Cochin, Hyderabad, Kanpur and Vishakhapatnam.

As a part of CCRP, NISSAT intends to promote & support development of Union List of Current Scientific Serials in major cities. These Union Lists will serve as a valuable resource for scientists, researchers, academicians and library professionls

- to provide information on the availability of serials in the selected cities.
- to identify the gaps in the acquisition of serials, and
- to help in the rationalisation of acquisition of serials by encouraging resource sharing.

7. NISSAT CARD

It is extremely difficult for an end user to access or use resources located outside the library of her/ his own institution. An imformation/literature search therefore gets restricted to the resources available within the institution and the user would need to depend entirely on external courtesy. The concept of NISSAT CARD is to develop a Universal Library Card System that would facilitate utilisation of external library resources with due safeguards for protection of the interests of cooperating libraries. A feasibility study on this concept is completed.

8. DOCUMENT SUPPLY SERVICE

ASTINFO/UNESCO has set up a regional document supply service for its member States. Under this scheme, the National Library of Australia would service overseas document requests at a cost of $2 irrespective of the number of pages. The service is open only to the ASTINFO member countries.

To handle the Indian requests for the services, NISSAT - as the ASTINFO national coordinating unit in India, has identified a set of institutions on considerations of logistics. These participant institutions are as indicated.

Institutions Handling ASTINFO Document Supply Service

S.No.	Place	Institution/Association
1.	Ahmedabad	NICTAS/ATIRA
2.	Bangalore	NICMAP/CMTI
3.	Calcutta	NICAC/CGCRI
4.	Delhi	DESIDOC
		IARI
		NISSAT
5.	Hyderabad	IICT
6.	Lucknow	NICDAP/CDRI
7.	Madras	NICLAI/CLRI
8.	Pune	NICHEM/NCL
9.	Shillong	NEHU

The service is priced on cost-recovery basis. For future requirements of request forms, user libraries would approach NICTAS/ATIRA, Ahmedabad, which is now an outlet for all NISSAT products and services.

9. MANPOWER DEVELOPMENT

NISSAT has been organising short term courses with a view to improving upon and update the skills of the information professionals on a continuing basis. It may be observed that NISSAT has developed facilities for the conduct of regular series of courses at INSDOC, New Delhi; DRTC, Bangalore; RCC, Calcutta and University of Poona, Pune. NISSAT also promotes and supports studies, preparation of directories, databases, basic and applied research in information science.

10. PROMOTION OF NISSAT ACTIVITIES, PRODUCTS & SERVICES

In order to reduce the dependence on government investments for the development of scientific & technical information infrastructure in the country, the NISSAT products and services are to be marketed aggresively. In this regard several measures have been taken for market promotion For example, operative level personnel from the various NISSAT information centres have been given orientation courses on information marketing. The NISSAT supported centres are being encouraged to generate revenue and to plough back this revenue for infrastructural development. As an incentive, NISSAT provides a matching grant for the revenue earned.

In collaboration with the Science Communication Unit of the CSIR, a video presentation on NISSAT and its activities has been produced. A Compendium of activities of NISSAT Centres brochures highlighting various aspects of NISSAT have been brought out.

10.1 Exhibitions

NISSAT prticipated in the demonstration of the potentials of databases hosted on different networks, developed and being operated by various organisations in the country, from a centralised 'Technology Platform' established at Pragati Maidan, New Delhi, during the 10th Indian Engineering

Trade Fair (IETF) from February 14-21, 1993. Over 200 visitors a day visited the stall.

NISSAT participated in the International Conference and Exhibition on Database Production and Distribution: Resources, Technology and Management, INFOTEX '93 held at The Taj Residency, Bangalore during November 28 - December 1, 1993. INFOTEX '93, attempted to focus on the role that country like India in the developing world can play in the global alliance of information industry and the profession. It also offfered a common platform for joint ventures both at academic and the industry level. Over 100 visitors a day visited the stall. In the exhibition, NISSAT was awarded a Trophy for the widest range of information products & services.

11. INTERNATIONAL ACTIVITIES

The Activities of ASTINFO/UNESCO (Regional Network for the Exchange of Information and Experiences in Asia and the Pacific/UNESCO) are closely coordinated with those of NISSAT. The NISSAT Advisory Committee also functions as the National Advisory Committee of UNISIST and the National Advisory Group for ASTINFO. The activities under ASTINFO are given below:

(a). NISSAT has successfully organised the 9th ASTINFO Consultative Committee Meeting and the Regional Seminar on Design & Development of Library Networks at Hotel Raj Hans, Suraj Kund, New Delhi during September 25 - October 1, 1993, which was attended by 24 overseas delegates representing ASTINFO member countries and 20 local participants.

(b). NISSAT with the support of UNESCO has successfully organised a National Experts Meet on Design and Development of Factual Databases using CCF (F), The Common Communication Format, Ed. 3 during April 19-30, 1993.

On follow up of the recommendations, the Draft Guidelines to implement CCF (B) in India has been published for wider circulation, use and comments. This would form the basis of exchange of bibliographic information in S&T in India.

VI.3 Inauguration of ASTINFO/UNESCO Regional Seminar on Library networks and 9th ASTINFO Committee Meeting

(c). NISSAT is coordinating the ASTINFO document supply service promoted and supported by UNESCO, ASTINFO and National Library of Australia.

(d). The NISSAT Secretariat has been given a contract to prepare standard course materials and teaching aids on the following topics:

- CCF: the Common Communication Format.
- CDS/ISIS, and
- Management Information System (MIS)

These were completed and the ASTINFO member countries were presented with these kits during 9th ASTINFO Consultative Committee Meet, New Delhi.

Similarly NISSAT Secretariat has another contract to develop teaching aids and course materials for introducing modern computer communication concepts to librarians and information scientists.

12. NISSAT NEWSLETTER

NISSART, in cooperation with the Society for Information Science (SIS) has been publishing quarterly NISSAT Newsletter. This effort is expres-

sion of the sincerity behind NISSAT's intention to mobilize the technical expertise available with professional bodies. The Newsletter covers wide ranging issues relating to information and development of information services networks and centres. Individuals and professional bodies are invited to contribute features and new items on new concepts and services, seminars and training courses, new products, status of information systems both national & international and trends in their development. With a present circulation list of 5000 institutions and individuals, the NISSAT Newsletter enjoys user appreciation and high professional esteem in India.

VII PUBLIC ENTERPRISES

VII (A) NATIONAL RESEARCH DEVELOPMENT CORPORATION

The overall performance of the Corporation has been quite satisfactory during the year 1992-93. The Corporation has earned a record lumpsum premia and royalty of Rs. 205.71 lakhs from licensing and commercialisation of indigenous technologies against Rs. 189.85 lakhs during 1991-92.

1. INCOME FROM LICENSING OF INDIGENOUS TECHNOLOGIES

(a) Lumpsum Premia

During the year, the Corporation's income by way of lumpsum premia was Rs. 85.50 lakhs as *against Rs. 96.00 lakhs in the previous year.* The marginal decline is mainly due to the disturbed conditions in the country during December 1992 to January, 1993.

(b) Royalty

The income from royalty has shown a significant increase during the year and the same has reached an all record of Rs. 120.21 lakhs as compared to Rs. 93.85 lakhs in the previous year.

2. PROFIT

In spite of New Industrial and Trade Policies for import of technology and highly liberalised policy framework to promote foreign investment alongwith technology, the Corporation has earned a gross profit of Rs. 61.33 lakhs against Rs. 68.44 lakhs in previous year.

The gross income of the Corporation from all sources including premia and royalty, but excluding Grant-in-Aid was Rs. 306.73 lakhs as compared to Rs. 298.24 lakhs in previous year.

3. PROCESSES ASSIGNED AND LICENCE AGREEMENTS CONCLUDED

To enlarge its technology resource base the Corporation signed Memoranda of Understanding with the Bhabha Atomic Research Centre, Bombay and Central Power Research Institute, Bangalore for marketing their technologies. 51 technologies *were assigned to the Corporation during the year* as compared to 49 in the previous year. Some of the *major technologies assigned to the Corporation* are:

- Dynamic Carrier Control System
- Computerised Networking System
- Invert Sugar
- Egg Powder
- Glycol Based Antifreez Coolant
- Carbon Fibre for Braiding Application
- *Synthetic Peptide for Inducing Growth* and Fertility in Fishery, Poultry and Cattle
- Intelligent Braille Interpreter

The Corporation signed 66 licence agreements during the year as against 73 in the previous years. The marginal decline in the number of licence agreements is mainly due to non-availability of commercially important processes from R&D Institutes many of whom are licensing the processes directly.

4. MAJOR TECHNOLOGIES LICENSED

Some of the major technologies licensed by the Corporation during the year are:

- Electrolytic Chromium Metal
- Fly Ash Bricks
- Spice Oleoresin
- Monocrotophos Pesticide
- Extraction of edible grade raw palm oil
- Dynamic Carrier Control System
- Acephate Pesticide
- Low-cost Plant Tissue Culture
- Maintenance free Lead Acid Batteries
- C-Band Signal Generator
- Blood Bags

5. TECHNOLOGY DEVELOPMENT PROJECTS

5.1 Projects Completed

Low cost plant tissue culture media

The Indian Institute of Technology, Kharagpur developed a laboratory process for the production of Low-cost Plant tissue culture media, a natural substitute for conventional tissue culture media. The product is widely used for In-Vitro regenerations of plantlets. In view of the fact that plant tissue culture is one of the thrust areas the Corporation provided a financial grant amounting to Rs. 50,000/- to optimise the various parameters involved in the process and to upscale the process from 20-25 grams/batch to a level of 1.5 - 2.0 kg per batch.

