

I. AN OVERVIEW

1. INTRODUCTION

The Department of Scientific and Industrial Research (DSIR), one of the departments of the Ministry of Science and Technology was set up through a Presidential Notification, dated January 4, 1985 (74/2/1/8 Cab.). The mandate of DSIR includes promotion of industrial research for indigenous technology promotion, development, utilization and transfer. Shri Kapil Sibal was the Hon'ble Union Minister for Ministry of Science & Technology and Earth Sciences.

The Allocation of Business for the Department is as follows:

- All matters concerning the Council of Scientific & Industrial Research
- Registration & recognition of R&D units
- All matters relating to National Research Development Corporation (NRDC)
- All matters relating to Central Electronics Limited (CEL)
- Technical matters relating to UNCTAD & WIPO
- National Register for Foreign Collaborations
- Matters relating to creation of a pool for temporary placement of Indian scientists & technologists.

The primary endeavour of DSIR is to promote R&D by the industries, support small & medium industrial units to develop state-of-the art globally competitive technologies of high commercial potential, catalyze faster commercialization of lab-scale R&D, enhance the share of technology intensive exports in overall exports, strengthen industrial consultancy & technology management capabilities and establish user friendly

information network to facilitate scientific and industrial research in the country. The DSIR has two public sector undertakings viz National Research Development Corporation (NRDC) and Central Electronics Ltd (CEL) and two autonomous organization viz Council for Scientific and Industrial Research (CSIR) and Consultancy Development Centre (CDC). The Department also provides host facilities and assistance to "APCTT".

2. TECHNOLOGY PROMOTION, DEVELOPMENT & UTILIZATION PROGRAMME

The scheme "Technology Promotion, Development and Utilization (TPDU) Programme" is aimed at promoting technology development and industrial research in the country and encouraging its utilization by various sections of economy, be it be industry, academic, scientific institution and the society at large. The components of the TPDU programme are:

- Industrial R&D Promotion Programme (IRDPP)
- Technology Development and Innovation Programme (TDIP)
 - Technology Development and Demonstration Programme (TDDP)
 - Technopreneur Promotion Programme (TePP)
- Technology Management Programme (TMP)
- International Technology Transfer Programme (ITTP)
- Consultancy Promotion Programme (CPP)

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- Technology Information Facilitation Programme (TIFP)
- Technology Development Utilization Programme for Women (TDUPW)
- Information Technology & e-Governance (IT&eG)

2.1 Major Achievements

Industrial R&D Promotion Programme

DSIR is the nodal Department for granting recognition to in-house Research and Development centres of industry. During the period from 1st January 2008 to 31st March 2009, there were 1361 in-house R&D centres with DSIR recognition. Of these centres, 157 in-house R&D centres incurred an annual expenditure of over Rs.5 crores each and 306 in-house R&D centres incurred an annual expenditure in the range of Rs.1 crore to Rs.5 crores.

During the period from 1st January, 2008 to 31st March, 2009, 170 in-house R&D centres were accorded fresh recognition and recognition of 259 in-house R&D units was renewed. As a part of the promotional efforts, the department proposed to organise the 22nd National Conference on in-house R&D in industry and National Awards were announced for six industrial units. DSIR brought out two directories during 2008 i.e 'Directory of recognized In-house R&D Units -2008' and 'Directory of recognized Scientific & Industrial Research Organisations-2008'.

Scientific research foundations in the areas of medical, agriculture, natural & applied sciences and social sciences seek DSIR approval as Scientific and Industrial Research Organisations (SIROs) under the DSIR scheme of granting recognition to SIROs. The recognised SIROs are eligible for availing customs duty exemption on imports and central excise duty exemption on indigenous purchase of essential scientific & technical instruments, apparatus, equipment (including computers), accessories, spare parts thereof and consumables, required for research and development activities. During the period

from 1st Jan, 2008 to 31st March, 2009, 32 new SIROs have been accorded recognition.

The department issued one certificate for accelerated depreciation allowance on indigenous technology based plant & machinery involving an investment of Rs.1804.98 lakhs.

