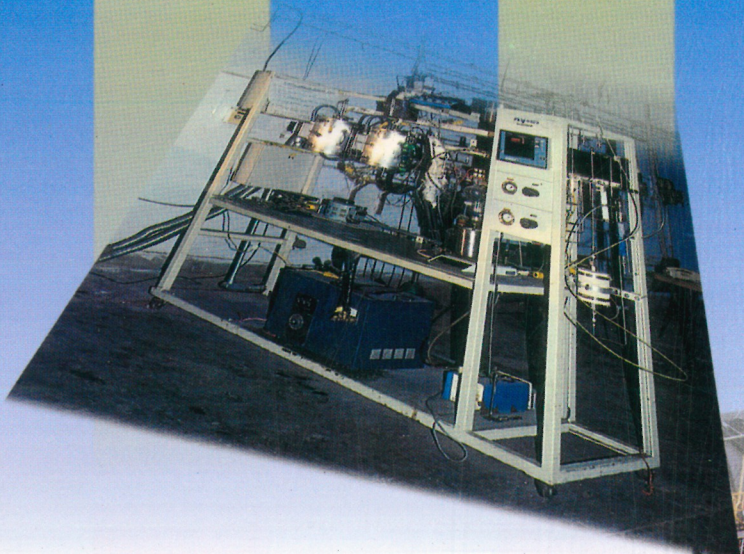
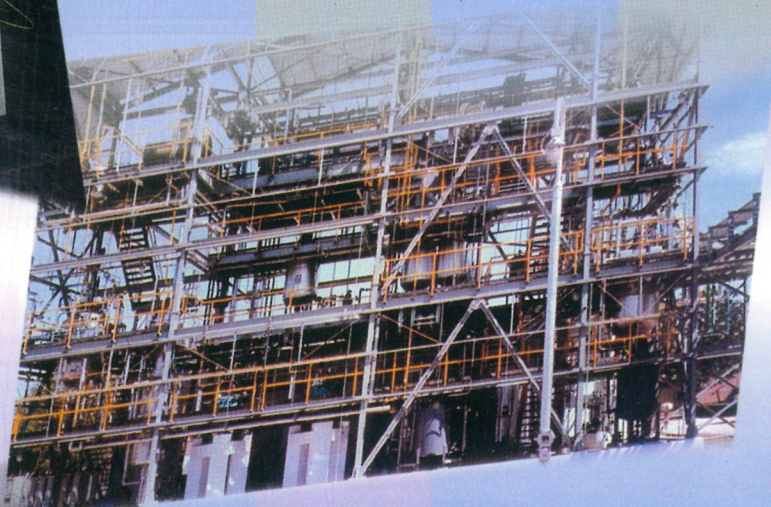
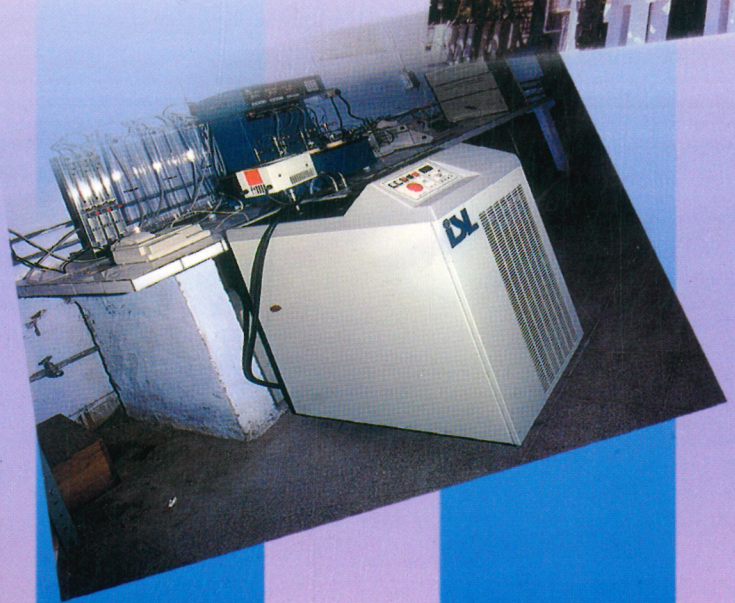
HIGHLIGHTS
1995-96