The project has been successfully completed and the process has already been licensed to M/s Pharmacia United Ltd. of Sweden.

5.2. Ongoing Projects

(a) Sand Lime Bricks

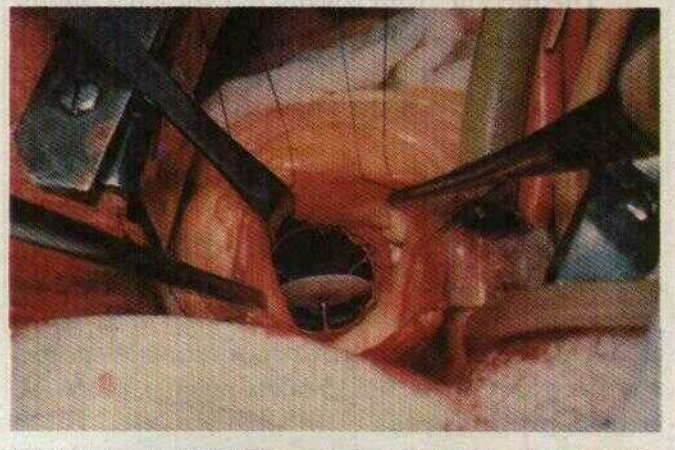
Sand lime bricks also known as Calcium silicate bricks are considered to be one of the advance building materials and is made from sand and hydrated lime. Keeping in view the need for developing an alternate building material, the Corporation licensed the process for the manufacture of sand lime bricks developed at Central Building Research Institute, Roorkee to M/s Periwal Bricks Pvt.Ltd., Dungargarh (Rajasthan). With the financiang from HUDCO in the form of Rs. 10.00 lakhs as equity and Rs. 340 lakhs by way of term loan, the Corporation participated in the equity to the extent of Rs. 30 lakhs. The plant having a capacity of 40 Million bricks per annum has been set up at Dungargarh (Rajasthan) at an estimated cost of Rs. 5.5 crores. The plant has since been erected and trial runs are in progress.

(b) Acid-proof cements from rice husk

Acid-proof cement is essentially used as a mortar for bedding and jointing of acid-proof bricks, tiles, stoneware pipes etc. The scientists at IIT Kharagpur developed a process for the production of acid proof cement on a laboratory scale. Keeping in view the market potential of acid process for the production of acid-proof cement on proof cement, the Corporation provided financial assistance to the extent of Rs. 2.34 lakhs to IIT Kharagpur for upscaling the process to pilot plant of 20 kg/day. The plant will be used for training and demonstration for future licensees of the Corporation for this knowhow. The work on the project is progressing satisfactorily.

(c) Artificial Heart Valve

The Corporation had funded a development project for the production of 300 artificial heart valve for clinical trials at Sree Chitra Tirunal Insti-



VII.A.1 An Artificial Heart Valve Being Implanted in the Human Body

tute of Medical Science and Technology (SCTIMST), Thiruvananthapuram. After overcoming teething problems, SCTMST has successfully developed a tilting type mechanical heart valve with the valve flap being made of Ultra High Molecular Weight Polyethylene. After the approval of Ethics Committee of the Institute, human trials have commenced at 6 Centres. So far 153 valves have been successfully implanted in human beings. In parallel, the Corporation has licensed the process to M/s TTK Pharma Ltd., Madras for commercial production.

Concurrently, NRDC took up the work of patenting the valve and patent applications have now been filed in India. The steps have also been taken for filing the patent applications in European Patent Office (EPO), Munich, USA and Japan.

The true significance of the Chitra Valve lies in the triumphant demonstration that the technology of Heart Valve substitutes an oligopoly of rich nations, could be mastered by Indian scientists. Their achievement has rekindled new hope for thousands of patients who are priced out of valve replacement therapy today.

(d) Copper Phthalocyanine Blue

Copper phthalocyanine blue is used for the manufacture of finished products like phthalocyanine pigments, Dyes etc. To obviate the drawbacks of the conventional process, Regional Research Laboratory, Bhubaneswar developed a laboratory scale process for the manufacture of Copper phthalocyanine blue. Since some entrepreneurs were interested in the process provided the process was demonstrated at least at 5 kg/batch scale, the Corporation provided financial assistance amounting to Rs. 40,000 to RRL, Bhubaneswar for scaling up the process to 5 kg/batch level. The work is in progress and the project is expected to be completed by December 1993.

(e) Synthetic peptides for inducing the growth and fertility in fishery, poultry and cattle

The Institute of Research in Reproduction, Bombay (IRR) developed a laboratory scale process for the manufacture of vaccine for inducing growth and fertility in fishery, poultry and cattle. The Corporation has identified M/s Vet Care Pvt. Ltd., Bangalore as a suitable party for licensing of the knowhow. However, M/s Vet Care Pvt. Ltd. desired that they would like to try out the samples in their fish farm before taking up the licence. Accordingly they have signed an MOU with NRDC. Having already identified a party, the Corporation provided financial assistance to IRR amounting to Rs. 3.00 lakhs for the development of a wide range of vaccines for the treatment of infertility in human beings and induction of super Ovulation for In-Vitro fertilisation/embroy transfer, inducing growth in poultry birds etc. and other veterinary use. The work on the project is in progress.

6. MARKET SURVEY

Market information not only make the technology package more complete and attractive but also help in assessing the realistic prices for the technology for licensing. With this end in view, the Corporation continued its activity to conduct market survey on commercially important technologies by commissioning professional market survey agencies. During the year market survey reports on the following items were completed:

* Gallic Acid
* Thermographic Paper
* Calcium Gluconate
* Silica Gel and Sodium Silicate
* Oxygen Free High Conductivity Copper
* Electronic Asbestos Fluff
* Carbon Fibre for Braiding Applications
* Ceramic Tools
* Invert Sugar
* Super Critical Extraction

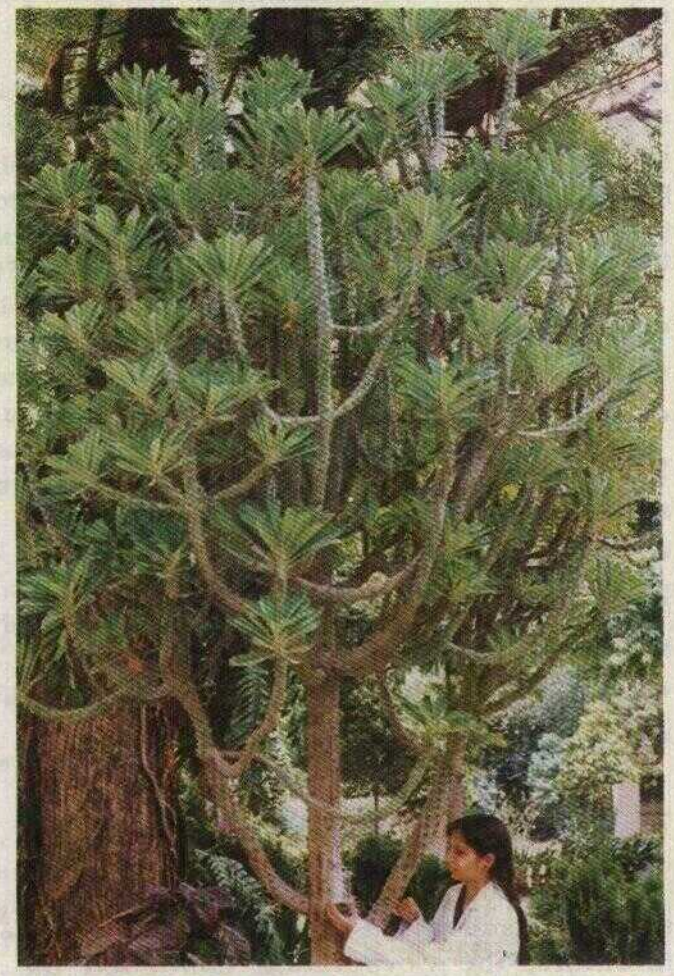
7. INVENTION PROMOTION PROGRAMME

To promote and encourage the spirit of inventiveness amongst scientists, workers, students and inventors, the Corporation continued its programme of Awarding Prizes for the development of novel processes/products/inventions.

During the year 67 applications for prize award and 37 for financial assistance were received. The Corporation announced on Independence Day (1992) cash awards amounting to Rs. 2.15 lakhs to 18 inventors for 9 meritorious inventions. On Republic Day 1993 cash awards amounting to Rs. 1.70 lakhs to 9 inventors for 7 inventions wer announced.

Some of the meritorious inventions recognised through awards during the year were:

* Armour Steel Coded as Jackal
* Multi Directional Carbon Fibre Preformed Process Technology
* Dynamic Hardness Tester
* W-Band Mono pulse Antenna System for Missile Seeker Application



VII.A.2 Tapping Latex from Cactus Plant for Trials in the Pilot Plant

* A New Method to Upgrade Manganese Dioxide Ore to Battery Grade
* Submerged Arc Welding Flux for Narrow Gap Application

8. PATENT ASSISTANCE

The Corporation continued to provide technical, legal and financial assistance to individual inventors in drawing up patent specifications of their inventions, processing their patent applications etc. During the year, the Corporation received 49 applications from individual inventors for such assistance for filing patent applications in India. Of which assistance was granted to 18 inventions, based on the patentability of the inventions involved. 20 patents applications were also filed on behalf of different R&D organisations.