DSIR is the nodal Department for registration of public funded research institutions, universities, IITs, IISc., RECs/NITs, for availing customs duty exemption and central excise duty exemptions under notifications 51/96-Customs and 10/97-Central Excise. During the period from 1st Jan, 2008 to 31st March, 2009, 34 fresh institutions were registered with DSIR; and 34 institutions were also granted renewal of registration.

Secretary, DSIR is designated as the Prescribed Authority under section 35(2AB) of Income-tax Act, 1961. Fresh approvals were accorded to 31 companies by the prescribed authority.

Agreements of co-operation for research & development were also signed with these companies. The detailed R&D expenditures of the approved companies are examined by DSIR and 85 reports forwarded to DGIT(E) in Form 3CL as required under the IT Act.

Technology Development and Innovation Programme

The programme has two sub-components:

- (i) Technology Development and Demonstration Programme (TDDP) to support technology development efforts of industry R&D system and
- (ii) Technopreneur Promotion Programme (TePP) to nurture the innovative spirit of individuals.

The component programme, Technology Development and Demonstration aims at catalyzing and supporting activities relating to technology absorption, adaptation and demonstration including capital goods development, involving industry and R&D organizations. Under the programme, research, development, design & engineering projects for absorption and up-gradation of imported

technology as well as development & demonstration of new and improved technologies are supported. While DSIR support is catalytic and partial, bulk of the financial contribution in any project is from the industry.

The Department, under this programme has so far supported about 200 R&D projects of Industrial units. These projects cover products and processes in various important industries such as metallurgy, electrical, electronics, instrumentation, mechanical engineering, earth moving and industrial machinery, chemicals and explosives, etc. Over 41 technologies developed under the scheme have been commercialized or under commercialization. During the period from January 2008 to March 2009, 7 new Technology Development Demonstration projects were supported under the programme and 54 projects were reviewed for progress.

Technology Development projects have strengthened the linkages with more than 25 national research laboratories/ institutions such as NAL, Bangalore; RRL, Trivandrum; IICT, Hyderabad; CMRI, Dhanbad; IIP, Dehradun; C-DAC, Pune; Institute of Plasma Research, Ahmedabad; ER&DC, Trivandrum; Dalmia Centre for Biotechnology, Coimbatore; CMTI, Bangalore; which have been collaborating with industry in the specific research, design, development & engineering (RDDE) projects of high techno-socio-commercial impact. The Scheme has been found successful in synergizing the R&D efforts of industry and national research organizations.

The Technopreneur Promotion Programme (TePP) is India's largest network program supporting independent innovators and start-up firms. The network, spread out with 28 outreach centres and 100 innovation managers provides grants, pre-seed funds, technical guidance, incubation facilities and assistance to get a sound business plan. The support is provided in two distinct phases - *innovation incubation* in first phase where maximum support is Rs. 15.00 lakhs and towards *enterprise incubation* in second phase where the cap is Rs. 45.00 lakhs. Since the time of inception, 356 innovations of independent innovators have been supported.

Out of these, 260 were supported by DSIR (rest by TIFAC). Some of the successfully completed TePP projects during the year are Cut off valve, Solar powered lamp, Natural air cooler, Banana stem injector, P&P dental implant systems, Banana fibre separator machine, Digital talk friend(DTF) – speed warning and limiting device(SWALD), Motorized cycle hoe, Integrated use of Neem and Sea Algae in the eco-friendly management of crop pests, Prefabrication Technology Development for small scale and cottage industries – to manufacture Indian Oriental Remedies, Wireless remote patient monitoring system, Hydroponics prototype devices and so on.

Technology Management Programme

The major objective of the Technology Management Programme is to provide technical inputs and support mechanisms for efficient transfer and management of technology. A number of technology and management related studies were taken up/carried out under the programme during the year. Of these (i) Study on Development of Beel Fisheries and various species of Bamboos in North Eastern States (ii) Study on Status of Technology in Castor Oil and its Derivatives in India (iii) Potential of E-waste Management in India (iv) Technology Audit of Fish Processing Industry in the Coastal Districts of Karnataka (v) Study on Managing Strategic Transformation of Hi-tech Firms in India (vi) Study of Knowledge Management in Auto Component Clusters in the NCR Region and (vii) Study on Evaluating the Application of Technology Management Assessment Procedure in Foreign Collaboration Cases in Madhya Pradesh were completed.