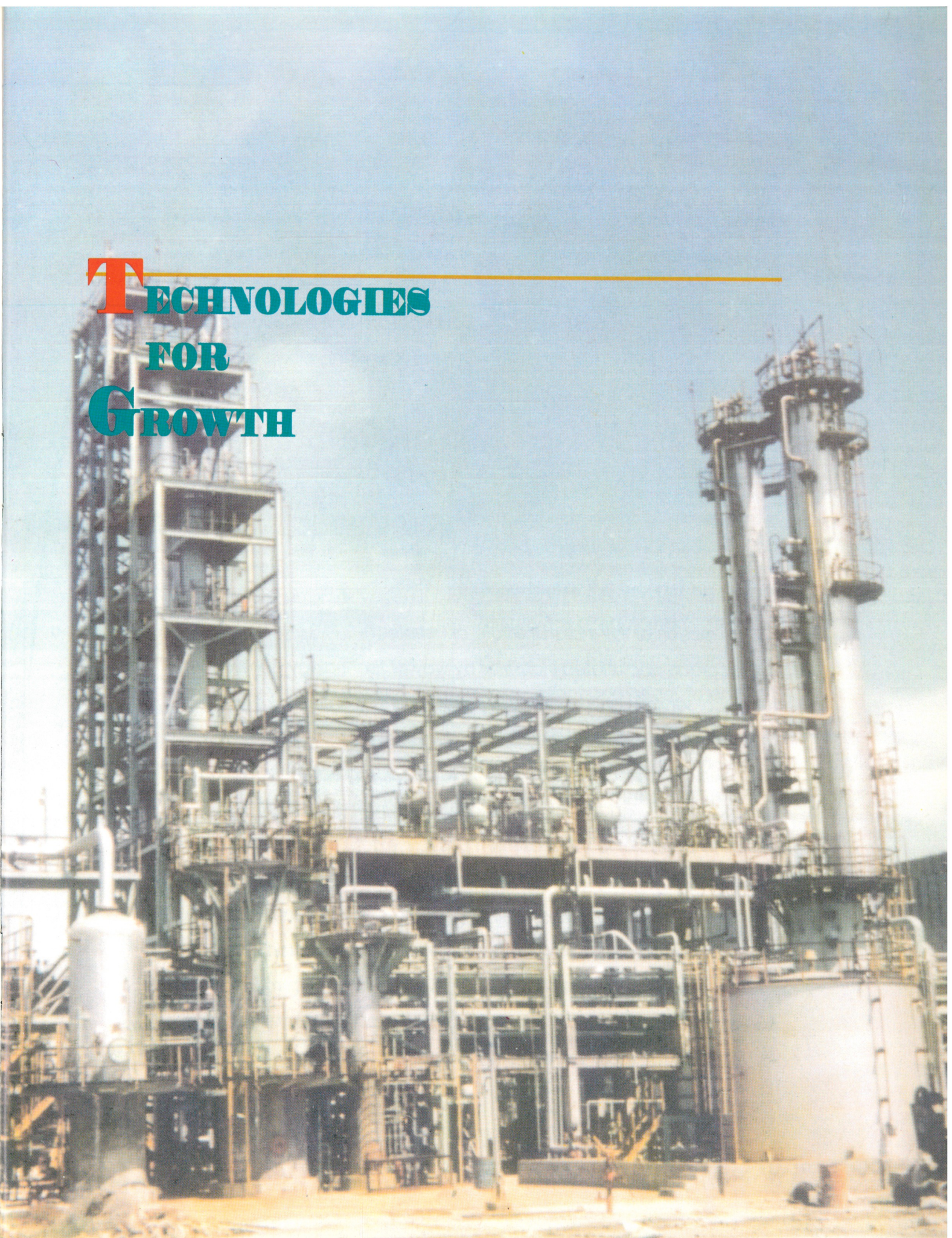






INDIAN INSTITUTE OF PETROLEUM, DEHRADUN

TECHNOLOGIES FOR GROWTH

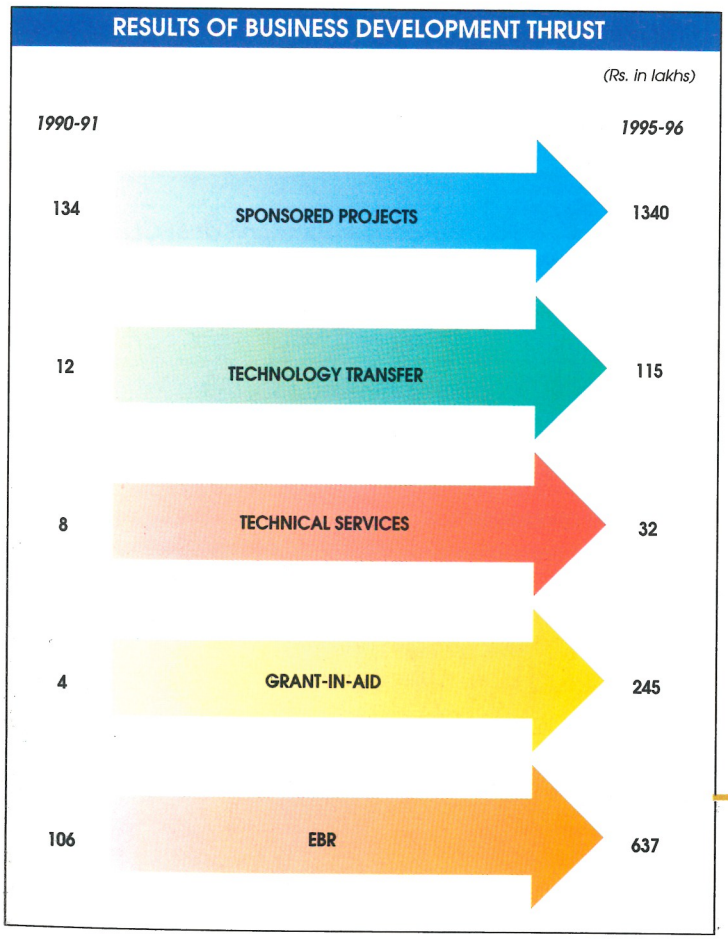


The mission of the Indian Institute of Petroleum is to serve the hydrocarbon and related industries by way of technology generation, technical services and continuously providing innovative solutions to the challenges faced by the industry. To achieve these objectives, it has been always an endeavour of IIP to develop greater interaction with industry. During the last few years, IIP has intensified its efforts to exploit its potential to the maximum possible extent. These efforts have shown results in terms of quantum jump in its business and income from private and public sectors as well as government organisations. The value of the sponsored projects has increased ten times from Rs. 134 lakhs in 1990-91 to Rs. 1340 lakhs in 1995-96. The income from Extra Budgetary Resources (EBR) have also shown a six times increase, from Rs. 106 lakhs to Rs. 637 lakhs, during the above period.

During the year the Institute continued its forward march towards R&D excellence. For the first time it has undertaken a detailed engineering job of revamping the existing unit for producing food grade hexane from sulfolane to NMP extraction. It has also developed major technologies like NMP based lube extraction, hybrid technology for lube base stocks and naphtha to LPG/gasoline.

To exploit its maximum potential with a view to acquire more business and visibility, IIP is making intensive efforts to have greater interaction with concerned national as well as international industrial organisations for contract/collaborative research, technical services and global marketing of the technologies. The Institute has already made tie ups with some of the international organisations and hopes to enter into agreements with more multinationals for these purposes. I sincerely hope that IIP will soon be on world map of technologies.

RESULTS OF BUSINESS DEVELOPMENT THRUST



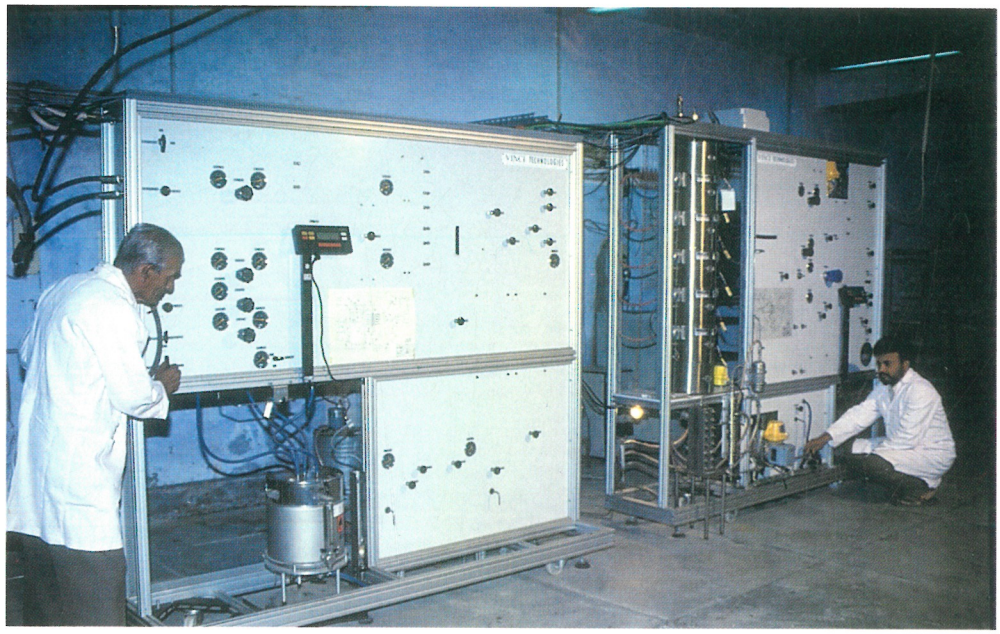
T S R Prasada Rao
Director

Major Breakthroughs

Simulation and optimisation package for catalytic refining process

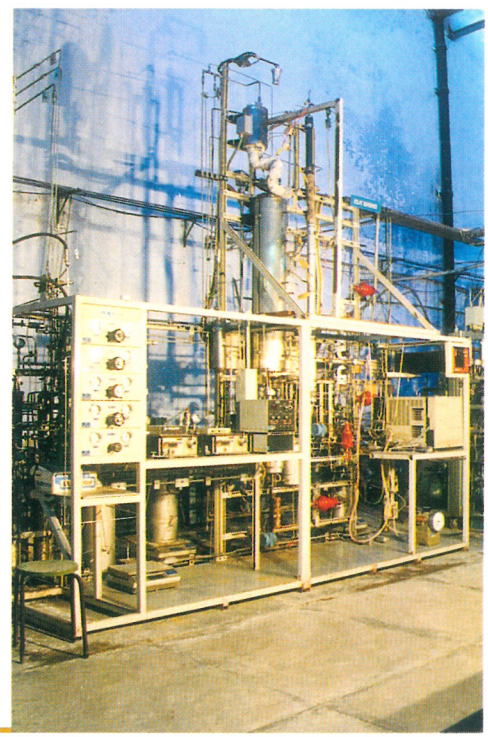
Food Grade Hexane unit at BPCL, Mumbai

- IIP technology of food grade hexane/special boiling solvents (FGH/SBP) using NMP has been accepted by BPCL, Bombay for change over from sulpholane to NMP in the existing plant. Process design package prepared by IIP has been submitted to BPCL. Gross benefit of 80 lakhs on initial solvent inventory, 20% reduction in utilities and 6-7% increase in yield with improved product quality are expected.
- HPCL, Bombay has accepted NMP technology for FGH production. Based on this technology, a grass root unit is under construction and is likely to go on stream in early 1997 (60,000 T/A of FGH).
- Process design package for the NMP based lube extraction technology has been developed in collaboration with EIL and MRL for a grass root lube extraction unit at Haldia Refinery, capacity 350,000 T/A.
- A hybrid process scheme has been developed for generating additional amount of quality LOBS in the existing lube plants using combination of mild hydrotreating with conventional solvent extraction. HIV base oil potential has been found to increase by 3-5% leading to an overall increase in base oil yield by about 10% with lower solvent treat rates (10-15%).



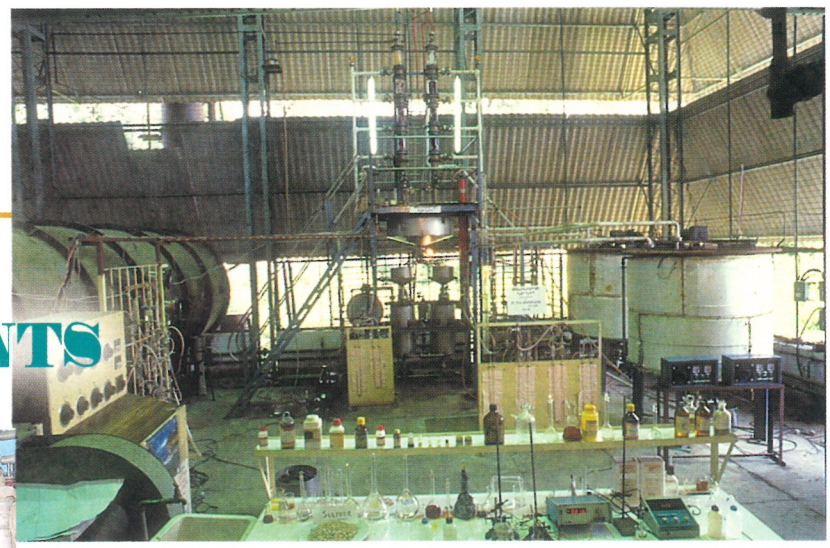
Pilot plant for catalytic reforming

- IIP, jointly with EIL, has developed a state-of-the-art software, CRESOP, for simulation and optimisation of semi-regenerative type catalytic reformers. The model has been implemented at BPCL for off-line optimisation of the catalytic reformer unit.
- Metal incorporation technique on wash coated monolith with 60% metal dispersion and high activity for CO, HC and NOx conversion has been perfected for the development of catalytic converters to reduce auto exhaust emissions. Catalytic converter, developed jointly by BHEL, ARAI and IIP, showed CO and hydrocarbons conversion efficiencies in the range of 80-90 and 70-90% respectively when tested under Indian Driving Cycle on 4 stroke motorcycle.
- A process has been developed for the manufacture of NMP. Novelty of the process includes use of zeolite base catalyst and a low pressure reaction with excellent conversion and selectivity.
- Technology to upgrade low octane feed stocks like NGL/light naphtha to LPG and high octane gasoline rich in aromatics using modified zeolites has been developed at bench scale.



