

## **Central Power Research Institute: Over Five Golden Decades of Dedicated Service to the Nation**

*Central Power Research Institute (CPRI), an autonomous Society under the Ministry of Power, Government of India was set up in 1960. The Institute has rendered over five decades of dedicated service to the Power Sector. The paper details the journey of CPRI from its inception, establishment of state-of-art specialized R&D and Testing Facilities viz. Short Circuit testing, High Voltage testing, Power System studies, Power Cables and accessories, Energy meter, Design of Transmission Line Towers and testing, Conductor Vibration Studies, Transformer Oil, Power Capacitors, Solar and LED Lighting Systems which has resulted in recognizing CPRI as one of the largest Research and Test House in the world catering to the entire gamut of services covering Generation, Transmission and Distribution under one roof. The decades witnessed the expansion of CPRI activities and besides Bangalore and Bhopal, CPRI Units were established at Hyderabad, Nagpur, Noida, Kolkata and Guwahati. Pioneering Research work aiding the Utilities and Industry and expansion of Field testing, Consultancy/System studies, Monitoring and Inspection achieved a healthy growth. The Institute during these years was able to enhance its brand equity and cater to the requirements of the Overseas Customers.*

The Central Power Research Institute was established on the recommendations of the "Planning Committee for Power Engineering Research" headed by Prof. M S Thacker, the then Director of the Council of Scientific and Industrial Research, which submitted its report in 1956. The Committee stressed the need for taking up an effective programme of power research in the country. In the context of an expanding power supply industry and the growing quantum of manufacture of electrical equipment in the country, the Committee recommended the setting up of a Power Research Institute at Bangalore and a Switchgear Testing and Development Station at Bhopal under the charge of a Director. It envisaged the setting up of six divisions, namely High Voltage, Electrical Engineering, Hydraulic Engineering, Mechanical Engineering, Switchgear Testing and Administrative divisions.

Bangalore was selected for the location of the Institute in view of the availability of the laboratories of Indian Institute of Science. Similarly, the Switchgear Testing and

Development Station was located at Bhopal as the Bharath Heavy Electricals' Plant (Erstwhile Heavy Electricals India Ltd.) was located there. The cost of both the projects was estimated at ₹ 4.20 crores.

Subsequently, the organization was set up under Sri. S Swayambu, Director, Central Water and Power Commission (CWPC) to work out the details of the Project. In view of the observations of the Planning Commission, it was decided to set up a 'Power Research Institute' in three stages as under:

1. *First Stage:* Formulation of a scheme for providing the necessary additional facilities for research at the Power Engineering Department of the Indian Institute of Science, Bangalore, with a view to initiate a programme of research of urgent problems.
2. Preparation of a scheme for the establishment of a Switchgear Testing Laboratory at Bhopal, so as to bring into commission in the early part of the Third Five Year Plan.

3. *Second stage:* Drawing up of plans for Power Research on a long term basis at Bangalore with separate laboratories with necessary equipment and other facilities.



50 MVA SHORT CIRCUIT GENERATOR AT CPRI

## 1.0 FIRST STAGE OF THE SCHEME

The nucleus organization headed by Shri. Swayambu submitted a report on “the First Stage Scheme of the Power Research Institute at Bangalore” in August 1958. This scheme was oriented towards-maximum utilization of the facilities available in the Indian Institute of Science and provided for the procurement of only the minimum additional equipment, construction of necessary extensions to the existing buildings of the Indian Institute of Science; and acquisition of land for the permanent Institute buildings. Administrative approval and expenditure sanction for the scheme at an estimated cost of ₹ 36.42 lakhs spread over a period of 4 years was accorded by the Government on 07.01.1960.

Thus, CPRI headed by a Director and as a subordinate office of the Central Electricity authority (Erstwhile Central Water and Power Commission (CWPC)), which itself was an attached office of the Ministry of Energy, came into existence in 1960. The CPRI had two units: one at Bangalore and the other at Bhopal named as ‘Switchgear Testing and Development Station’.

## 2.0 UNDP ASSISTANCE

The Government, while considering the first stage of the scheme, simultaneously sought assistance from the UNDP and posed the Scheme as proposed by the Planning Committee (under the Chairmanship of Prof. M S Thacker) to UNDP assistance in January 1959. The UNDP agreed to give assistance and a Plan of Operations agreement was signed by the Government of India UNDP and UNESCO in January 1960. The UNDP assistance was limited to the supply of equipment for LT Short Circuit laboratory, High-Voltage impulse testing and equipment for Insulation laboratory at Bangalore and for setting up of Switchgear Testing and Development Station at Bhopal. The assistance also included services of experts and awarding of Fellowships to CPRI personnel for training abroad. The agreement provided for UNDP aid of \$192,800 with an Indian counterpart Contribution of ₹ 20,78,300. This estimate had to be revised later due to escalation in prices and the agreement was amended in September 1969, providing for UNDP contribution of \$2,738,773 and the Indian counterpart contribution of \$3,061,758.