9. DEVELOPMENT & PROMOTION OF RURAL TECHNOLOGY

The programme aims at the application of S&T to enrich the life of our rural people by increasing employment potential through the development and application of appropriate technologies utilising local resources. With this end in view, the Corporation continued its programme of development and Promotion of Rural Technology.

During the year the Corporation provided financial assistance amounting to Rs. 3 lakhs to Shri Ram Institute for Industrial Research, Delhi for setting up of a pilot plant for the production-cum-demonstration of latex based productions from Cactus plants. Latex bearing cactus plants such as Euphorbia Nivulie/Nonfolia are abundantly available in arid and semi arid zone. The process aims at the commercial utilisation of latex which is not put to any use at present.

10. RURAL TECHNOLOGY DEMONSTRATION CUM TRAINING CENTRE (RTDT)

Besides strengthening 5 existing RTDT Centre, two new Centres were opened at the following locations:

1. Himachal Pradesh S&T Council, Surendra Nagar (HP)
2. Tarun Sanskar, Jabalpur

11. TECHNOLOGY EXPORT

The Corporation continued its efforts in exporting Indian Technologies to the Developing countries. The Corporation has successfully transferred technology for the manufacture of AZT Drug to M/s Labogen, Brazil at an estimated cost of Rs. 7 lakhs. Against stiff international competition, the Corporation signed a MOU with M/s Tradeast, Singapore and Bimantara Group of Indonesia for setting up blood bag project in Indonesia. The project cost is estimated at around US$4 million.

VII.A.3 Dye Produced at Plant Installed and Commissioned by NRDC in Vietnam

Synthetic and Natural Dyes Project

The contract for setting up of a synthetic and natural dyes plant in Vietnam at an estimated cost of Rs. 125 lakhs was awarded to the Corporation by UNIDO. The Natural Dyes section of the plant was successfully commissioned in May 1992. Work on the Synthetic dyes unit is progressing satisfactorily. The plant and machinery have already been installed and pre-commissioning trails are in progress.

12. FOREIGN EXCHANGE EARNINGS

The foreign exchange earnings of the Corporation amounted to Rs. 34.31 lakhs during the year.

13. PUBLICATIONS

An important activity of the Corporation is to disseminate information on indigenous development of new products and processes to industry, entrepreneurs and the general public. With this end in view, the Corporation continued to bring out the following publications during the year:

Awishkar - (Monthly in Hindi)
Invention Intelligence - (Monthly in English)

The Corporation also brought out the following special publications:

- Process Diary
- New Materials in Building industry

14. EXHIBITIONS AND PUBLICITY

The Corporation has been participating in selected exhibitions, seminars, get-togethers and also organisation Tech Trans, Seminars to create awareness among the entreprenurs and industry about the technologies available with the Corporation for commercialisation. During the year, the Corporation organised in the following Tech Trans Exposition/Exhibitions:

Tech-Trans Exposition-cum-Seminar

1. Tech-Trans, 92, Raipur	26-27 June, 1992
2. Tech-Trans, 92, Faridabad	28-29 July, 1992

3. Tech-Trans, 93, Nashik — 12-13 January, 1993
4. Tech-Trans, 93, Chandigarh — 5-6 February, 1993

Exhibitions

1. Technologies and Opportunities for Industrial Development
(11-12th May, 1992 at Hotel Park Shereton, Madras)

2. National Convention on Quality for Survival Organised by HRD Foundation in collaboration with BIS & SCOPE
(14-16th May, 1992 at Ashoka Hotel, New Delhi)

3. Seminar-cum-Exhibition on New Materials in Building Industry
(22-23rd September, 1992 at Vigyan Bhavan Annexe, New Delhi)

4. International Symposium on "Recent Advances in Extraction Technologies : Non-Ferrous Metals"
(14-17 November, 1992 at Udaipur)

5. Tech-Mart, 1992 India International Trade Fair
(14-29 November, 1992 at Pragati Maidan, New Delhi)

6. VI International Congress & Exhibition ENVIRO-2000
(20-21st November, 1992 at Hotel Maurya Sheraton, New Delhi)

7. An Exhibition on Aerospace Components, Technologies and Capabilities
(7-12 December, 1992 at HAL Premises, Bangalore)

8. Science & Technology Exhibition
(14-27 February 1993 at Mandi, H.P.)

15. IMPLEMENTATION OF OFFICIAL LANGUAGE

Pursuant to the Statutory requirements of the Official Language Act 1963 and the policy guidelines and directions received from Government of India from time to time, the Corporation continued to take various measures for promoting and popularising the use of Hindi in its day to day official work. A Hindi Workshop was organised in the Corporation on 8th June, 1992 to create awareness amongst the employees about the various provisions of Rajbhasha implementation rules and regulations and to encourage day to day working in Hindi. Training was arranged to 12 English Stenographers and typists in Hindi typewriting and awards were given to successful candidates on Hindi Day which was observed on 14th September, 1992.

The Second Sub-Committee of the Committee of Parliament on Official Language visited the Corporation on 8th September, 1992 to inspect and review the progress in the implementation of Hindi in the day to day use of the Corporation.

VII (B) CENTRAL ELECTRONICS LIMITED

1. INTRODUCTION

Central Electronics Limited (CEL) holds a unique position among the family of Public Sector Enterprises in Electronics, with its emphasis on indigenous technology inducted both from its in-house developments and from the country's National Laboratories, for its production programmes in diverse hi-technology areas of National Relevance. The activities of CEL are sharply focused in three thrust areas:

(i) Solar Photovoltaic Cells, Modules and Systems for a variety of applications.

(ii) Selected Electronic Systems - Equipment for *Railway Signalling & Safety, Cathodic Protection* Equipment for Oil Pipelines, Switching Systems and Projection Television Systems.

(iii) Selected Electronic Components - Professional (Soft) Ferrites, Electronic Ceramics, Piezo Electric Elements and Microwave Components.

CEL has been the pioneer in the country in the areas of Solar Photovoltaics, Ferrites and Piezo-Ceramics. Today, it enjoys the international status of being the fourth largest producer of Single Crystalline Silicon Solar Cells in the world.

2. PERFORMANCE IN 1992-93

2.1 Operating Results

The details of division-wise production and sales achieved during the year as compared to the previous year are given below:

	1991-92 (Rs. in lakhs)	1992-93 (Rs. in lakhs)	Increase/ Decrease
Production	3952	4975	(+) 26%
Sales	3976	4691	(+) 18%

Actual production achieved has just met the target of Rs. 50 crores, whereas the sales was slightly lower (by 6%) than the target of Rs. 50 crores.

As a result of this excellent performance, the Company was able to achieve a net profit of Rs. 3.4 crores after charging depreciation, interest and prior period adjustments.

2.2 Highlights of Operations:

2.2.1 Solar Photovoltaics (SPV)

In the Solar Photovoltaics Group, 1250 KWp of solar cells were produced, which is the maximum production achieved as yet, far in excess of the 939 KWp produced last year. A total of 9500 SPV Power Sources were supplied to DOT for its Rural Telecommunication Network, thus, bringing the total number of these systems supplied by the Company so far to about 22000. 22 Nos. of SPV Power Sources for Very Low Power TV Transmitters (VLPT) (at a total value of Rs. 1.8 crores) were supplied to Doordarshan against their order received earlier in the year. CEL also received during the year orders for 10 sets of Solar Refrigerators from UNICEF, Delhi. The first Defence order for 200 Nos. (total value Rs. 60 lakhs) of Foldable SPV Modules for charging batteries of the Portable Transceiver Sets.

Late in 1991-92, the Company had received a turnkey contract from the Non-Conventional Energy Development Agency (NEDA) of UP for the supply and installation of two 100 KW Power Plants - one at Kalyanpur in Aligarh District and the other at Sarai Sadi in Ghosi District of UP. These power plants had been conceived by UP-NEDA as part of their promotional efforts for wider applications and accetability of SPV power sources in rural areas. These are the first SPV Power Plants of 100 KWp rating in Asia. The power plant at Kalyanpur was almost completed before the end of the year, while work on second one in Ghosi district was started early in financial year 1993-94.

VII.B.1 View of SPV Array 100 KW Power Plant at Kalyanpur, Distt. Aligarh, U.P. for NEDA

A significant development of the year was the Company manufacturing, supplying, installing & commissioning in a record time of 8 weeks, a 10 KWp Power Plant at the MS Swaminathan Research Foundation, Taramani Complex, Madras. The Research Foundation was founded with the objective to develop environmentally friendly and ecologically safe systems on a sustainable basis. The SPV power plant owes its origin to the foundation, deciding accordingly to use pollution-free SPV Power Sources to provide continuous power particularly for critical areas of the Research Foundation, such as the gene bank and some biological laboratories. The Company also exported special battery chargers using light weight foldable SPV modules to Bangladesh.

2.2.2 Systems Group

The highlight of the operations of the Systems Group was the successful production and supply to DOT of the targeted 9000 charge controllers for the SPV Power Systems for Rural Telecom. In addition, another 450 charge controllers were supplied to various other customers. There was a substantial short fall (Rs. 292) lakhs in production and Rs. 366 lakhs in sales) of Cathodic Protection products from the oil companies and Block Proving Electronic Systems from the Railways. This was mainly due to non-receipt of projected orders for Cathodic Protection Systems and the delay in the appropriate railway agency providing the safety clearance for the Block Proving System. The safety clearance for the introduction of the CEL's Block Proving System in the Jhansi - Bina Section of Central Railways was received only in the first week of April, 1993.