The case studies covering Technology Management Aspects which were supported under the programme and completed are (i) A Case Study relating to Specific Sectors to target Rural Economy in Karnataka (ii) Case Study on Industrial Clusters of Uttar Pradesh relating to Leather Processing Cluster of Kanpur, the Silk Producing Cluster of Varanasi and Brasswork Cluster of Moradabad. The Centres for Technology & Innovation Management which

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were set up under DSIR programme were functional with enhanced activities in PSG Institute of Management, Coimbatore, Madhya Pradesh Council of Science & Technology (MPCOST), Bhopal, IIT, Bombay, IHBT, Palampur, IED, Patna, Bihar, IMI, New Delhi and KCTU, Bangalore. Newsletters are being brought out on specific technology management aspects in association with IIT Bombay, PSGIM Coimbatore, KCTU Bangalore, MPCOST Bhopal and IED Patna, Bihar. Seminars/workshops and training programmes on specific issues related to technology management are also organized. As an initiative under the programme towards curriculum development in technology management, five modules have been completed. With a view to give thrust on research and teaching in technology management aspects, a DSIR Technology Management Chair is created at IIT, Guwahati.

International Technology Transfer Programme

Under the International Technology Transfer Programme (ITTP), major activities completed or in progress during the year include: studies on trans-nationalization of SMEs in the machine tool sector and auto-components sector; organization of fourth International Awareness - cum - training programme on packaging technologies and machinery including quality assessment systems for packaging materials and equipment (for food processing sector); promoting technology co-operation and trade between India and CIS countries and India and African countries in association with Department of Commerce and facilitating MoUs between Indian and foreign SMEs; bringing out a Compendium on Technology Exports in association with IIFT containing data of 372 organizations for the period 2002-2007, giving contact details, technology status, areas of operation, sales turn-over, exports etc.; training consultants under a TEDO - project on Capability Building to Enhance Export Competitiveness & Facilitating Market Access for Indian Technologies and Technology Intensive Products and making SMEs export ready; support to the Centre for International

Trade in Technology at IIFT in which activities like Programme on International Marketing of Technology and Technology Intensive Products, Study on Technology Branding of SMEs, Programme on Enhancing Technology Sourcing Capabilities for Export Competitiveness in Packaging Industry and a Workshop on Capacity Building in Technology Sourcing for Enhancing Export Competitiveness in Processed Foods Industry were organized; participation in ITM Expo at Mumbai; and planning exhibitions-cum-fairs on rural technologies at Dausa (Rajasthan) and Fatehabad (Haryana). All these efforts seem to have catalyzed the technology intensive and high value added exports. The percentage of such exports, in the overall exports, has steadily increased over the years. A large segment of exporting community has been trained and sensitized towards high value added exports.

International Cooperation

DSIR continues to play the role of being the focal point for the APCTT, an agency under UNESCAP facilitating the establishment of networks of technology transfer inter-mediaries in the region to promote cross-border business cooperation among SMEs.

Other than the institutional support extended by the Government of India and the other administrative support extended as per the host country agreement, DSIR has also extended support to APCTT to implement the project, *Promotion of National Innovation Systems (NIS) in Countries of the Asia Pacific Region Phase I* and initiated to support the project, *National Innovation System Phase II*. As part of the effort, the Centre has established an *NIS Online Resource Centre*.

APCTT is also implementing the Grass Roots Innovations (GRI) Project. The last of the national workshops under the project was a two-day China-National Workshop on GRI in Tianjin, China organized by APCTT and the Tianjin University of Finance and Economics. About 380 experts and senior officials, of whom about 140 were women, from various government departments and ministries, R&D institutions and technology transfer intermediaries had

participated. This Grassroots Innovations (GRI) project is a DSIR-APCTT-SRISTI Initiative.

APCTT received 243 technology offers and 187 technology requests from SMEs and entrepreneurs across the Asia-Pacific region. The Centre's technology transfer portal, www.technology4sme.net, served as an active platform for information exchange between APCTT, SMEs and business firms in the Asia-Pacific region. This website was also used by business firms in Europe, Latin America and the United States of America.