FIELD STUDIES

## 2.1 Modification to Stage-I Scheme

The scope of the original first stage of the scheme, for which Administrative approval and expenditure sanction had been accorded

by the Government, required modifications in view of the agreement with the UNDP. The modifications covered inclusion of Switchgear Testing and Development Station at Bhopal, LT Switchgear Testing Laboratory, Partial Discharge Laboratory and Insulation laboratory at Bangalore. Acquisition of land, construction of an independent building and other civil works had also to be included. A revised sanction for ₹ 534.01 lakhs with breakup as under was therefore obtained including these works.

RUPEES IN LAKHS			
Particulars	Bangalore	Bhopal	Total
UNDP Contribution	17.10	126.30	143.40
Indian Equipment	33.70	86.03	119.73
Land and Building	59.58	92.91	152.49
Staff (recurring)	78.80	39.59	118.39
Total	189.18	344.83	534.01

The setting up of the CPRI, Bangalore, was accomplished in 2-phases. In the first phase, the Institute functioned in the premises of the Indian Institute of Science by utilizing their equipment and putting extension to their buildings, while in the second phase, land was acquired and independent premises were put up in the vicinity of IISc for the various laboratories.

Although commenced in 1960, the completion of the total scheme under Stage-I was achieved in 1971.

The Institute started functioning in the new campus in 1971. The Institute was assisted by Mr. Parkman of ERA (UK), Consultant to UNDP, during its formative years. The Switchgear Testing and Development Station at Bhopal was set up at Bhopal on 40 acres of land acquired from the Madhya Pradesh Government adjoining BHEL. This station was also commissioned in 1971.

## 2.2 Stage-II Scheme

Proposals were submitted to Government for sanctioning CPRI Stage-II Scheme. The scheme envisaged adding facilities like Power frequency testing, pollution studies and Impulse current facilities at the High-Voltage Laboratory. The scheme was sanctioned at an outlay of ₹ 152.40 lakhs in 1976. Under this scheme, all the laboratories hitherto functioning in the premises of IISc were shifted to the existing premises in 1979.

In pursuance of its policy decision, the Government of India set up a committee under the chairmanship of Sri K B Rao to review the working of Central Power Research Institute in 1974. The objectives of the committee was to put forth suggestions and measures for strengthening the organization in the context of massive power development programmes under way in the country during that period. After in-depth study and discussions with various organizations, the committee submitted its report in June 1975. One of the major recommendations of the committee was related to the organizational restructuring of CPRI into autonomous organization. The recommendations of the Rao's Committee was accepted by the Government of India and CPRI was declared Autonomous body on 16th January 1978. It was recognized as an autonomous society under Ministry of Power, Government of India.



FIELD STUDIES



CPRI on reconstitution as a registered Society from January 1978 is under the management of a Governing Council of which the Secretary to the Government of India, Ministry of Power is the President. The 14-member Governing council was formed comprising representatives drawn from Union Ministry of Power, Finance and Industry, Central Electricity Authority, State Electricity Boards and Academic Institutions. The council appointed a Standing Committee (administrative and financial matters) and two technical committees, one on Testing and Certification and the other on Research to advise on various topics connected with the development of the institute.

### 2.3 Plan Schemes and Five Year Plans

The Institute came into existence during the Second Five Year Plan with an initial sanction of ₹ 36.42 lakhs, which included recurring expenditure of the Institute for four years. By the time the First Stage of the project got completed in the middle of Fourth Five Year Plan, this amount was revised to ₹ 534.01 lakhs, which comprised of ₹ 143.40 lakhs as developmental aid received from UNESCO under UNDP. During Fifth Five Year Plan, the Institute received capital grants of ₹ 152.40 lakhs for augmenting the four laboratories at Bangalore.

During the Sixth Plan period, several important projects were sanctioned by Government of India, notable among them was the setting up of 2500 MVA Short Circuit Testing with Synthetic Test facility at High Power Laboratory and Establishment of Materials Technology Division at Bangalore during 1992.

Several units of the Institute were established during the Seventh Five Year Plan period. To study the suitability of using higher transmission voltage of the level of 1000 kV, an experimental line project at Ultra High-Voltage was set up at Hyderabad at a cost of ₹ 2645 lakhs in August 1993. To study the problems related to Thermal Power Stations, a laboratory was set up near Koradi, Nagpur at a cost of ₹ 1718.17 lakhs during 1993.

To help the electrical industry in the northern belt of India, the Government sanctioned setting up of Regional Testing laboratory at Muradnagar near New Delhi at a cost of ₹ 636 lakhs which has relocated to Noida in the Delhi capital region during June 2009 with an investment of ₹ 10.17 crores.

In the Eighth Plan stress was given for Augmentation and modernization of five laboratories High Voltage, Insulation, Materials Technology and Short Circuit in Bangalore and the STDS at Bhopal. This was necessitated by the continuous revision of National/International Standards and advancement in measuring techniques.