2.2.3 Components Group

The highlight of the operations of the Component Group was 15000 PZT Electronic Systems (value Rs. 225 lakhs) were supplied to an Ordnance Factory against their first large order received during the year. This achievement was the culmination of sustained efforts undertaken by the Company over the last 6 to 8 years to have extensive field trials undertaken by the concerned Defence Service completed satisfactorily and to secure a commercial order thereafter. It is expected that now there would be recurring requirements of this product from the concerned Ordinance Factory. The Microwave Electronics Division could only achieve a production of Rs. 26.5 lakhs and a sales of Rs. 3.5 lakhs against their target of Rs. 100 lakhs and Rs. 95 lakhs respectively. This was essentially due to certain technical problems coming up in the production of the Phase Shifters being made in the Division. Another contributory factor to the above short fall in production and sales was the fact that a sizeable quantum of Phase Shifters planned for the year could not be produced due to the non-finalisation of the order by DRDO. The production and supply of the X-band Phase Shifters being worked on during the year against the order already in hand.

3. OTHER HIGHLIGHTS OF 1992-93

3.1 Visits of Important Dignitaries:

The year witnessed a large number of VIPs visiting the Company particularly the SPV Plant. These included foreign delegations such as those from Syria, Malawi, Senegal, Algeria and Philippines and many senior policy makers and officials from the Government of India.

The crowning point of the year was the visit of Prime Minister, Shri P.V. Narasimha Rao to the Company's SPV cell & module plants and demonstration area on September 25, 1993. He also had

VII.B.2. Shri P.V. Narasimha Rao, Prime Minister of India watching a Demonstration of a Solar Pump at CEL

VIII.B.3 Signing of MOU Between DSIR and CEL for 1992-93 at CSIR

discussions with the PV and Pump manufacturers in the country at CEL on that day. Shri S. Krishna Kumar, Minister of State for Non-Conventional Energy Sources visited on March 9, 1993. This was followed by the memorable visit of H.E. Julius Nyerere, former President of Tanzania on 31 March, 1993.

3.2 M.O.U With the Government for 1992-93

The Company signed for the first time an MOU with the Government for 1992-93. The MOU was prepared in February, 1992 and after clearance by the High Level Committee constituted by the DPE was signed on 7th May, 1992 by Dr. S.K. Joshi, Secretary, DSIR on behalf of the Government of India and Brig. M.R. Narayanan, CMD, CEL for the Company. The MOU production target was set at Rs. 42 crores.

However, in the light of achieving close to Rs. 40 crores production/sales during 1991-92, the Company set itself a revised production target of Rs. 50 crores against which it achieved Rs. 49.75 crores as already reported. On the basis of the Composite Scoring based on the provisional figures provided to DPE in April, 1993, the Company has been rated as "Excellent" by DPE.

3.3 33 KV Feeder Line

In view of the total load of the Company exceeding 1000 KVA and also to obtain continuous/uninterrupted power supply, the Company decided to go in for the installation of a 33 KVA Feeder Line along with the necessary transformers etc. This line draws power from the existing 33 KVA feeder line to M/s Uptron which passes close to CEL. With positive support of the Chairman, UPSEB and Principal Secretary of the UP Government, acceptance of UPSEB was finally received on 11 January, 1993 and the 33 KVA Sub-Station in CEL became operational on April 1, 1993. The total expenditure towards the 33 KV Sub-station has been met from the funds made available under the 'Plant Modernisation' Project through the (I&M) plan funds of DSIR.

3.4 Promotion Policy

The Company effected a revised/new promotion policy for the executives of the Company after revising the promotion policy which was in existence over the past decade or more. The new promotion policy was brought into operation w.e.f. April 1, 1992 after the same had been discussed with the senior management & also with both the Executives and Officers' Associations. The new Promotion Policy has a number of superior features over the existing one.

3.5 Technology Transfer

On March 23, 1993, the Company signed a Memorandum of Understanding (MOU) for the transfer of solar cell technology for the establishment of a cell production plant with a capacity of 1 MWp/annum by a new company M/s. Rajasthan Solar Energy and Electronics Limited (RASEL), Jaipur jointly promoted by Instrumentations Limited (IL), Kota, Rajasthan State Industrial Development & Investment Corpn., Rajasthan Electronics & Instruments Ltd. (REIL), Jaipur and CEL.

4. ROLE IN NATIONAL TECHNOLOGY MISSIONS

The Company's SPV group supplied about 9500 SPV Power Sources (value at Rs. 20 crores) for the DOT's VIIF Rural Telecommunication Network. Special Refrigerators meeting WHO specifications are being developed for operation on SPV power. These refrigerators are required for storing vaccines in village health centres as part of the National Mission on Immunization.

5. DESIGN AND DEVELOPMENT

In the SPV area, development activities continued for improvement in the existing process for the production of silicon solar cells using the Screen Printed Technology (SPT) currently being used by CEL in its Solar Cell & Module Plants. The process improvements already developed at laboratory level were consolidated in the existing solar cell plant for obtaining an average efficiency of solar cells (in module) of 13% on a consistent basis in commercial volume production. Parallelly, further activities were initiated including the procurement of necessary production equipment, for effecting further process improvements to take the efficiencies of the solar cells from the Company's SPV Plant to the level of 14% by March, 1994.

The special R&D team of the Solar Photovoltaic Group continued its activities on the development of a production-worthy process for Ultra High Efficiency Solar Cells based on the laboratory knowhow from University of New South Wales, Australia. While the activities during the year were confined to visits of CEL engineers to UNSW, ordering of needed equipment and certain laboratory trials, the major activity is scheduled for year (1993-94) when the Bench Scale Facility for UHE Solar Cells is expected to be established.

In the area of development of New Solar Photovoltaic Application Systems, the major activity was the development of improved models of Surface Centrifugal Pumps being used in SPV water pumping system. The Company continued to work in close association with M/s Kirloskar Bros. Ltd. (KBL), Dewas who are developing new models of DC pumps of higher efficiency and increased head (upto 20 meters). Complete test beds including required SPV Array have been set-up one at KBL, Dewas Campus and the other at CEL. The latter test bed for testing in an open well, simulating actual rural conditions, was demonstrated to the Prime Minister during his visit to CEL in September, 1993. Further activities in this area included development of a new foldable module of water pumping systems, evaluation of an indigenous passive tracking system, special Charge Controllers for working with SPV operated refrigerator systems and improvement in battery chargers using special foldable modules for Defence applications. SPV systems were successfully developed with special inverter to take on inductive loads for powering Diesel and Petrol dispensing units and these are being deployed in large nos. against orders from the Indian Oil Corporation.

In the process of executing the above orders CEL has come up with a modular 3.3 KWp Power Generator Unit (with a 3.5 KWp Electronic Control Unit - Charge Controller, and Inverter with Phase Synchronisation facility) and a 25 KWp Power Plant with appropriate Power Conditioning Unit (PCU). These 3.3 KW/25 KW units will form the building blocks for the smaller capacity (around 10 KWp) and larger capacity (100 KWp) SPV power plants. The PCU for the above power generator/plant has been developed and manufactured to our specifications by M/s DB Electronics, Pune at a cost far lower than the FOB price of foreign equivalent.

Power plants based on such 3.3 KW/25 KW units as basic building blocks, will be standard

features of the Company's SPV operations in the near future.

In the Railway Electronics area, the Company continued its development activities on a number of products for Signalling and Safety Applications in the Railways and prototypes of these systems (such as Solid State Interlocking System, Data Logger System etc.) were made ready/offered for approval by RDSO, Lucknow.

Special RM-8 Cores with high AL-values for the new range of High Permeability Ferrites were successfully developed by the R&D group in the Ferrites Division, were qualified by ITI for their use and initial trial orders received from ITI for about 5000 nos. of these cores. The Ferrites Division continued to improve the technology for the production of Microwave Ferrite Rods and Yokes required for the Phase Shifters being produced by the Company against orders from the Defence.

CEL collaborated with the Solid State Physics Laboratory (SPL), Delhi for the development of suitable material for Microwave Ferrite Rods for Phase Shifters. The knowhow transfer was initiated froms SPL to CEL after which 1000 numbers of the Ferrite Rods were produced for the Phase Shifters. The modified design of the Hybrid Driver for the C-Band earlier developed and used, was taken up with GCEL, Baroda who were able to supply some quantities of X-band Hybrid Drivers by the year end. With these development actions, the entire X-band Phase Shifter order was expected to be supplied to DRDO by October, 1993.

6. WELFARE OF WEAKER SECTIONS

All Government directives relating to the Reserved Categories such as, Scheduled Castes, Scheduled Tribes, Physically Handicapped, Ex-Servicemen etc. continued to be implemented during the year. As on 31 March 1993, the total number of employees in these categories was 254 which represents about 27% of the total strength of the Company.

7. USE OF HINDI

In accordance with the guidelines on the progressive use of Hindi, the various sections of the Company were encouraged to use Hindi in both internal and external correspondence and also in the in-house training programmes for employees.

8. INDUSTRIAL RELATIONS AND HUMAN RESOURCES DEVELOPMENT

The Company had fairly cordial industrial relation during the year as a result of the Management's continuous dialogue with the recognised Workers Union and with the Officers/ Executives Associations.

Employees participation in management continued through the forums of Shop Level and Plant Level Committees constituted for the purpose. 13 Meetings of the Shop Floor Committees and two of the Plant Level Committees of the different divisions of the Company were held during the year as against 26 and 3 respectively in the previous year.