Efforts were made to set up the Asia-Pacific Traditional Medicine Network (APTMNET) a viable and productive network linking the 14 member countries in the region.

Consultancy Promotion Programme

The programme relating to consultancy promotion essentially aims to strengthen our consultancy capabilities for domestic and export markets. During the period under report, IT Consultancy Clinic for SMEs in NOIDA, three Consultancy Clinics on Hosiery Industry at Kanpur, Jute & Jute Diversified Products at Kolkata and Design & Engineering centre for mould design used in Automotive & Durable Consumer Goods with high surface finish at Coimbatore were progressing satisfactorily. The Consultancy Export potential studies in eight African countries, four Latin American countries, three CIS countries and four European countries were supported. Also, technical inputs/supports were provided to Consultancy Engineers Association of India (CEAI) and other consultancy promotion organizations.

Technology Information Facilitation Programme

Technology Information and Facilitation Programme (TIFP) has the broader objectives of generating endogenous capacities for the development and utilization of digital information resources and facilitate accelerated S&T research. The strategy concentrates on facilitation of Indian content on S&T, avoid duplication of efforts, and allow minimum overlap and maximum utilization of existing facilities. The

specific achievements of the programme during the period of report include:

(i) Promotion of Content Development:

Completed

- Design and Development of on-line database on Mycorrhiza (New Delhi)

Nearing Completion

- Preparation of Database on Metallo-pharmaceuticals (Pune)

Under Progress

- Floral potential of J&K State: Survey and Documentation (Srinagar)
- Indian Wood Insect Database - a Database on diversity of indigenous and exotic wood insects/pests in India (Bangalore)
- Development of Decision Support software System for Cereals, Millets, Pulses and Tuber crops & establishment of an Agricultural Digital Information centre (Trivandrum)

(ii) National Websites/ Servers

Completed

- Science & Technology Portal (Pune)
- Spread of Indigenously Developed Textile Technology Research via Internet (Ahmedabad)
- Energy Information Support Services for the Indian Industry (Delhi)

Under Progress

- Online Directory of Indian Academic & Research Establishments (Bangalore)
- Enterprise Performance Improvement through Integrated Management Systems (Delhi) – nearing completion.
- Developing a user-centered Website on Sugarcane Production Technologies (Coimbatore)

(iii) Indian Digital Library of Theses and R&D Publications

Completed

- Design and Development of Database and Web-Portal of Indian Theses in the field of Manufacturing Technology & Management (Satyamangalam)

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(iv) Documentation of Traditional Knowledge and Folk Wisdom

Completed

- Documentation and Preservation of Agricultural Traditional Knowledge by using Modern Electronic Media through Farmer Participatory Approach (Madurai)
- Folk Wisdom of West Bengal (Kolkata)

Nearing Completion

- Development of a Portal and Kiosk of Goldsmith's skill towards enhancement of entrepreneurship abilities among unemployed youth (Durgapur)

Under Progress

- Application of ICTs in Agricultural Extension Services Provision and its Impact on the Tribal Farmers of Arunachal Pradesh State of North-East India (Pasighat)
- Development of a Multimedia Database of Traditional Knowledge in Andhra Pradesh (Delhi)

(v) Electronic Publishing of Selected Indian S&T Materials

Completed

- E-publishing of the Journal of Tropical Agriculture (Thrissur)

(vi) Virtual Systems

- A Virtual information Centre, <http://www.vic-ikp.info> has been established at ICICI Knowledge Park (ICCIKP), Hyderabad.