Bench scale unit for IIP-NTGC process

R&D ACHIEVEMENTS



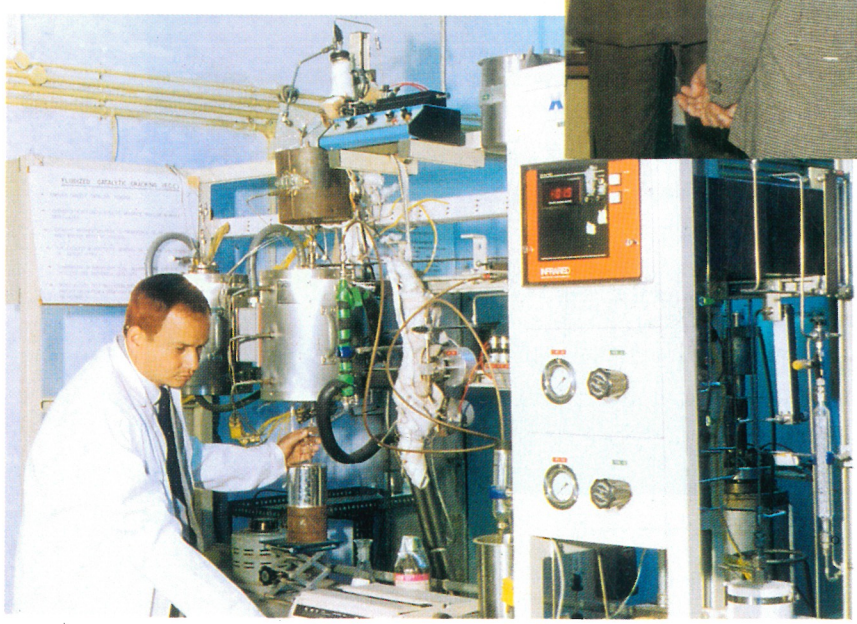
Pilot plant for desulphurisation of flue gases

Pilot plant for visbreaking

- Pilot plant for desulphurisation of flue gases has been erected in collaboration with CRL. The plant is being commissioned for collecting scale-up data.
- Replacement of sulpholane by NMP for dearomatisation of full range kerosene using re-extraction route.
- Technology for production of microcrystalline waxes from tank bottom sludge has been developed and offered to the user.
- Development of dewaxing aids for improved slurry filterability in dewaxing/deoiling units. Polymeric additives have been synthesised at laboratory scale which are equally effective as compared to internationally known additives.
- Recovery of carbon black feed stocks, waxes and low pour cutter stock from FCC clarified oil.
- Two new formulations of CCR catalyst developed at IIP have shown performance comparable to proven catalyst at pilot plant level.
- Formulation developed for skewed Pt-Re reforming catalyst.
- New generation FCC catalyst recipe formulated meets the targeted catalytic properties in terms of activity for middle distillates, coke selectivity and also bottoms conversion. Physical properties such as apparent bulk density and particle strength need further improvement.

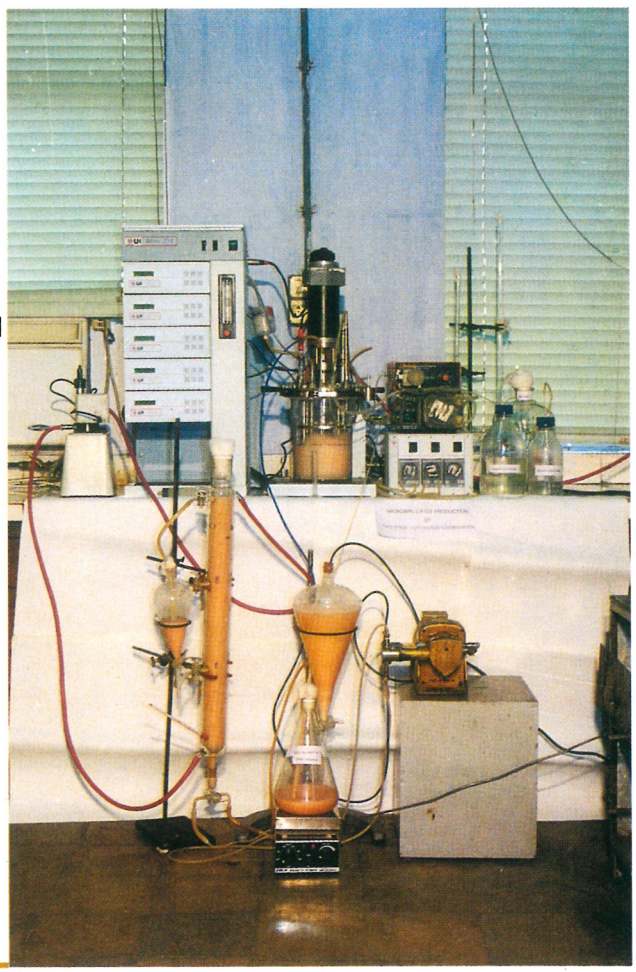
- Product yield and property correlations for visbreaker unit based on pilot plant data have been developed, kinetic model development is in progress.
- Simulation package for hydrodesulphurisation of naphtha using an indigenous commercial catalyst has been developed.
- Water soluble and fixed bed catalysts for sweetening of LPG, naphtha and kerosene, with performance comparable to the state-of-the-art globally available commercial catalysts have been prepared. Bulk preparation of the catalysts has been carried out for commercial trials.
- IIP-EIL soaker visbreaking process technology has been licensed to Haldia Refinery for revamp of coil visbreaker to soaker mode.
- Catalytic hydrogenolysis of vegetable oils to the corresponding saturated alcohols has been achieved using an indigenous catalyst. Conversion and selectivity of 72 and 82% respectively have been obtained.

Shri GV Ramakrishna, Chairman Research Council, IIP, visiting carbon materials laboratory