9. REVISED PLAN FOR 1993-94

The Revised Plan targets for 1993-94 are Rs. 60 crores of Production and Rs. 58 crores for Sales. These are also the MOU targets for 1993-94.

VIII. ADMINISTRATION

1. ADMINISTRATION

The Department of Scientific & Industrial Research was created through a Presidential Notification of January, 1985. The Administrative functions of recruitment of personnel, provision of general facilities, redressal of grievances of employees, Parliament work and use of Hindi are being performed by the Department of Scientific & Industrial Research. Other house-keeping jobs are being performed by Department of Science & Technology for both the Departments.

2. PROMOTION OF HINDI

DSIR made the following efforts for the use and promotion of Hindi in the official work and implementation of official language policy of the Government:

(a) The meetings of the Official Language Implementation Committee were held regularly in DSIR.

(b) The Quarterly Progress Report regarding use of Hindi in the Department was sent to the Department of Official Language regularly and in time.

(c) Under Hindi Teaching Scheme, non-Hindi knowing employees of the Department were nominated for Prabodh, Praveen and Pragya courses. Employees of the Department were also nominated for training in Hindi Stenography, Hindi Typing and Hindi Computer.

(d) In April, 1991 Committee of Parliament on Official Language inspected this Department. The assurances given to the Committee have been fulfilled.

(e) From 13th to 20th September, 1993 combined Hindi Week was observed by the Department of Science & Technology and Department of Science & Industrial Research at Technology Bhavan.

To promote the use of Hindi in the official work, essay, noting and drafting and speech competitions were organised in the Department during this period and offiecers and officials of the Department were given prizes. Three sections of the Department were awarded cash awards for doing their official work originally in Hindi.

(f) During 1-3 September, 1993 Hindi Workshop was organised for encouraging the Officers/ Employees who possess the working knowledge of Hindi for using Hindi in their official work.

(g) Hindi version of Orders, Notifications, Literature of In-house R&D in Industry, Standard Drafts, Annual Report and Performance Budget were provided.

(h) To review the progress of the use of Hindi, the Subordinate Office Central Electronics Ltd., Sahibadad was inspected during the period.

The sanctioned staff strength in the different groups in the Department of Scientific & Industrial Research as on 1.3.1994 is given below:

	Number of Employees			
	General	SC	ST	Total
Group A (Gazetted)	31	3	-	34
Group B (Gazetted)	8	1	-	9
Group B (Non-Gazetted)	16	1	-	17
Group C (Non-Gazetted)	13	3	2	18
Group D (Non-Gazetted)	10	1	-	11

ANNEXURES

ANNEXURE II.1

LIST OF CSIR ESTABLISHMENTS

Central Building Research Institute (CBRI), Roorkee

Centre for Biochemicals Technology (CBT), Delhi

Centre for Cellular and Molecular Biology (CCMB), Hyderabad

Central Drug Research Institute (CDRI), Lucknow

Central Electrochemical Research Institute (CECRI), Karaikudi

Central Electronics Engineering Research Institute (CEERI), Pilani

Central Fuel Research Institute (CFRI), Dhanbad

Central Food Technological Research Institute (CFTRI), Mysore

Central Glass and Ceramic Research Institute (CGCRI), Calcutta

Central Institute of Medical and Aromatic Plants (CIMAP), Lucknow

Central Leather Research Institute (CLRI), Madras

Central Mechanical Engineering Research Institute (CMERI), Durgapur

Central Mining Research Station (CMRS), Dhanbad

Central Road Research Institute (CRRI), Delhi

Central Scientific Instruments Organization (CSIO), Chandigarh

Central Salt and Marine Chemicals Research Institute (CSMCRI), Bhavnagar

Indian Institute of Chemical Biology (IICB), Calcutta

Indian Institute of Chemical Technology (IICT), Hyderabad

Indian Institute of Petroleum (IIP), Dehradun

Institute of Microbial Technology (IMT), Chandigarh

Indian National Scientific Documentation Centre (INSDOC), New Delhi

Industrial Toxicology Research Centre (ITRC), Lucknow

National Aerospace Laboratories (NAL), Bangalore

National Botanical Research Institute (NBRI), Lucknow

National Chemical Laboratory (NCL), Pune

National Environmental Engineering Research Institute (NEERI), Nagpur

National Geophysical Research Institute (NGRI), Hyderabad

National Institute of Oceanography (NIO), Goa

National Institute of Science Technology and Development Studies (NISTADS), New Delhi

National Metallurgical Laboratory (NML), Jamshedpur

National Physical Laboratory (NPL), New Delhi

CSIR Complex Palampur (CSIR-CX-PAL), Palampur

Publications & Information Directorate (PID), New Delhi

Regional Research Laboratory (RRL-BHO), Bhopal

Regional Research Laboratory (RRL-BHU), Bhubaneswar

Regional Research Laboratory (RRL-JMU), Jammu

Regional Research Laboratory (RRL-JOR), Jorhat

Regional Research Laboratory (RRL-TRI), Thiruvananthapuram

Structural Engineering Research Centre (SERC-G), Ghaziabad

Structural Engineering Research Centre (SERC-M), Madras

ANNEXURE III.A.1

STATEMENT OF RECOGNITION OF IN-HOUSE R&D UNITS

Month		Receipt	Cumulative Receipt	Disposal	Cumulative Disposal	Cumulative Pedency at the end of month
December	1992					17
January	1993	4	4	8	8	13
February	1993	10	14	7	15	16
March	1993	13	27	8	23	21
April	1993	9	36	5	28	25
May	1993	7	43	14	42	18
June	1993	9	52	8	50	19
July	1993	6	58	8	58	17
August	1993	4	62	13	64	8
September	1993	9	71	5	69	12
October	1993	1	72	5	74	8
November	1993	8	80	5	79	11
December	1993	12	92	2	81	21

ANNEXURE III.A.2

STATEMENT OF RENEWAL OF RCOGNITION BEYOND 31.03.1993

Month		Receipt	Cumulative Receipt	Renewals granted/ rejected	Cumulative Renewals granted	Cumulative Pedency at the end of month
December	1992	137	137	-	-	137
January	1993	110	247	-	-	247
February	1993	20	267	-	-	267
March	1993	24	291	82	82	209
April	1993	16	307	129	211	96
May	1993	9	316	38	249	67
June	1993	5	321	46	295	26
July	1993	-	-	14	309	12
August	1993	-	-	12	321	Nil
		321		321		

LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING ANNUAL R&D EXPENDITURE MORE THAN RS. 100 LAKHS

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
1	Advanced Radio Masts Ltd.	163
2	Alembic Chemicals Works Company Limited	194
3	Altos India Limited	187
4	Asea Brown Boveri Limited	165
5	Ashok Leyland Limited	810
6	Asian Paints (India) Limited	204
7	Assam Electronics Development Corporation Ltd.	108
8	Associated Cement Co. Ltd.	481
9	Atic Industries Limited	105
10	Atul Products Limited, The	127
11	BPL Sytems & Projects Limited	213
12	Bajaj Auto Limited	1216
13	Bajaj Tempo Limited	606
14	Balmer Lawrie & Company Ltd.	123
15	Baroda Rayon Corporation Limited., The	151
16	Bata India Limited	144
17	Bharat Earth Movers Limited	1023
18	Bharat Electronics Limited	3988
19	Bharat Heavy Electricals Ltd. (Pollution Control Research Institute, Hardwar)	2842
20	Bharat Heavy Electricals Ltd. (Corporate R&D Centre, Hyderabad)	4250
21	Bharat Heavy Electricals Ltd. (Ranipur, Hardwar)	184
22	Boots Pharmaceuticals Ltd.	194
23	Brakes India Ltd.	298
24	Brimco Plastic Machinery Pvt. Ltd.	150
25	Bush Boake Allen (India) Limited	115
26	CMC Limited	740
27	Cable Corporation of India Ltd.	434
28	Cadila Laboratories Limited	380
29	Ceat Limited	157
30	Central Electronics Limited	115

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
31	Central Mine Planning & Design Inst. Ltd.	388
32	Cheminor Drugs Limited	158
33	Cibatual Limited	145
34	Cipla Limited	554
35	Cochin Refineries Ltd.	120
36	Colour-Chem Limited	201
37	Crompton Greaves Limited	632
38	Dhampur Sugar Mills Limited, The	290
39	Dr. Reddy's Laboratories Ltd.	103
40	Dunlop India Limited	355
41	E.I.D. Parry (India) Limited	181
42	Electronics Corp. of India Ltd.	446
43	Electronics Research & Development Centre	437
44	Engineers India Limited	447
45	Escorts Limited	105
46	Excel Industries Limited	166
47	Gharda Chemicals Limited	286
48	Glaxo India Limited	169
49	Godrej & Boyce Mfg. Company Limited	574
50	Godrej Soaps Limited	176
51	Goodlass Nerolac Paints Limited	136
52	Grindwell Norton Limited	112
53	Gujarat State Fertilizers Company Limited	503
54	HMT Limited (Watch Directorate)	244
55	HMT Limited R&D Centre (Metal Cutting & CNC Unit)	1498
56	Haryana State Electronics Development Corporation Limited	191
57	Hindustan Aeronautics Limited (Corporate office, Bangalore)	10237
58	Hindustan Aeronautics Limited, Nasik	314
59	Hindustan Aeronautics Limited (Design & Engg. Department)	212
60	Hindustan Antibiotics Limited	200
61	Hindustan Ciba-Geigy Limited	277
62	Hindustan Copper Limited	102
63	Hindustan Lever Limited	471