(vii) Open Archives Initiative

Completed

- Development of OAI based Institutional Research Repository Services in India (Bangalore)
- Developing an Institutional Repository of Science and Technology (Kochi)

Nearing Completion

- Establishing MOLTABLE- An Open Access initiative for Molecular Informatics (Pune)

(viii) Surveys and R&D Studies

Completed

- Web GIS based Digital Atlas of the Sacred Groves of the North East India: Pilot study

with Sacred Groves of Arunachal Pradesh (Nirjuli)

Nearing Completion

- Archiving Ethnomedicinal Knowledge and Local Health Care Systems (LHCS) through Modern Electronic Gadgets: An Explorative Study (Madurai)

(ix) Education and Training

Nearing Completion

- Web based interactive multimedia training programme on Digitization and Digital libraries (Delhi)

Technology Development Utilization Programme for Women

In pursuance of the recommendations of the Inter-Departmental Committee set up to consider issues regarding Gender Budgeting, the Department established a "Gender Budgeting Cell", initiated steps to enhance the share of women in respect of beneficiary oriented schemes, and designed a scheme namely, Technology Development and Utilization Programme for Women (TDUPW) in 2005-06. The programme is aimed to meet specific needs of women and to enhance their contribution towards technology capability building. Department has supported several projects so far and twelve projects have been completed.

Information Technology & e-Governance

Information Technology & e-Governance has been initiated in the Department during the middle of the Tenth Plan by allocating a fixed percentage of the plan funds of the TPDU Scheme to create an IT environment in the Department in conformity with the National e-Governance Action Plan. IT Action Plan of DSIR was worked out in May 2003 and for its implementation, a separate IT Budget Head was created, which became operational in FY 2004-05.

Various applications like IntraDSIR, Instant Messaging System, Document Management Information System, Central Information System, Public Grievance Redress & Monitoring System, Procurement and Inventory Management

system, Foreign Collaboration Approvals Information Management System, ExtraDSIR and Exchequer were operational during the year. IT-Security Policy has also been implemented in the department. The activities related to customization of *Project Application and Monitoring System (PAMS)* were completed and the same was hosted on DSIR Server located in Technology Bhawan. User trials for implementation of PAMS are being carried out. A Customized Pay Roll System, developed by NIC, has been installed, configured and is under testing in the department.

3. AUTONOMOUS INSTITUTIONS

3.1 Council of Scientific & Industrial Research (CSIR)

CSIR, a nationwide network of 37 national research laboratories and 39 extension centres, spans the length and breadth of India – from Jammu in the North to Thiruvananthapuram in the South; and from Jorhat in the East to Bhavnagar in the West. Established in 1942 as an autonomous, non-profit organization, CSIR's charter of functions includes promotion, guidance and co-ordination of scientific and industrial research, collection and dissemination of information on research and industry, founding of laboratories to carry forward scientific and industrial research and utilization of the new knowledge so generated, for the development of industry. CSIR is also charged with tasks such as rendering assistance to other institutions conducting research, awarding of research fellowships and publishing of scientific journals.

The year was very significant with respect to the achievements registered in **high science**. Many research outcomes from CSIR adorned the cover pages of peer-reviewed journals, some of which, to name a few, are *Technology & Applied Pharmacology*, *Journal of Polymer Science*, *Nanomolecular Chemistry and Physics*, *Zebrafish*, etc. Perhaps the most significant contribution towards high science is the development of apomixis technology for asexual seed production in food crops by a

process that allows production of high yielding hybrid seeds at greatly reduced costs to the farmer. Likewise, the development of Indian Genome Variation Database (IGVDB), which houses Single Nucleotide Polymorphism (SNP) frequency data in over 1000 genes from disease and drug response candidates in population representing the entire genetic diversity of India, with over 150 co-authors, is another landmark achievement.

Development of a seismic technique “the S-wave receiver function” and accurate measurement of the lithospheric thickness of several continents, India, Antarctica and Australia, which were all part of Gondwanaland, was published in one of the most prestigious journals of the world, *Nature*. It not only provides a new dimension to the classical plate tectonics theory, but also establishes CSIR's pre-eminence in the area of earth science research. Strong evidence has been provided to indicate how the plate thickness correlates with the speed of plate motion. For the first time, an explanation has been provided for the first drift of the Indian plate in the initial period after Gondwanaland break up. Yet another contribution to high science is in the field of **Electronics Engineering**, wherein CSIR scientists have carried out a detailed analysis of the light transmission through a corrugated long period waveguide grating made in silica-on-silicon planar waveguide. A design has been optimized by proper choice of the grating parameters, which results in a polarization-independent rejection band in the operating wavelength region. This type of waveguide grating has significant potential for use in various integrate-optic devices and sensing applications.