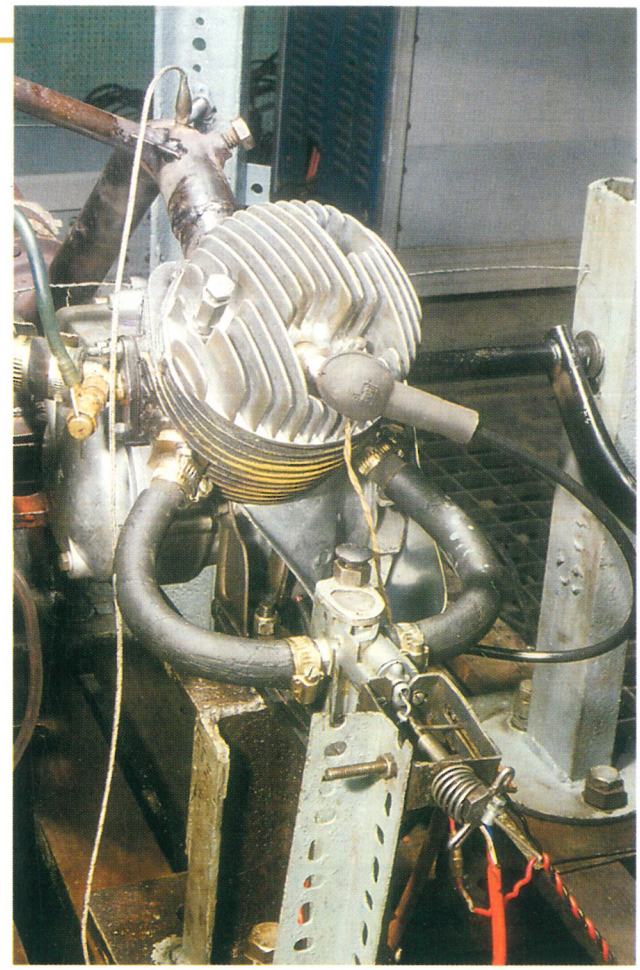
MAT Unit for FCC

- Process for the production of mono- and dicarboxylic acids (C_9-C_{13}) by oxidation of non-traditional vegetable oils with conversion and selectivity of 98 and 75% respectively has been developed.
- Development of antifriction, antiwear and extreme pressure multifunctional additives for fuels and lubricants has been completed at laboratory scale.
- Synthesis of alkyl arylated mono- and di-esters of fatty acids derived from non-traditional/non-edible vegetable oils as energy efficient biodegradable high performance lubricants achieved at laboratory scale and evaluated.
- Energy efficient friction and wear reducers for gearoils and automotive engine oils synthesised at laboratory scale and evaluated.
- Mettalocenes and rare earth fatty acid salts for combustion improver and CO and NOx reduction in engine exhaust have been synthesised at laboratory scale and evaluated.
- Two prototypes of industrial natural gas burner have been designed and fabricated.
- A fuel efficient LPG canteen burner with thermal efficiency of 64% has been developed.
- A batch process at bench scale level for the production of an effective and stable biosurfactant using IIP developed bacterial strain has been developed.
- Technique for continuous production of microbial lipids using IIP developed yeast strain has been devised. Fatty acid profile of the lipids has been correlated with process conditions.
- A two-stroke engine for genset application was optimised with kerosene fuel for best fuel efficiency and low deposits. Recommendations for prototype with optimized settings have been made to the manufacturer.



Bio-tech fermentor

Basic Research



Dual intake two-stroke engine for three wheeler

- **Surface diffusion kinetics in the adsorption of acetic acid on activated carbon**

  Kinetics of adsorption of acetic acid on activated carbon has been studied. Experimental results have been simulated by a mathematical model. Surface diffusivity values will be used in modelling continuous adsorption columns required for industrial design.

- **Removal of phenols from waste water using liquid membranes in a microporous hollow fibre membrane extractor**

  A novel concept of integrating emulsion liquid membranes with hollow fibre extractions was studied. This new concept overcomes the problems of leakage and swell encountered in conventional liquid membranes.

- **Catalysis by zeolite materials**

  Acid sites of enhanced strength have been identified in hydrothermally treated ZSM-5 zeolites and role of extra framework aluminium elucidated. TS_2 and VS_1 zeolites were synthesized by novel sol-gel method for the first time and these are comparable in all respects to conventional preparations.

- **Development of process sequence for the production of bitumen from non-bitumen crude and modified bitumens**

  Systematic data have been generated to study the kinetics of bitumen blowing process. Product properties have been intercorrelated and dependence on composition is being investigated.

- **Electrochemical studies of reactions pertaining to petroleum industry**

  Cyclic voltametry of iron chelates in the absence and presence of certain organic buffer has afforded mass transport data of the iron species useful in optimizing the buffer concentration in the iron chelate formulation for hydrosulphide ion oxidation.

- **Homogeneous Catalysis**

  Developed environment-friendly new synthetic route (using molecular oxygen) for oxidation of sulphides to sulphones with aldehyde as sacrificial agent and metal phthalocyanine as catalyst.

  Developed new synthetic route for ring opening metathesis polymerization (ROMP) of norbornylene with ruthenium complex catalyst.

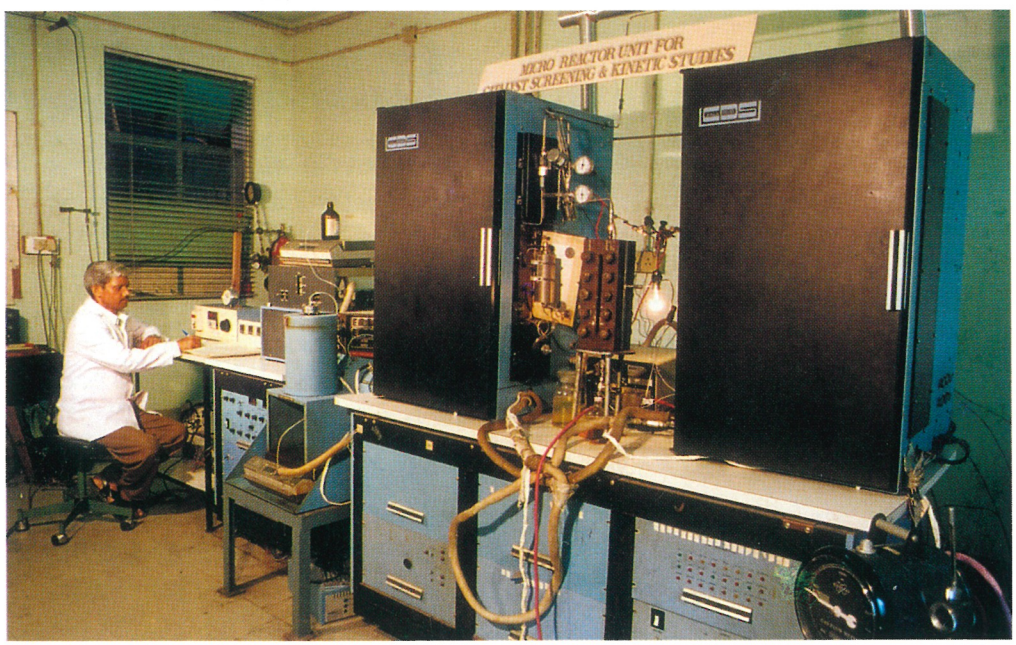
- **Nature of chemisorbed EP, friction and wear films from additives**

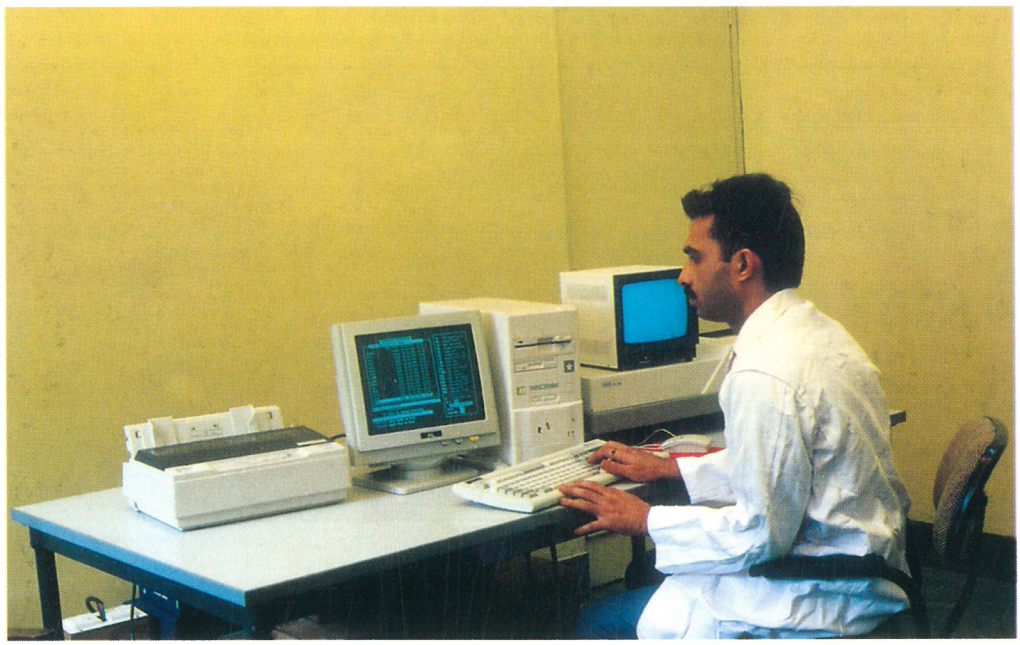
  Relationship between the structures of chemisorbed films on iron surfaces and friction, wear and lubricity characteristics has been established.

- **Optimization of combustion chamber geometry of a tractor engine using mathematical simulation model**

  Combustion chamber geometry of a tractor diesel engine was designed with mathematical simulation of air-fuel mixing and combustion. An engine prototype was evaluated to meet emission norms. This study has demonstrated the

Micro reactor unit for catalyst screening





Laser particle size analyser

significance of use of mathematical model for designing combustion chamber geometry at the design stage. The designed tractor engine is being commercialised by the manufacturer.