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
64	Hindustan Motors Limited (Auto Division)	132
65	Hinsustan Photo Films Manufacturing Company Ltd.	163
66	Hindsutan Teleprinters Limited	132
67	*Hindustan Zinc Limited*	160
68	Hoechst India Limited	880
69	ICI India Limited	253
70	ICI India Limited (Explosives & Fertilisers Division)	209
71	IDL Chemicals Limited	113
72	IOL Limited	120
73	ITC Limited	113
74	ITC Ltd. (International Business Div.)	247
75	Indian Aluminium Company Limited	290
76	Indian Oil Corporation Limited	1580
77	Indian Petrochemicals Corporation Limited	1856
78	Indian Telephone Industries Limited	2803
79	Indin Telephone Industries Limited	667
80	Indian Telephone Industries Ltd.	154
81	Indo-American Hybrid Seeds	110
82	J.K. Industries Limited	160
83	J.K. Synthetics Limited	255
84	Johnson & Johnson Limited	158
85	Jyoti Ceramic Industries Ltd.	179
86	Jyoti Limited	147
87	Kegg Farms Private Limited	152
88	Kelvinator of India Limited	255
89	Khandelwal Ferro Alloys Ltd.	229
90	Kirloskar Brothers Limited	314
91	Kirloskar Cummins Limited	359
92	Kirloskar Oil Engines Limited	123
93	Kolhapur Steel Limited	879
94	L&T-McNeil Limited	190
95	Larsen & Toubro Limited	968
96	Laxmi Boilers (South) Pvt. Ltd.	185
97	Lubrizol Indian Limited	355
98	*Lucas-TVS Limited*	325

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
99	Lupin Laboratories Limited	765
100	Lupin Laboratories Limited	136
101	MRF Limited	883
102	Madras Refineries Limited	381
103	Maharashtra Hybrid Seeds Company Limited	239
104	Mahindra & Mahindra Limited (Tractor and Automotives Division)	277
105	Maruti Udyog Limited	239
106	Merind Limited	120
107	Modi Rubber Limited	101
108	Modi Xerox Limited	149
109	Motor Industries Co. Limited	695
110	Mysore Kirloskar Limited, The	281
111	National Mineral Development Corporation Ltd.	245
112	National Organic Chemical Industries Limited	476
113	National Rayon Corporation Limited, The	194
114	Neyveli Lignite Corporation Limited	121
115	Nirup Synchrome Limited	165
116	Oil & Natural Gas Commission (Keshava Deva Malaviya Institute)	523
117	Oil India Limited	203
118	Padmashri Dr. Vithalrao Vikhe Patel Sahakari Sakhar Karkhana Limited	317
119	Peico Electronics & Electricals Limited	524
120	Peico Electronics & Electricals Limited	147
121	Petrofils Co-Operative Limited	110
122	Pfizer Limited	132
123	Polyolefins Industries Limited	127
124	Premier Automobiles Limited	268
125	Premier Instruments & Controls Limited	126
126	Projects & Development India Limited	785
127	Punjab Communications Limited	763
128	Punjab Tractors Ltd.	307
129	Punjab Wireless Systems Ltd.	113
130	Rallis India Limited (Agro Chemical Division)	280
131	Ramco Industries Limited	113
132	Ranbaxy Laboratories Limited	534

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
133	Reliance Industries Limited	290
134	Sandoz (India) Ltd.	313
135	Sandvik Asia Limited	112
136	Semiconductor Complex Limited	871
137	Siemens India Limited	486
138	Southern Petrochemical Industries Corporation Ltd.	162
139	Southern Petrochemical Industries Corporation Ltd.	225
140	Steel Authority of India Limited (Bokaro Steel Plant)	237
141	Steel Authority of India Ltd. (R&D Centre for Iron & Steel)	3898
142	Steelsworth Limited	297
143	Sudarshan Chemicals Industries Limited	141
144	Tamil Nadu Dadha Pharmaceuticals Limited	153
145	Tata Chemicals Ltd	106
146	Tata Engineering & Locomotive Company Limited	2112
147	Tata Hydro-Electric Power Supply Company Limited, The	258
148	Tata Iron & Steel Company Ltd., The	808
149	Tata Sons Limited (Tata Consultancy Services)	175
150	Tata Tea Ltd.	282
151	Thermax Limited (Chemical, Computer & Engg. Div)	174
152	Venco Research & Breeding Farm Limited	131
153	Venkateshwara Research & Breeding Farm Limited	107
154	Vidyut Metallics Limited	310
155	Vikrant Tyres Limited	168
156	Widia (India) Limited	242
157	Wipro Infotech Limited	499
158	Wockhardt Limited	120
159	Zandu Pharmaceuticals Works Limited	102

ANNEXURE III.A.4

LIST OF IN-HOUSE R&D UNITS IN INDUSTRY REPORTING ANNUAL R&D EXPENDITURE IN THE RANGE OF RS. 25 LAKHS TO RS. 100 LAKHS

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
1	Advanced Micronic Devices Private Limited	48
2	Advani-Oerlikon Limited	39
3	Advani-Oerlikon Limited	30
4	Afco Industrial & Chemicals Limited	29
5	Alembic Glass Industries Ltd.	32
6	Alfa-Laval (India) Limited	65
7	Amar Dye Chem Ltd.	55
8	Ambalal Sarabhai Enterprises Limited	76
9	Amco Batteries Limited	48
10	Amphetronix Limited	41
11	Andhra Sugars Limted	41
12	Andrew Yule & Company Ltd.	46
13	Anil Starch Products Limited	35
14	Anupam Machine Tools Ltd.	45
15	Apollo Tyres Limited	82
16	Applied Electro Magnetics Private Limited	65
17	Applied Electronics Limited	68
18	Armour Chemicals Limited	27
19	Arvind Mills Ltd. (Electronics Division)	29
20	Arvind Mills Ltd.,	29
21	Astra-IDL Limited	34
22	Audco India Limited	41
23	Automatic Electric Limited	30
24	Autometers Ltd.	26
25	BASF India Limited	89
26	BPL - INDIA	43
27	Bajaj Electricals Ltd.	29
28	Bakelite Hylam Limited	46
29	Ballarpur Industries Limited	26
30	Basik Breeders Pvt. Ltd.	80
31	Bayer India Limited	71

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
32	Bengal Immunity Limited	26
33	Berger Paints India Limited	50
34	Bharat Aluminium Company Ltd.	41
35	Bharat Dyanamics Limited	84
36	Bharat Forge Limited	26
37	Bharat Heavy Electricals Ltd. (Electroporcelein Division, Bangalore)	40
38	Bharat Heavy Electricals Ltd. (Trichi & Ranipet)	40
39	Bharat Heavy Plate & Vessels Limited	64
40	Bharat Refractories Limited	26
41	Bharat Starch & Chemicals Ltd.	26
42	Bharti Telecom Limited	25
43	Bicycle & Sewing Machine Research & Development Centres	65
44	Blue Star Limited	45
45	Bomabay Oil Industries Limited	25
46	Bombay Paints Limited	27
47	Bombay Tyres International Ltd.	37
48	Britannia Industries Ltd.	45
49	Burroughs Wellcome (India) Ltd.	76
50	Cadbury India Limited	85
51	Camphor & Allied Products Limited	92
52	Carborundum Universal Limited	78
53	Castrol India Ltd.	35
54	Catvision Products Ltd.	31
55	Ceat Limited	28
56	Century Textiles Industries Limited, The	35
57	Chemfab Alkalis Limited	71
58	Chemicals & Plastics Indian Ltd.	34
59	Chloride Industries Limited	79
60	Citurgia Biochemicals Limited	32
61	Coats of India Limited	42
62	Concept Pharmaceuticals Ltd.	37
63	Continental Device India Limited	37
64	Control & Switchgear Co. Ltd.	36
65	Cynamid India Limited	55

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
66	DCM Data Products	89
67	DCM Shriram Industries Limited	26
68	DCM Toyota Limited	28
69	Datapro Electronics Pvt Ltd.	29
70	Daurala Sugar Works	31
71	Dey's Medical Stores (Mfg) Ltd.	60
72	Dharamsi Morarji Chemical Company Limited, The	57
73	Digital Electronics Limited	25
74	Digital Equipment (India) Limited	34
75	Divi's Research Centre Pvt. Ltd.	40
76	Dr. Beck & Company (India) Ltd.	39
77	Drachem Speciality Chemicals Ltd.	44
78	Duke Arnics Electronics Pvt. Ltd.	53
79	Duphar Interfran Limited	52
80	ESAB India Ltd.	27
81	EWAC Alloys Limited	38
82	East India Pharmaceutical Works Limited	44
83	Elcot Power Controls Ltd.	66
84	Electronic Research Pvt. Ltd.	50
85	Electronica Machine Tools P. Ltd.	62
86	Elgi Tyre & Tread Limited	52
87	Engel India Machines & Tools Limited (1987)	69
88	English Electric Company of India Limited	37
89	English Indian Clays Limited	40
90	Escorts Tractors Limited	52
91	Eskayef Limited	97
92	Eternit Everest Ltd.	57
93	Ethnor Limited	37
94	Eureka Forbes Limited	57
95	FDC Limited	61
96	Fenner (India) Ltd.	44
97	Ferro Alloys Corporation Ltd.	73
98	Fertilizers & Chemicals Travancore Limited	38
99	Flakt India Limited	32
100	Flex Industries Ltd.	50