Apart from contributions to high science, CSIR has marked its presence in developing many high-end processes, technologies, devices in different areas of S & T. Following paragraphs highlight some of the most significant accomplishments.

In the field of **aerospace science and technology**, an application of level 1 data fusion to the air defense, a seeker filter based on Interacting Multiple Model Modified Extended

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Kalman Filter (IMM-MEKF) has been designed by NAL. In addition to that, NAL has also developed, as an application of level 2 data fusion, a fuzzy-logic Bayesian network-based hybrid situation assessment model to serve as a pilot decision making aid for Beyond Visual Range (BVR) Combat. NAL has also designed and built India's first state-of-the-art 12.88 metre dia. Doppler Weather Radar (DWR) mark-II radome. It has been installed around the 9 m dia. DW radar at BEL, Bangalore. The mark-II radome has features like greater transparency for electromagnetic signals, etc.

In **biological science & technology**, significant contributions have been reported from CCMB, IGIB, IICB and IMTECH. CCMB has sequenced the complete Pysomal hydrolase cathepsin B (CTSB) gene in an adequately powered cohort study with a large number of well-characterized patients and healthy controls and identified several variants spread across the gene. The work provides the first human evidence for the 30 year old cathepsin B hypothesis of pancreatitis and suggests CTSB gene as the second candidate gene after SPINK1 gene to be involved in the pathogenesis of tropical calcific pancreatitis (TCP). Understanding the functional basis of mutations in these genes may help in developing predictive tests for susceptibility to chronic pancreatitis.

IGIB developed a method which relates allelic variants of the human inositol polyphosphate 4-phosphatase (INPP4A) gene and splice variants of the coding sequence. It encodes INPP4A enzyme, known to be an important regulator of platelet activation. It also provides primers and method suitable for the detection of the allelic variants for applications such as molecular diagnosis, prediction and prevention of an individual's susceptibility to asthma and/or the genetic analysis of the INPP4A gene in a population.

CSIR is also responsive to the challenge of **conserving endangered animals**. Black Buck is one such animal. CCMB scientists used the technique of artificial insemination, which is routinely practiced for domestic animals, but not for wild animals. CCMB scientists synchronized

estrus in Black Buck by using an intra-muscular injection of estradiol valerate with norgestomet and an ear-implant containing norgestomet. The estrus-synchronized animals were then inseminated intra-vaginally using a cattle artificial insemination device containing freshly collected semen from an adult male. As a result, the conceived animal delivered a live fawn after 6 months of pregnancy.

IGIB developed a **systems biology platform** for tuberculosis research, which offers a comprehensive resource of annotations, drug information, host pathogen interaction polymorphism gene expression and pathways. This platform is useful for researchers to identify and assess drug targets and vaccine candidates.

IMTECH scientists provided fresh insights into the mechanism of RNA interference and heterochromatin silencing. They found that heterochromatin protein SWi6 acts downstream Aaphase Promoting Complex (APC) in the assembly of heterochromatin. It was found that APC also participates in the RNA interference pathway.

CSIR's contributions to the area of **electronics engineering and instrumentation** are evidenced by CEERI's design and fabrication of a triode type **Magnetron Injection Gun for a 200 Kw 42 GHz Gyrotron**. CEERI has also developed a system which can locate trapped miners. With this system, it is easier for the management to keep track of each and every miner wirelessly without interfering in the day-to-day operations. CEERI designed and fabricated a **complete graphite electrodes multistage depressed collector assembly** using copper impregnated high density graphite and integrated with Ku-band TWT prototype. CSIO has developed an infra red probe to **measure the temperature of snow surface** without the need for physical contact with snow surface. The system can operate round-the-clock in harsh weather in snow-bound areas in the temperature range of -40° C to + 50 °C with high relative humidity and wind speed of the order of 200 km/hour. CSIO has developed a process for titanium nitride (TiN) coating on stainless steel ophthalmic surgical instruments using the physical vapour

deposition technique. The deposition process has been standardized in terms of coating thickness, film stoichiometry, hardness and adhesion. The coating provides resistance to corrosion and is bio-compatible. The coated instruments underwent a large number of autoclaving cycles during user trials at several hospitals.