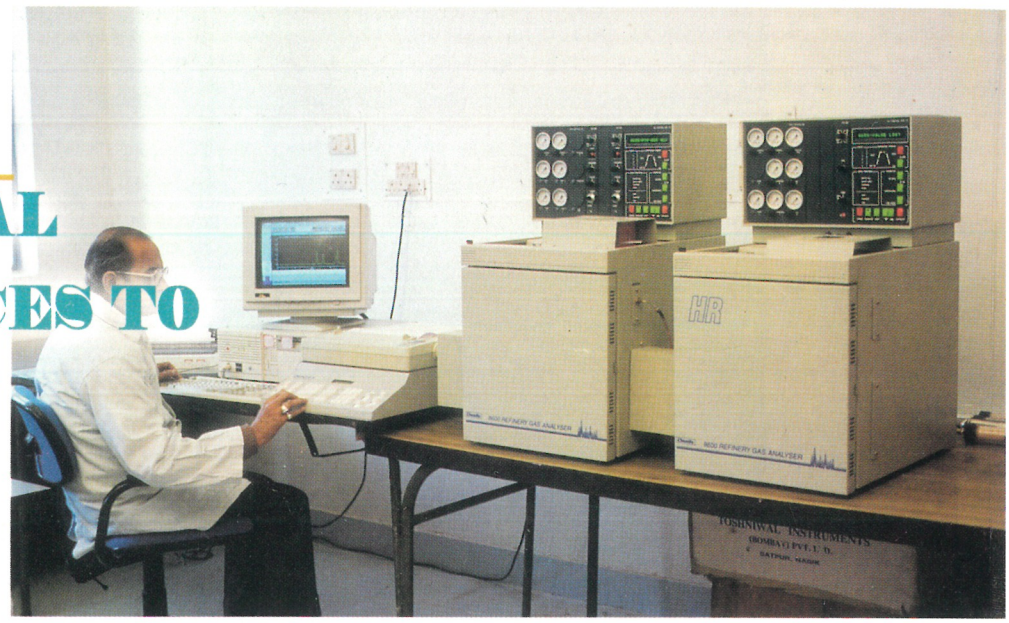
- **Development of a dual-intake two-stroke engine for three wheelers**

  A dual-intake engine to facilitate initial scavenging by air only in order to reduce unburnt hydrocarbon emissions was developed to accommodate two intakes: one for the conventional primary air-fuel mixture and the other for secondary air. A prototype engine has been made and delivered to the sponsor. The engine is capable of full range of speed load operation and results show substantially lower (upto 40%) hydrocarbon emissions with additional benefits of lower carbon monoxide emissions and lower fuel consumption.

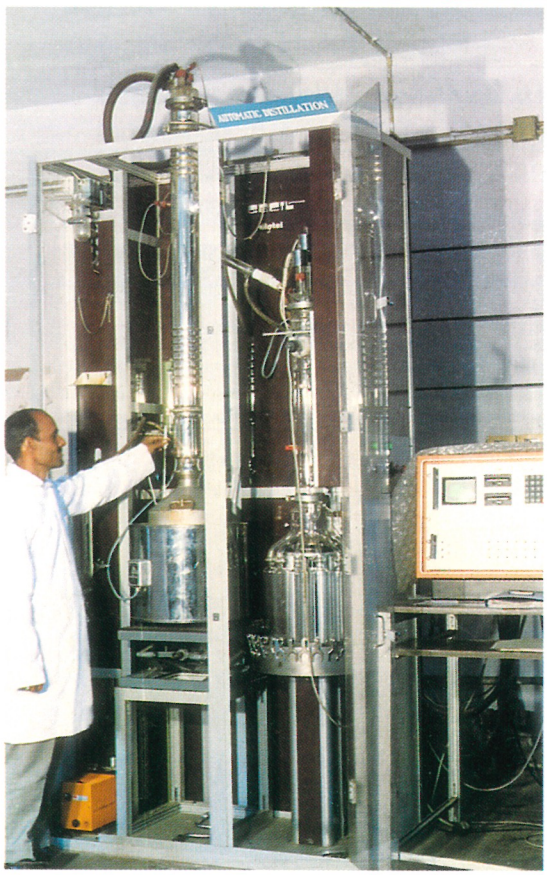
- **Cyclic variation and misfiring phenomena in two-stroke engine**

  Understanding of the cyclic variation and misfiring phenomena in two-stroke engine was comprehensively studied. Technological solutions to minimise misfiring were identified.

TECHNICAL SERVICES TO INDUSTRY



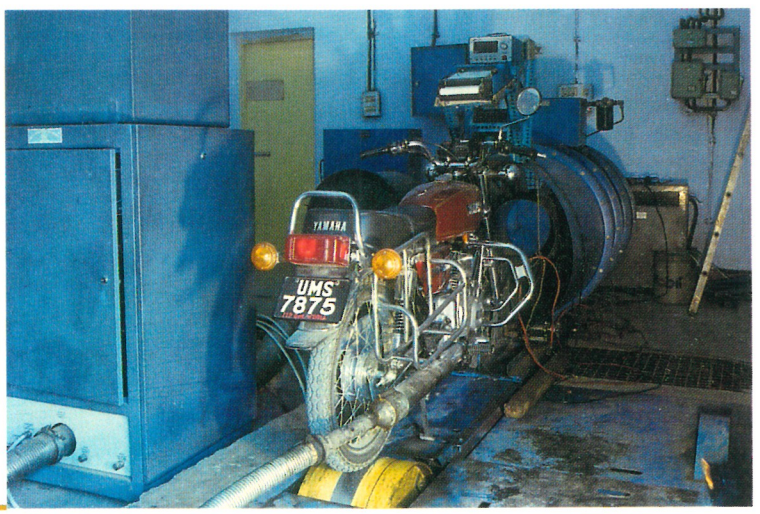
GC-MSD-RD System



Automatic distillation apparatus

In addition to its R&D activities, the Institute also offers technical services to industry for detailed and short evaluation of crude oils for fuels, feed stocks and lubricating oil base stocks, performance evaluation of various petroleum products in engine, type approval and certification of vehicles/ engines for emission standards compliance, techno-economic feasibility studies and market demand surveys for petroleum and related products, technical services and trouble shooting operations for hydrocarbon industry, technological support services to the operating refineries, characterisation of various products using advanced analytical techniques, assistance to BIS in formulation of standards/specifications and test procedures for petroleum and related products. The following services were provided to industry during this period.

- Studies on revamp of soaker visbreaker at Haldia and Madras refineries.
- Prefeasibility study for production of microcrystalline waxes from Uran tank sludges.
- Evaluation of Bombay off-shore crude oils and those produced by joint venture companies.
- Assessment of quality of gasoline and diesel fuel in the Indian market. Evaluation of Gandhar field condensate.
- Evaluation of naphtha for Barauni refinery.
- Evaluation of CO meter as per ISO standards and measurement of mass emissions of tractor engine after modification of injection system.
- State-of-the-art report on the effect of diesel fuel properties on particulates and gaseous emissions.
- Utilisation of 3% methanol-gasoline blends (M3) in Maruti van.
- Optimisation of engine parameters and vehicle performance for the CNG kit.
- State-of-the-art report on the use of alternative fuels in transport sector.
- Evaluation of road worthiness of vehicles retrofitted with CNG conversion kits as per the CMVR 1989 and Motor Vehicle Act 1988.
- State-of-the-art report on use of PIB in 2T oils and its assessment in Indian context.
- Third regeneration of bimetallic reforming catalyst and start-up of reformer at Haldia Refinery.
- Ninth regeneration of bimetallic reforming catalyst, first regeneration of naphtha HDS catalyst and debottle necking for capacity expansion of reformer plant for xylenes production at BRPL, Bongaigaon.
- Performance evaluation studies on bimetallic reforming catalyst for CRL, Cochin to decide on the catalyst replacement.



Two wheeler chasis dynometer

AWARDS

Awards received by IIP

- **Doon Ratna Award for 1995**

  Certificate of Honour was presented by Nagrik Parishad, Dehradun to Dr. T S R Prasada Rao, Director, IIP along with Khurshid Lal Science & Technology Award 1995 for significant contribution in his field. He was also bestowed with the honour of Doon Ratna.

- **Hari Om Prerit S S Bhatnagar Research Endowment Award for Catalysis 1993 (Declaration 1995)**

  Dr. G Muralidhar has been given this award for his work in heterogeneous catalysis especially for development of a model for active sites on Co-Mo catalysts and elucidating the nature of active sites for different functionalities and their potential utility in developing catalyst for hydrotreating of petroleum fractions.

SEMINARS WORKSHOPS

FTIR workshop

Challenges in Crude Oil Evaluation with Changing Crude Scenario (April 5-6, 1995)

This workshop was arranged to provide a common platform to professionals from research and industry to discuss the advancement and challenges in the area of evaluation of crude oil and products in view of the fast changing crude oil scenario due to environmental concerns, impact on product specifications coupled with frequent changes in crude source and globalisation of economics of buying crude.

The two days programme covered seven technical sessions: Crude scenario and challenges, Analytical developments, Product quality and specifications, Heavy crude characterisation, Flow behaviour of crude oils, Crude assay as a marketing tool and Management of analysis and analytical data. More than 100 delegates from different oil sector organisations participated in the workshop.

FTIR Spectroscopy — Analytical Challenges in Petroleum Industry (November 8-9, 1995)

This workshop was aimed at discussing the analytical challenges in petroleum industry and advancements in FTIR spectroscopy which is fast becoming a workhorse for quality control, production and product utilisation.