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
101	Fort Gloster Industries Limited (Cable Division)	74
102	Franco-Indian Pharmaceuticals Privated Ltd.	35
103	Gajra Gears Private Limited	28
104	Gammon India Limited	25
105	Garware Paints Limited	31
106	Garware Plastics & Polyester Limited	54
107	Garware Wall Ropes Limited	87
108	Goodricke Group Ltd.	45
109	Graphite India Limited	46
110	Grauer & Weil (India) Limited	64
111	Greaves Foseco Limited	88
112	Guest Keen Williams Limited	42
113	Gujarat Alkalies & Chemicals Limited	59
114	HBL Aircraft Batteries Ltd.	40
115	HMT Limited	47
116	HMT Limited (Tractor Business Group)	96
117	Haryana Steel & Alloys Ltd.	37
118	Hawkins Cookers Limited	51
119	Herdillia Chemicals Limited	49
120	Hico Products Limited	73
121	High Energy Batteries (India) Limited	28
122	Hindalco Industries Limited Formerly Hindustan Aluminium Corpn. Ltd.	31
123	Hindoostan Spinning & Weaving Mills Limited, The	36
124	Hindustan Cables Limited	82
125	Hindustan Insecticides Limited	74
126	Hindustan Motors Limited (Earthmoving Equipment Division)	86
127	Hindustan Organic Chemicals Limited	68
128	Hutty Gold Mines Company Limited	25
129	Hyderabad Allwyn Limited	70
130	Hyderabad Industries Limited	85
131	IBP Company Limited (Chemical Division)	47
132	IBP Company Limited (Engineering Division)	31
133	ICI India Limited (Fibres Division)	59
134	IPCA Laboratories Pvt. Ltd.	46
135	ITC Limited (Agri Business Division)	46

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
136	ITI Equatorial Satcom Limited	51
137	Incab Industries Limited	67
138	Indchem ATL Limited	41
139	India Foils Ltd.	36
140	Indian Drugs & Pharmaceuticals Limited	67
141	Indian Dyestuff Industries Limited	53
142	Indian Farmers Fertilizers Cooperative Limited	55
143	Indian Hume Pipe Company Ltd., The	33
144	Indian Lead (P) Ltd.	38
145	Indian Organic Chemicals Ltd.	99
146	Indian Rare Earths Limited	40
147	Indofil Chemicals Company	31
148	Infar (India) Limited	92
149	Instrumentation Limited	77
150	International Computers Indian Manufacturers Limited	67
151	Ion Exchange (India) Limited	75
152	J. Mitra & Bros. Private Limited	26
153	Jamna Auto Industries	37
154	Jaysynth Dyechem Ltd	29
155	K.C.P. Limited	58
156	K.E.C. International Limited	30
157	K.G. Khosla Compressors Limited	43
158	KSB Pumps Limited	28
159	Kasila Farms Private Limited	91
160	Keltron Component Complex Ltd.	48
161	Kilburn Engineering Ltd.	40
162	Kinetic Engineering Limited	89
163	Kirloskar Brothers Limited	38
164	Kirloskar Electric Company Ltd.	88
165	Kirloskar Pneumatic Co. Ltd.	82
166	Klockner Windsor (India) Ltd.	74
167	L&T Gould Limited	37
168	Lakme Limited	27
169	Lakshmi Machine Works Limited	74
170	Lectrotek Systems (Pune) Private Limited	25
171	Li-Taka Pharmaceuticals Ltd.	28

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
172	Lona Industries Pvt. Ltd.	49
173	Lyka Labs Private Limited	39
174	M.P. Electricity Board (R&D Cell)	64
175	Machine Tools Aids and Reconditioning	27
176	Macmet India Private Limited (Simulation Systems Division)	49
177	Maftlal Fine Spinning & Mfg. Co. Ltd., The (Textile Div.)	28
178	Maharashtra Electronics Corporation Ltd.	58
179	Maharashtra Electronics Corporation Ltd. (Strategic Development Division)	60
180	*Mahendra Hybrid Company Private Limited*	33
181	Malhotra Shaving Products Ltd.	33
182	Malladi Drugs & Pharamecuticals Limited	48
183	Marine & Communications Electronics (India) Limited	61
184	Max India Ltd.	87
185	Mc Dowell & Company Limited	43
186	Metallurgical & Egineering Consultants (India) Limited	80
187	*Mirc Electronics Ltd.*	66
188	Modern Malleable Casting Works Limited,	35
189	Modern Woollens Limited	35
190	Modipon Limited	34
191	Monica Electronics Limited (Onida Corporate Office)	26
192	Montari Industries Limited	69
193	Mukand Limited	76
194	*Mytimasters' Engineering Private Limited*	37
195	NGEF Limited	31
196	Nalco Chemicals India Ltd.	30
197	National Peroxide Limited	55
198	National Radio & Electronics Company Limited, The	73
199	National Telecom of India Ltd.	45
200	National Textile Corporation (APKK&M) Ltd.	47
201	National Textile Corporation (Tamil Nadu & Pondichery) Ltd.	30
202	National Thermal Power Corporation Limited	49
203	Navdeep Chemicals Private Limited	31
204	Nepa Ltd., The	26
205	Network Limited	77
206	New Shorrock Mills	44

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
207	Nippon Denro Ispat Limited	38
208	Nirlon Limited	28
209	Nirmal Overseas Pvt. Ltd.	26
210	Northern Minerals Ltd.	28
211	Nuchem Plastics Limited	29
212	OMC Computers Ltd.	72
213	Orissa Industries Limited	33
214	Otis Elevator Co. (India) Ltd.	74
215	PSI Data Systems Limited	25
216	Pace Elcot Automation Ltd.	38
217	Parke-Davis (India) Limited	42
218	Peico Electronics & Electricals Limited	94
219	Penam Laboratories Ltd.	36
220	Pennwalt India Limited	25
221	Pesticides India Limited	28
222	Phillips Carbon Black Limited	54
223	Pidilite Industries Ltd.	40
224	Polychem Limited	32
225	Porrits & Spencer (Asia) Ltd.	28
226	Praga Tools Limited	45
227	Proagro Seed Company Limited	78
228	Process & Products Development Centre	36
229	Purolator India Ltd.	28
230	Ralliwolf Limited	41
231	Rane (Madras) Limited	77
232	Rane Brake Linings Limited	38
233	Raptakos Brett & Co.Ltd.	33
234	Rashtriya Chemical & Fertilizers Limited	72
235	Raymond Woollen Mills Ltd., The	75
236	Reckitt & Colman of India Ltd.	66
237	Reliance Industries Ltd.	77
238	Renewable Energy Systems Private Limited	57
239	Rhone-Poulenc (India) Ltd.	29
240	Rosemount (India) Ltd.	30
241	Ruston & Hornsby (India) Ltd.	38
242	S.A.J. Froude Test Plant Private Limited	36

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
243	S.D. Technical Services Pvt. Ltd.	33
244	S.S. Clonetech Private Ltd.	34
245	SRF Limited	49
246	Sakthi Sugars Limited	68
247	Sapana Polyware Pvt. Ltd.	58
248	Sarabhai Electronics Ltd (ORG System Division)	55
249	Sealol Hindustan Limited	51
250	Searle (India) Limited	66
251	Shalimar Paints Limited	36
252	Shaw Wallace & Company Ltd.	95
253	Shriram Refrigeration Industries Limited	33
254	Shyam Antenna Electronic Pvt. Ltd.	69
255	Sieflex Automation & Robotics Co.	51
256	Simpson & Company Limited	37
257	Siris Limited	46
258	Smithkline Beecham Consumer Brands Ltd.	31
259	Standard Industries Limited	44
260	Standard Industries Limited	41
261	Standard Organics Ltd.	29
262	Sun Pharmaceutical Industries	82
263	Sundram Clayton Limited	45
264	Sundram-Abex Limited	27
265	Swadeshi Polytex Limited	30
266	T.T.K. Pharma Pvt. Ltd.	27
267	TIL Limited	45
268	TVS Electronics Ltd.	50
269	TVS-Suzuki Limited	80
270	Tamil Nadu Electricity Board	42
271	Tamil Nadu Newsprint and Papers Limited	78
272	Tamil Nadu Petroproducts Ltd	53
273	Tata Elxsi (India) Limited	64
274	Tata Oil Mills Co. Ltd.	61
275	Tata Refractories Limited	79
276	Tata Telecom Limited	38
277	Technofour	83
278	Textool Company Limited	77

Sl. No.	Name of the firm	R&D Expenditure (Rs. in Lakhs)
279	Titan Watches Limited	29
280	Titanium Equipment & Anode Manufacturing Company Limited	35
281	Tractors & Farm Equipment Ltd.	45
282	Transpek Industry Limited	32
283	Travancore Titanium Products Ltd.	34
284	U.S. Vitamin (India) Limited	30
285	Ugar Sugar Works Limited, The	38
286	Uni-Compine Limited	30
287	Unichem Laboratories Limited	61
288	Unique Pharmaceuticals Laboratories Private Ltd.	27
289	United Catalysts India Ltd.	34
290	United Phosphorous Ltd.	42
291	Universal Cables Ltd.	59
292	Uptron India Limited	38
293	Usha Telehoist Limited	26
294	Vam Organic Chemicals Limited	43
295	Vintek RF Products Pvt. Ltd.	93
296	Voltas Limited	29
297	Voltas Ltd. (Chemicals Plant)	29
298	Walchandnagar Industries Limited (Copper Group)	74
299	Webel Telematik Limited	64
300	Webfil Limited	30
301	West Bengal Electronic Industry Development Corporation Limited	27
302	Wheels India Limited	42
303	Wires and Fabriks (S.A.) Ltd.	26
304	Wyeth Laboratories Limited	53