In **materials related research**, CSIR, through AMPRI, CGCRI, NAL and NML, has made significant progress. AMPRI developed a **foldable and transportable twin house unit** having foldable side walls, foldable end walls and foldable roof panels. The twin house weighs 40 kg and costs Rs. 40,000 and can easily be transported. It is made of sisal fibre and industrial waste, like red mud, etc. It is very useful under disaster management conditions to house disaster victims. AMPRI has also developed a **rural climatizer** made of open cell aluminium foam with a pore size of 1-2 mm. An efficient cooling of the chamber is attained without using electricity, and thus the climatizer can be used in the rural sector most effectively. Typically, the inside temperature is reduced by 7-9 °C with respect to the atmospheric temperature.

CGCRI has developed porous silicon nitride diaphragm tubes, useful for **fast breeder reactors**. It also discovered a process technology for coating of hydroxyapatite on metallic substrates by protein mediated biomimetic route.

NML placed a **microgravity payload on board SRF-I satellite** launched by ISRO. They have also designed and fabricated a biomimetic reactor for an unmanned space capsule. The nanoparticles synthesized under microgravity during journey in space exhibited a great degree of morphological sophistication in terms of nanoparticle size, shape and their ordered assembly leading to the formation of higher order nanostructures akin to biological structures like tooth enamel.

CSIR has been continuously interacting with Indian industry over the years to know and fulfill its needs. As a part of this endeavour, during the year under review, the process knowhow of a

new catalyst for sweetening of lighter petroleum fractions has been licensed for commercial use to BPCL, Mumbai. Other refineries like RIL, Jamnagar will also start its use soon. Under the New Millennium Indian Technology Leadership Initiative (NMITLI), CSIR also encouraged development of indigenous innovative technology in diverse industrial sectors.

The growth of peer reviewed research publications from CSIR for the last few years is appreciable. It is at par with that for IITs and even ahead of prestigious institutions like IISc, TIFR, BARC and DRDO. This year CSIR published **3858 research papers** in SCI journals with average impact factor per paper of 2.047. CSIR has shifted its philosophy in patent filing from random to selective and accordingly filed 356 patents abroad and 207 in India, whereas it has a portfolio of 1246 patents in India and 1770 patents abroad. CSIR has been granted 356 patents in India and 289 patents abroad and 14 copyrights.

Apart from its own efforts, CSIR continued its initiative of promoting excellence in science through recognition of the outstanding work done by 11 Indian scientists through presenting the prestigious Shanti Swarup Bhatnagar Awards.

CSIR has also contributed significantly to building of human resource base of S & T in the country by financially supporting around 7000 research fellows, 120 emeritus scientists and more than 800 extra mural research proposals in diverse fields of science and technology.

Apart from promoting HR resources at the R&D level, CSIR has been contributing to training of manpower for some industrial sectors also. Three of CSIR laboratories, CFTRI, CLRI and CSIO, contributed to the build-up of trained manpower for the food, leather and instrumentation industries, respectively through specially tailored training programmes aimed at the small scale industrial units.

3.2 Consultancy Development Centre

The Consultancy Development Centre (CDC) came into being as a registered society in January 1986, and is functioning from its office

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at India Habitat Centre Complex since May 1994. The CDC was approved as an Autonomous institution of DSIR in December 2004. The Centre is managed and guided by a Governing Council headed by Secretary, DSIR. The Governing Council consists of representatives of Government, Industry and Academia. The activities of CDC pertain to educational programmes in consultancy management, competency enhancement through training and skill building programmes, development of young professionals and women to opt for consulting as a career option and studies/projects relating to development of the consultancy profession.

During the year 2007-08 Consultancy Development Centre (CDC) re-oriented its activities in line with its mandate of development and promotion of consultancy capabilities in the country as given in the Memorandum of Association. Towards this, the following thrust areas have been identified.