Thirty eight delegates both from hydrocarbon industry and research institutions participated in the deliberations.

HRD
(Human Resource Development)

Advanced programme for Senior Executives of Oil Industry

For Industry

Twelve training programmes of 1-3 weeks duration, sponsored by Reliance Petroleum Ltd. and Reliance Industries Ltd., Bombay, Indian Oil Corporation Ltd., (R&P Division), Numaligarh Refinery Ltd. Indo-Burma Petroleum Co. Ltd., Hindalco Ltd. and different refineries, were conducted in the areas of petroleum refining technology and petrochemicals, application of fuels and lubricants in automotive and industrial machines, characterisation of speciality chemicals and analytical and physico-chemical testing techniques for petroleum and petrochemicals. 233 engineers participated in these programmes. A major highlight was an advance level programme on "Advances in Petroleum Refining Technology and Related Aspects" organised from 5-8 February, 1996 for senior level executives of operating refineries in the country. A total of 15 General Managers/Deputy General Managers attended the programme.

In-house

Three programmes on "Programme your Mind for Success", "Creativeness and Innovativeness" and "Management Programme-cum-Workshop" were organised during the year for IIP staff.

RAJ BHASHA UNIT

Hindi Diwas celebrations

Raj Bhasha Unit is engaged in promoting and popularising the use of Hindi in day-to-day work more effectively. In this direction the unit is also bringing out a monthly magazine "Vikalp". Among other activities, a three day "Administrative Terminology" workshop was organised from June 6-8, 1995 under the auspices of the Commission for Scientific & Technical Terminology (CSTT), Ministry of Human Resources, Govt. of India, New Delhi. Prof P S Suklani, Chairman CSTT and Dr. Sharjan Garg, a renowned poet, were among the guests present during the workshop. Hindi Diwas was celebrated in the month of September, 1995 when various activities were organised. The famous humorist and satirist of India, Dr. Barsaney Lal Chaturvedi, was the Chief Guest.

Administrative Terminology workshop

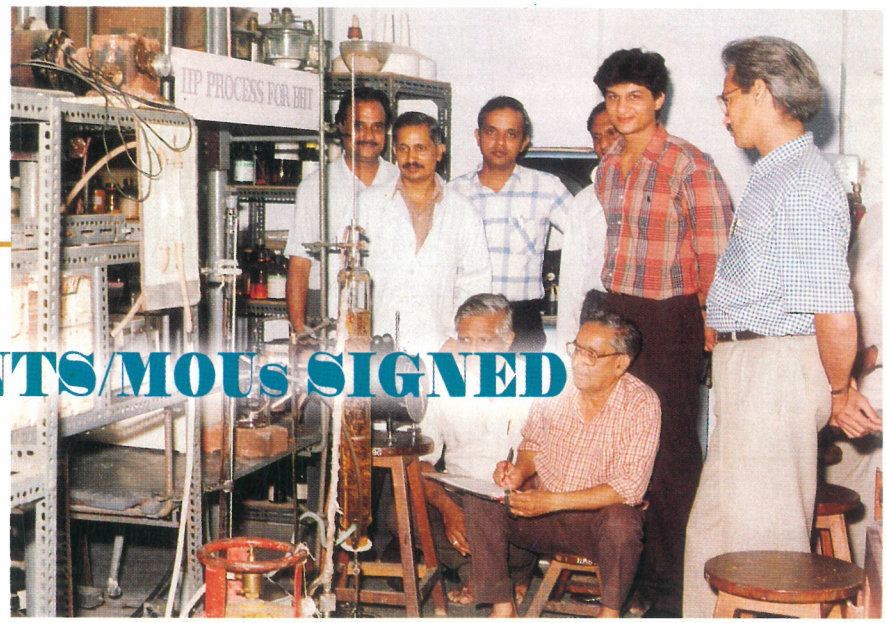
INTERNATIONAL COLLABORATIONS

Slovak Ambassador visiting IIP

- IIP has bilateral agreements with IFP, France in the area of hydrotreating processes like hydrogenation of pyrolysis gasoline, hydrodesulphurisation of naphtha, kerosene and gas oil and catalytic reforming technology. The agreement includes extending the co-operation to other areas and for export for various IIP technologies as well as IIP expertise in different areas for basic design packages, pre-commissioning, start-ups, catalyst regeneration, trouble shooting etc.
- IIP has entered into a contract with M/s Paramins (Exxon), UK for performance evaluation of 2T lubricants through field trial on scooters/motor cycles.
- The Institute participated in various exchange and co-operation programmes with DAAD (Germany), CSAV (Poland), JSPS (Japan), TWAS (Italy), British Council, UK, LEEDS and Czech and Slovak Republics.
- During 1995-96 as many as eighteen scientists/ engineers were deputed to Zimbabwe, Portugal, Poland, Japan, Dubai, USA, Germany, Singapore, Slovak Republic, England, Netherlands, France, Denmark, Nepal, Hong Kong, Belgium and China under various programmes/assignments.
- Eleven scientists from Poland, Canada, Ukraine, Germany, Czech Republic, Kuwait, USA and Bangladesh visited the Institute during the year.

Swiss delegation visiting engine laboratory

MAJOR AGREEMENTS/MOUs SIGNED



Technology transfer for antioxidants

The following major R&D agreements of total value of Rs. 459 lakhs were signed during the period.

- Lube Base Stocks Characterisation and Additive Response Studies, Madras Refineries Limited, Madras.
- High Temperature Antioxidants, Process Engineering and Technology, Tria Fine Chem., Bombay.
- Diesel Fuel Quality: Requirements for Meeting Future Emission Standards, Centre for High Technology, New Delhi.
- Development of Know-how on Cold Rolling Oils for Steel, Hindustan Petroleum Corporation Ltd., Bombay.
- Process Engineering for High Temperature Antioxidants, Tria Fine Chem., Bombay.
- Catalyst and Technology Development for Hydrotreatment of Diesel and VGO, CHT, New Delhi.
- Effect of Soaker Geometries and Internals of Visbreaking Process, CHT, New Delhi.
- Ethrification of C_5 olefins, CHT, New Delhi.

TECHNOLOGIES TRANSFERRED

Technology	Client	Plant Capacity
Change-over from sulpholane to NMP in hexane unit	Bharat Petroleum Corpn. Ltd., Mumbai	FGH: 25,000 TPA SBP: 75,000 TPA
IIP-AEC process on high temperature anti-oxidants	Tria Fine Chem., Mumbai	1,000 TPA
Pyrolysis gasoline hydrogenation	Haldia Petrochemicals, Haldia	230,000 TPA
Improved technology on impregnating pitches	Graphite India, Bangalore	—
Hydrodesulphurisation of VGO	ESSAR OIL, Mumbai	3.2 MMTPA
IIP-EIL process on sulpholane extraction for BTX production	National Organics & Chemicals of India Ltd., Mumbai	90,000 TPA Benzene 110,000 TPA Toluene
Improved kerosene wick stove	Kero Stove Ind.	—
Improved LPG stove	80 Parties	—

Memorable Events

33rd meeting of SAC on hydrocarbons (MOPNG)

- Sulpholane plant went on stream based on IIP Technology at Cadila Laboratories, Ahmedabad, 12-17 April, 1995.
- 33rd Meeting of Scientific Advisory Committee on Hydrocarbons, (MOPNG), 21-22 April, 1995.
- IIP Foundation Day Lecture by Dr. Vijay L Kelkar, Secretary, Ministry of Petroleum and Natural Gas, 22 April, 1995.
- World Environment Day Lecture by Shri Avdhesh Kaushal, Environmentalist, 5 June, 1995.
- 14th Meeting of the Research Council of IIP, 22 June, 1995.
- Meeting of the Technical Advisory Board (Chemical Sciences) of CSIR, 23-24 June, 1995.
- Farewell to Dr. S K Joshi, Director General, CSIR and felicitation of Dr. R A Mashelkar, the new DG, 23 June, 1995.
- 12th Meeting of the Activity Committee of the Centre for High Technology on extraction and dewaxing, 3-4 August, 1995.
- 15th Meeting of the Activity Committee of the Centre for High Technology on Visbreaking, 11-12 September, 1995.
- CSIR Foundation Day, 26 September, 1996.
- Oil Conservation Week, 1-7 February, 1996.
- National Science Day, 26 February, 1996.
- Lovraj Kumar Memorial Lecture by Dr. S Vardarajan, 29 February, 1996.

FACILITIES CREATED/UPDATED

XRF Sulphur Analyser

- **Reforming Unit**
  Vinci
  Vinci Pilot Reforming Unit is a conventional fixed bed down flow type micro processor based automatic unit which is capable of processing variety of naphtha feed stocks at different operating conditions. Computer interfacing maintains all the physical process parameters while storing equipment data. Cata volume is 60 ml. The unit will help to evaluate the performance of reforming catalysts besides development of processes of similar nature.