LIST OF SCIENTIFIC AND INDUSTRIAL RESEARCH ORAGANISATIONS APPROVED DURING 1993*

Agrcultural, Natural & Applied and Medical Sciences

S.No.	Name of the Institution	Approval Valid upto
1	Aspee Research Institute, Bombay	31.03.95
2	Cancer Hospital and Research Institute, Gwalior	31.03.95
3	Centre for Liquid Crystal Research, Bangalore	31.03.95
4	Christian Medical College, Ludhiana	31.03.95
5	Dalmia Centre for Biotechnology, N. Delhi	31.03.95
6	Delhi Library Network, New Delhi	31.03.95
7	*Dharmashila Caner Foundation and Research* Centre, New Delhi	31.03.95
8	Diabetes Foundation of India, New Delhi	31.03.95
9	Electronic Braille Foundation, Punc	31.03.95
10	Footwear Design & Development Institute, Noida	31.03.95
11	HAIC Agro Research & Development Centre, Panchkula	31.03.95
12	Hari Shankar Singhania Elastomer, and Tyre Research Institute, Rajasmand	31.03.95
13	Hormone Research Foundation, New Delhi	31.03.94
14	Indian Health Organisation, Bombay	31.03.95
15	Indian Institute of Technology, Kharagpur	31.03.95
16	Indian Scoiety of Bio Sciences and Environment, Kanpur	31.03.95
17	Indo French Centre for the Promotion of Advance Research, New Delhi	31.03.95
18	Institute of Cardiology & Research Centre, Ahmedabad	31.03.95
19	Institution of Electronics and Telecommunication Engineers (The), New Delhi	31.03.95
20	Khorakiwala Foundation, Delhi	31.03.95
21	Kundalini Research Association International (Indian Chapter, Delhi)	31.03.94
22	LPG Equipment Research Centre	31.03.95
23	Mining Geological and Metallurgical, Institute of India, Calcutta	31.03.95
24	Naoroji Godrej Centre for Plant Research, Bombay	31.03.95

S.No.	Name of the Institution	Approval Valid upto
25	National Institute of Scientific Information and Research, Lucknow	31.03.95
26	Post Graduate Institute of Medical Education & Research, Chandigarh	31.03.95
27	Sanjay Gandhi Accident Hospital and Research Institute, Bangalore	
28	Shri Mukandi Lal Memorial Foundation for Heart and Medical Care, New Delhi	31.03.94
29	Society of Indian Plant Taxonomists, Allahabad	31.03.95
30	Sunrise Emerging Technologies (R&D), Bangalore	31.03.95
31	Technology Information, Forecasting and Assessment Council, New Delhi	31.03.95
32	VMA Oilseeds Research and Development, Delhi Institute, New Delhi	31.03.94

* These Organisations were also recommended to Director General (IT Exemptions) for Notification u/s 35(i) (ii) of the I.T. Act.

ANNEXURE-III.B.2

LIST OF SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATIONS APPROVED DURING 1993*

Social Sciences

S.No.	Name of the Institution	Approval Valid upto
1	Academy of Sanskrit Research, Melkote	31.03.95
2	Administrative Staff College of India, Hyderabad	31.03.95
3	Auroville Foundation, Auroville	31.03.94
4	Bar Council of India Trust (The), New Delhi	31.03.95
5	Rashtriya Veda Vidya Pratishthan, New Delhi	31.03.95
6	Sweekar Rehabilitaion Instituion for Handicapped, Secunderabad	31.03.95
7	Vaikunthbhai Mehta Research Centre for Decentralised Industries, Bombay	31.03.95

* These Organisations were also recommended to Director General (IT Exemptions) for Notification u/s 35 (i) (iii) of the I.T. Act.

ANNEXURE III.C

CERTIFICATE FOR ACCELERATED DEPRECIATION ALLOWANCE ISSUED BY DSIR DURING THE YEAR UNDER RULES 5(2) OF I.T. RULE VIDE NOTIFICATION NO. 133/342/86-TPL DATED 1.4.1988

S.No.	Name of the Company	Lab where know-how developed	Rs. in lakhs	item of manufacture
1.	Electronics Corporation of India Ltd., Hyderabad	In-house	447	Sound Ranging System, Data Display System, Test & Measuring Equipments, Security System, agriculture analytical Instruments, Nuclear Instruments/systems, nuclear industrial instruments/systems, Pulse Code Modulation equipment SYN.S Band TVRO; RRA Equipment etc.
2.	Gharda Chemicals Ltd., Bombay	In-house	125	Anilofos Technical and its Formulations.
3.	Gharda Chemicals Ltd., Bombay	In-house	128	Isoproturon Technical, Isoproburon 50% WP, and Isoproturon 75% WP
4.	Gharda Chemicals Ltd., Bombay	In-house	69	Isoproturon Technical, Isoproburon 50% WP, and Isoproturon 75% WP.
5.	Herdillia Chemicals Ltd., Bombay	In-house	1558	Isobutyl Benzene and Diphenyl Oxide.
6.	Filtra Speciality for Plant and Machinery, Bombay	In-house	8	Catalyst
7.	Dharamsi Morarji Chemical Co. Ltd., Bombay	In-house	150	Single Superphosphate at Amreli Gujarat
8.	Dharamsi Morarji Chemical Co. Ltd., Bombay	In-house	315	Sulphuric acid plant at Amreli Gujarat
9.	Dharamsi Morarji Chemical Co. Ltd., Bombay	In-house	295	Enhancement of capacity/ modernisation of the Sulphuric Acid Plant at Thane

S.No.	Name of the Company	Lab where know-how developed	Rs. in lakhs	item of manufacture
10.	Veejay Lakshmi Engineering Works Pvt. Ltd, Coimbatore	In-house & SITRA	67	Two for one Twister based on technology acquired from south India Textile Research Association (SITRA)
11.	Larsen & Toubro Limited, Bombay	C-DOT	50	128P RAX and P RAX
12.	Metchem Silicon and Silicon wafers. Ltd., New Delhi	I.I.Sc., Bangalore & In-house	349	Polysilicon, silicon ingots, wafers
13.	Punjab Tractors Ltd., Punjab	In-house & CMERI	1052	Agriculture Tractors, Harvestor Combines, Grey Iron Castings and Industrial Forklifts.
14.	BASF India Limited, Bombay	In-house	97	Calixin and Bavistin.
15.	WEBEL Electronics Communication Systems Ltd., Calcutta	In-house	3	Automatic Message Accounting Equipment (AMA) and Electronic Director (ED) Transistor.
16.	Shaw Wallace & Company Ltd., Calcutta.	In-house & NCL, Pune	330	Dimethoate, Ethion and Acephate.

ABBREVIATIONS USED

ACC	Associated Cement Company
ACE	Association of Consulting Engineers
APCTT	Asian and Pacific Centre for Transfer of Technology
BEL	Bharat Electronics Limited
BHEL	Bharat Heavy Electricals Limited
CBDT	Central Board of Direct Taxes
CDC	Consultancy Development Centre
CEERI	Central Electronics Engineering Research Institute
CEL	Central Electronics Limited
CFTRI	Central Food Technological Research Institute
CFRI	Central Fuel Research Institute
CGCRI	Central Glass & Ceramic Research Institute
CLRI	Central Leather Research Institute
CMERI	Central Mechanical Engineering Research Institute
CMPDIL	Central Mine Planning & Design Institute Limited
CMRS	Central Mining Research Station
CRRI	Central Road Research Institute
CSIO	Central Scientific Instruments Organisation
CSIR	Council of Scientific and Industrial Research
CSMCRI	Central Salt & Marine Chemicals Research Institute
CSTT	Central for Studies on Technology and Trade
DGTD	Directorate General of Technological Development
DSIR	Department of Scientific and Industrial Research
ECIL	Electronics Corporation of India Limited
ERDA	Electrical Research and Development Association
ESCAP	Economic and Social Commission for Asia and the Pacific
GSI	Geological Survey of India
HMT	Hindustan Machine Tools
ICAR	Indian Council of Agricultural Research
ICSSR	Indian Council of Social Science Research
IICB	Indian Institute of Chemical Biology
IIFT	Indian Institute of Foreign Trade
INSDOC	Indian National Scientific Documentation Centre
IPCL	Indian Petrochemical Corporation Limited
ISRO	Indian Space Research Organisation
ITI	Indian Telphone Industries
NAL	National Aerospace Laboratories
NCAER	National Council of Applied Economic Research
NCL	National Chemical Laboratory
NEERI	National Environmental Engineering Research Institute
NGRI	National Geophysical Research Institute
NICMAR	National Institute of Construction Management and Research
NIDC	National Industrial Development Corporation
NISSAT	National Information System for Science and Technology
NML	National Metallurgical Labotratory
NPL	National Physical Laboratory

NRDC	National Research Development Corporation
NRFC	National Register of Foreign Collaborations
OCCI	Overseas Construction Council of India
RRL	Regional Research Laboratory
TAAS	Technology Absorption and Adaptation Scheme
TATT	Transfer and Trading in Technology
TPIC	Technology Policy Implementation Committee
UNCTAD	*United Nations Conference on Trade and Development*
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organisation
WIPO	World Intellectual Property Organisation

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