- Education
- Capacity Building
- Export of Services of Experts/ Consultants/ Technologists/ Scientists
- Promotion of Consulting as a career option among women/ young professionals

Specific programmes and activities were drawn up in line with each of the above thrust areas. In order to facilitate CDC to carry out developmental activities relating to the consultancy profession, a budgetary support of Rs.10 crores has been approved for CDC during the 11th Five Year Plan. The year 2007-08, being the first year of the 11th Plan, the support of 2 crores from DSIR was utilized for various new initiatives. As a follow up of the Cabinet decision approving CDC as an autonomous institution of DSIR, the CDC Rules and Regulations 2008 were framed and notified. The new Governing Council of CDC was constituted in accordance with the new Rules.

During 2008-09 specific programmes and activities were drawn in line with the thrust areas and were executed. A Road Map upto 2018 was

prepared. Interaction with CSIR was increased during the year and three assignments were carried out. New areas including consultancy support for large national projects covering safe drinking water, SME Sector competitiveness enhancement, etc. were initiated.

4. PUBLIC SECTOR ENTERPRISES

4.1 National Research Development Corporation (NRDC)

National Research Development Corporation (NRDC) is a Section 25 Company, established to Promote, Develop and Commercialise technologies, know how, inventions, patents and or processes emanating from various National R&D institutions. The Corporation offers its services throughout the country in improving the manufacturing base in India with innovative technologies specially suitable for Indian entrepreneurs and acts as an effective catalyst in translating research into marketable industrial products. During the several years of its existence, the Corporation has forged strong links with various R&D organizations both within the country and abroad, and pursued the worthy cause of bringing inventions to fruition. Equipped with the vast number of technologies, the corporation is now recognized as a repository of wide ranging technologies spread over many industry verticals, viz., Chemicals, Drugs and Pharmaceuticals, Bio Technology, Metallurgy, Building Materials, Mechanical, Electrical and Electronics, etc. and has licensed technologies to over 4600 entrepreneurs.

Beside technology licensing, the Corporation has also been providing services for the promotion of technologies by way of rendering technical and financial assistance for prototype development and protection of the inventions by filing patents in India and abroad, Pre-investment studies & Feasibility reports, Basic Engineering Design Packages, training in operation of plants, Raw material and Product testing.

The Corporation has also initiated a major thrust for export of those technologies, which have become a success in India, to other developing countries. It has already supplied a number of technologies and services to entrepreneurs both in the developed as well as the developing countries.

The broad based expertise within the Corporation along with the extensive network of national and international contacts in scientific bodies, technology transfer agencies, industrial and engineering concerns ensures the entrepreneurs in receiving the very best in technology and other services.

During the year 2008-09, the Corporation entered into Memorandum of Understanding / Agreement with the 18 organisations as compared to 12 organisations in 2007-08. As a result, 55 new processes were assigned to the Corporation for commercialization as compared to 58 processes during the previous year. The Corporation signed 35 licence agreements during 2008-09 as compared to 41 license agreements signed during 2007-08. the year. During 2008-09, the Corporation organized 17 seminars and awareness programs on How to Draft a Specification and Prosecute Indian Patent Application, Patenting in Biotechnology and other IPR issues as compared to 15 seminars during 2007-08.

4.2 Central Electronics Limited (CEL)

CEL is one of the leading manufacturers of Mono Crystalline Silicon Solar Cells/Modules in the country. It had also the distinction of being the first company in India in the development and manufacturing of Professional Ferrites and Piezo Ceramics. The mission of company is “to achieve excellence in the technology and manufacture and be market leader in Solar Energy Systems and Strategic Electronics”.

Major products and applications developed and deployed by CEL with various customers in the public and private sector include: Solar Photovoltaics such as Solar Cells, Solar

Modules, Solar Systems, Industrial Systems such as Railway Electronics, Universal Axle Counter, Digital Axle Counter, Block Proving System, Train Actuated Warning device, Cathodic Protection System; and Strategic Electronics Systems such as C & X Band Phase Shifters, identification of Friend & Foe System and Night Vision device, Piezo based Heat Fuse devices for Defence, etc.

The authorized capital of CEL as on 31.3.2009 is Rs.60 Crores and paid up capital is Rs.49.76 Crores. CEL achieved the production turn over of Rs.154.06 Crores in 2008-09 with an operating profit of Rs. 3.37 Crores against Rs.167.66 Crores in 2007-08 with operating profit of Rs.13.74 Crores.