- **Laser Particle Size Analyser (Galai, Israel)**
  Model CIS-100
  Accurate measurement of particle size and shape is of immense importance for quality control, product research and on-line production in the area of catalysis, oils, lubes, greases, slurries, emulsions etc. The instrument is capable of carrying out such characterization. Range of measurement: 0.2 to 600 microns.

- **Cold Filter Plugging Point (CFPP)**
  Analyser ISL CF PP 116
  Automatic Cold Filter Plugging Point Analyser is for determination of CFPP of diesel fuels and middle distillates. Three simultaneous measurements can be carried out upto -53°C.

- **Automatic Freezing Point Apparatus**
  Oil Lab 400 (Linetronics)

  Automatic freezing point measures the freezing point of ATF and other distillates from +30 to -60°C. Phase change is detected by light level difference.

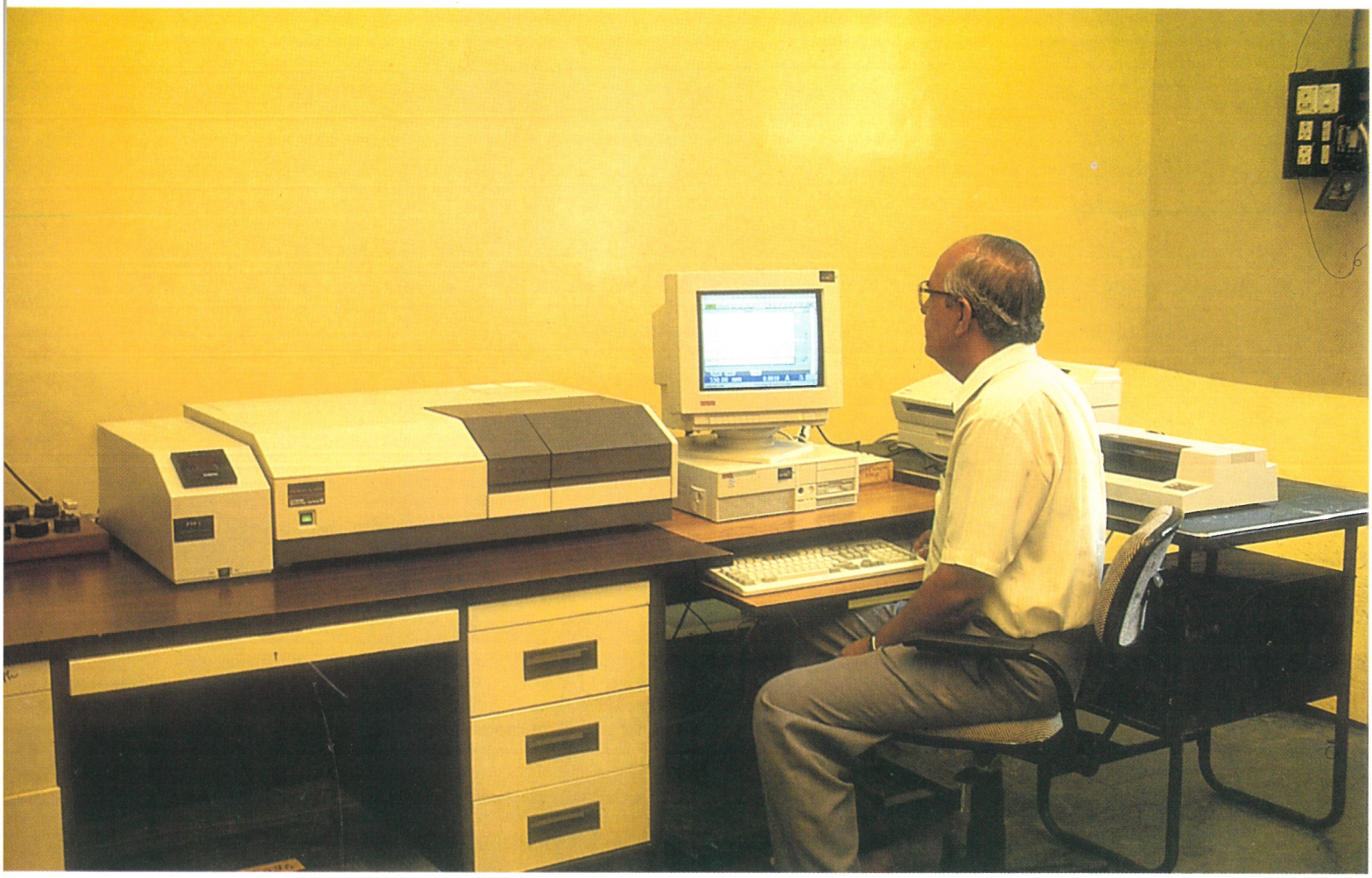
- **X-ray Florescence System**
  LAB-X 3000 Oxford

  XRF analyser for analysis of sulphur in petroleum products (10 ppm to 5%) and lead in gasoline. It gives quantitative analysis in 50-200 seconds.

- **Automatic Kinetic Viscosity Determination Apparatus**
  MP 480 (Herzog)

  Automatic Viscometer consists of Ubbelohde viscosmeters and is able to perform two simultaneous analysis. The instrument has a single variable temperature bath (+20 to +150° C) with near infra-red meniscus detection.

UV-VIS Spectrophotometer



Auto Freezing Point Apparatus

- **Automatic Cloud Point and Pour Point Apparatus**
  ISL CPP 97-2

  The Automatic Pour Point Apparatus consists of two independent measuring systems. The detection is through optical device. Additional detection head is available for cloud point.

- **Refinery and Natural Gas Analyser**
  Model S 600 (Chemito)

  This gas chromatographic system with multicolumn attachment will help in the analysis/estimation of refinery gases, natural gas, CO, CO_2 (in trace levels) and straight run/cracked product in the C_1-C_5 hydrocarbon range. The system can also

calculate calorific value, density, relative density and Wobbe number with the help of software using computerised data.

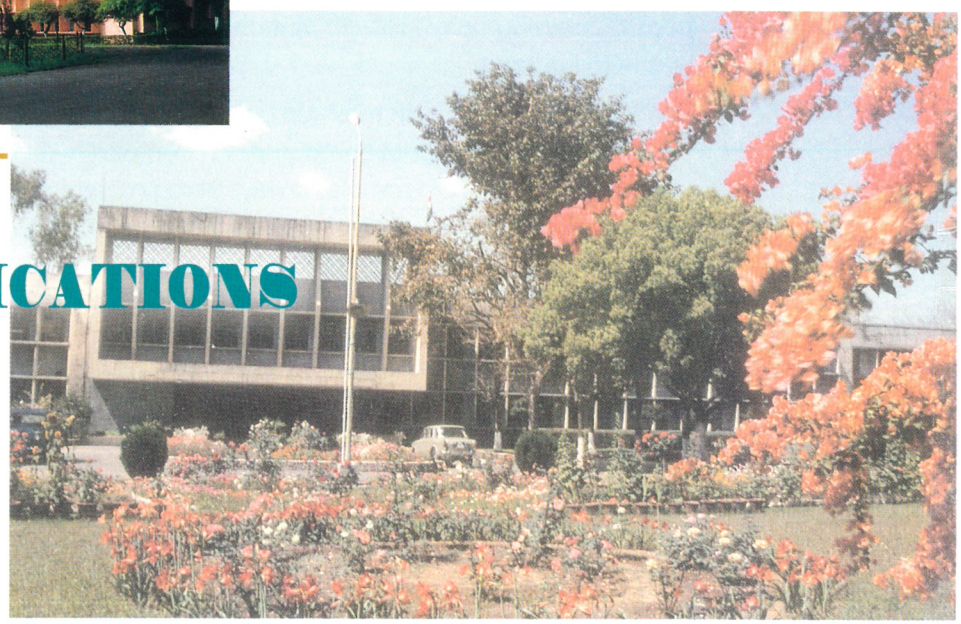
- **Gas Chromatography MSD-IRD System**
  (Hewlett Packard)

  Capillary GC System with mass-ion and infra-red detector will be utilised for identification of individual components in complex hydrocarbon mixtures. Characteristics of such samples always pose problem due to lack of reference compounds. Concentration of individual hydrocarbon number will help to predict RON/MON data also. Analysis will be less time consuming and involve smaller quantities of samples compared to ASTM D-908 and ASTM 357 methods.

- **UV-VIS-NIR Spectrophotometer**
  Model LAMBDA-19 (Perkin Elmer)

  The instrument is capable of estimating polynuclear aromatics, olefins in cracked products, determination of molecular structure particularly oxygenates and components containing CH, NH, OH etc. The technique will also be useful for measuring the fuel quality.

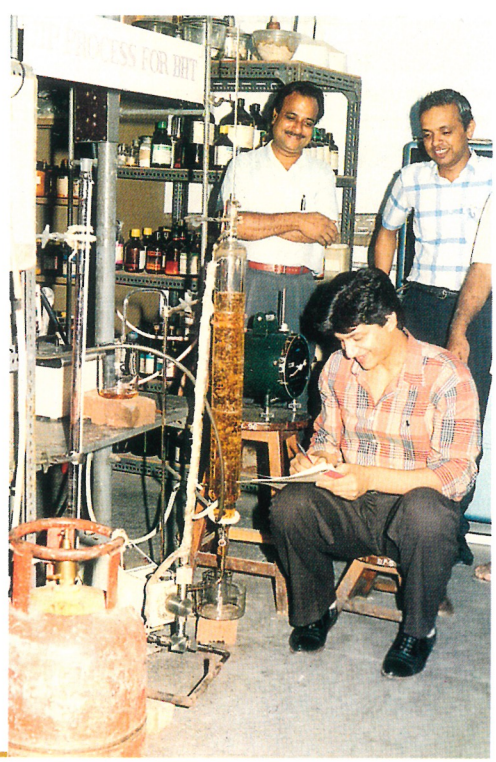
- **Automatic Computer Controlled Pilot Plant for Catalytic Reforming**



PATENTS & PUBLICATIONS

- A patent on "New catalyst useful for the preparation of dicarboxylic acids" has been filed in Taiwan. This patent has already been filed in USA, Europe, Japan, Canada, Mexico and South Korea.
- The Institute filed five more patents during the year. Eight applications are at various stages of filing.

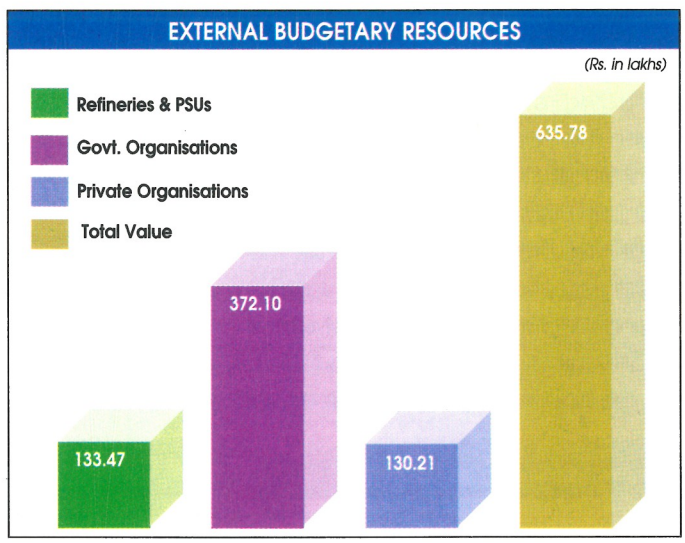
Twenty four papers were published in various national and international journals. Forty-nine papers were presented at various conferences/seminars/ workshops, including five at international platforms.

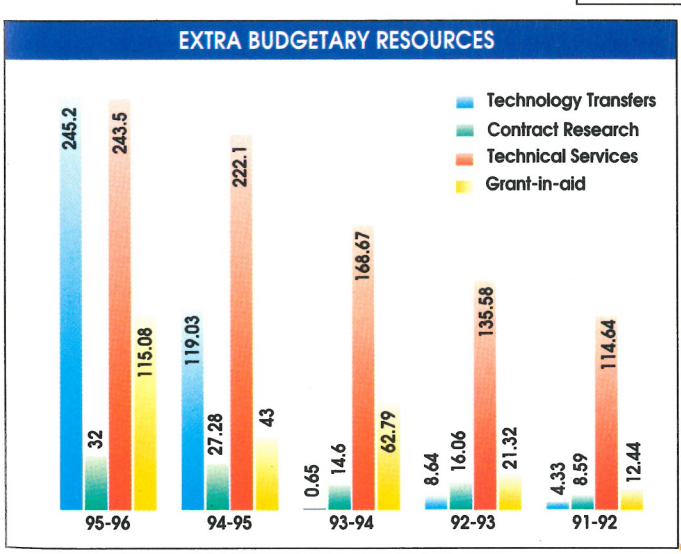


IIP process for BHT

Extra Budgetary Resources (EBR)

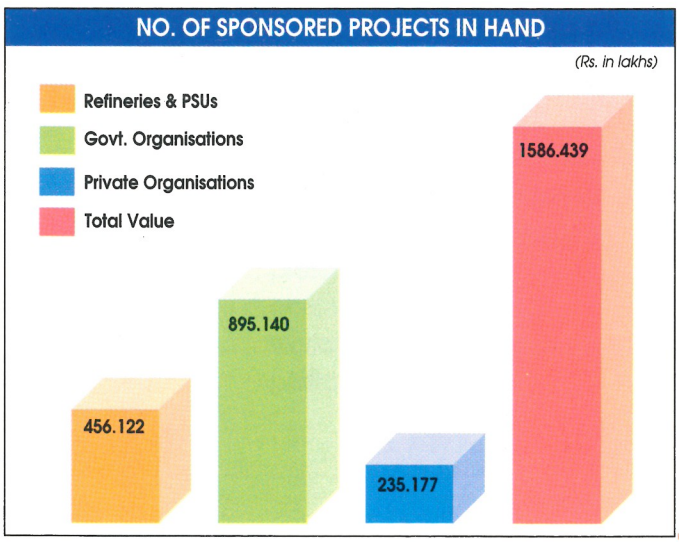
Earnings from contract research, consultancy, license fee and royalties from technology transfers (EBR) increased six times from Rs. 106.8 lakhs in 1990-91 to Rs. 637 lakhs during 1995-96. In 1996-97 it is expected to touch Rs. 1100 lakhs, more than the budgetary grants from CSIR.

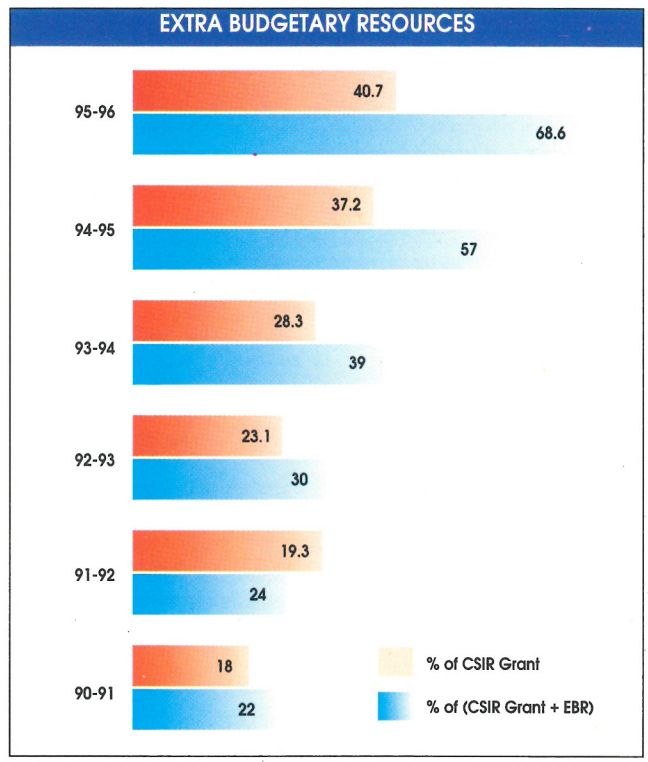




SPONSORED RESEARCH

Over the years, value of sponsored research has been on the increase. The value of the sponsored research completed and initiated during the year was Rs. 140.115 and Rs. 662.241 lakhs respectively. By the end of the year Institute had Rs. 1088.148 lakhs worth sponsored projects in hand, while the value of the proposals submitted to various agencies for sponsorship/grant was Rs. 799.299 lakhs. All these are the indicators of the growing confidence of the industry in IIP.





ERRATA

Page			
4.	Photo Caption	:	Food Grade Hexane Unit at MRL, Chennai for BPCL, Mumbai
	Last Para	:	HVI for HIV
9.	Last Title	:	non-bitumenous for non-bitumen
13.	Photo Caption	:	Two wheeler chassis dynamometer for chasis dynometer
23.	Photo Caption	:	Dual Chrome 3000 HPLC-HRGC Unit for UV-VIS Spectrophotometer
24.	Photo Caption	:	UV-VIS-NIR Spectrophotometer for Auto Freezing Point Apparatus
27.	Third Line from Top	:	licence for license
28.	Top Bar Chart	:	% of (CSIR Grant + EBR) for % of CSIR Grant and vice versa
	Bottom Bar Chart	:	VALUE OF SPONSORED PROJECTS IN HAND for NO. OF SPONSORED PROJECTS IN HAND

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MACRO GRAPHICS