Realizing the importance and need for Seismic Qualification of equipment, the Government sanctioned an Equipment Vibration Centre project in the Ninth Five Year Plan at Bangalore for seismic qualification of Electrical and other equipment used in earthquake - prone areas. This has assumed importance as more and more of the power projects are getting located in the earthquake - prone regions of India. The center was operationalized during 2003.

The Regional Testing Laboratory, Kolkata, was established with the co-operation of WBSEB during October 2006 to provide service in the transformer dielectrics.

A Regional Testing Laboratory was established in July 2007 at Guwahati with the objective of catering to the testing needs of Power Utilities and manufacturers of the North Eastern region.



REAL-TIME DIGITAL SIMULATOR FACILITY



1600 kV, 9600 kVA CASCADED TRANSFORMER AT UHVRL, HYDERABAD

### 3.0 SPECIALIZED TESTING AND R&D FACILITIES SETUP

The 1980s and 1990s saw the development of several specialized and unique Testing and Research facilities at the Institute. The 2500 MVA Short Circuit Test station with Synthetic Test facility was commissioned in 1992. This laboratory namely High Power Laboratory comprises of Direct Testing facility of 2500 MVA capacity at 36/72.5 kV in three phase and 1400 MVA at 245 kV capacity in single phase for testing of Circuit Breakers and for short-time short circuit withstand capability tests on apparatus like Power Transformers, Current Transformers, Isolators, Wave Traps, etc. Synthetic Testing facility for high power testing of EHV Circuit Breakers up to 63 kA, 245 kV full pole and unit testing of EHV Circuit Breakers beyond 245 kV level, have also been created. This facility is unique which is the fifth biggest in the world.

The facility for carrying power transmission at voltage level of 1000 kV and the possible biological effects that are likely at this UHV voltage range are being studied at the Institute's Research laboratory established at Hyderabad.

The Ultra High Voltage Research Laboratory came into existence in August 1993.

To study the operations and maintenance problems of Thermal Power Stations, a unit has been established adjacent to the thermal power station at Koradi, Nagpur. This unit namely Thermal Research Centre addresses problems like flue gas treatment, ignition studies, coal characteristics, combustor designs, remaining life assessment and estimation, failure analysis/risk analysis, environmental pollution impact, power plant waste utilization, etc. With the Institute short-listed as a consultant by PFC for taking up R&M/LE studies at coal-based Thermal Power Stations in India, this unit will play a major role in the years to come.

The Institute established a unique digital power system simulation facility in its Bangalore center during 2003. The Real Time Digital Simulator (RTDS) is used extensively for studying power generation, transmission and distribution net works on real-time dynamic simulation model.

A Research center namely 'Centre for Collaborative and Advanced Research' was established



SEISMIC QUALIFICATION TEST

in the year 2006 with objective of collaborating with all the research organizations and Experts from abroad to device and implement R&D projects as well as continuing education programs.

#### 4.0 ACHIEVEMENTS IN THE FIRST DECADE (1960–1969)

CPRI put in sustained efforts in the first 15 years of its establishment in establishing testing facilities based on the needs of the Power sector and industry.

##### 4.1 Low-Voltage Switchgear Testing Division

This division which was functioning at IISc premises in a congested place has been conducting tests to assist the short circuit withstand capacity of transformers, isolators, etc. It has also been assisting R&D programmes in LT switchgear and HRC fuses to the manufacturers in the country. It has helped to bring out HRC fuses by the Indian Industries which were hither to imported from abroad.

##### 4.2 High-Voltage Division

This division, also located at IISc campus, hardly had any facility for conducting research or studies in the field of high-voltage engineering. The division has developed a testing kit for lightning arresters in service. The kit helps in evaluating the lightning arrester and detect failure. The early detection of failure avoids major power outage. This invention has fetched CPRI, an invention promotion Award from NRDC.

##### 4.3 Partial Discharge Division

This facility has been extensively used by manufacturers of PVC cables and contributed to the development of PVC cables in the country. When the Govt. of India took a policy decision to switch over from paper-insulated, lead-covered cables to 11 kV voltage class, manufacturing difficulties were experienced by the cable manufacturers in the country. The Institute played a significant role in the development of good-quality PVC cables by providing laboratory facilities for product development and evaluation. Detailed studies on XLPE cables were also undertaken for effecting improvement and were suggested to the manufacturers. It has also assisted ISI certification marks for quality products.

##### 4.4 Insulating Material Division

The testing facility in this laboratory has been utilized by a wide range of organizations. It is also assisting ISI in the quality control of products. The chemistry laboratory of this division has developed a simple testing kit for field testing of transformer oils. This would enable field staff to periodically monitor the condition of the oil.

This laboratory has also developed a process for reclamation of used transformer oils. This method is techno-economically effective and has definite advantages over methods using water washing. In this method, Korvi earth available in Kashmir is used with the adoption of suitable method for activation process.



A few utilities had established reclamation plant based on CPRI know-how for recycling of used transformer oil.

The Institute had been using Gas chromatography technique for analyzing dissolved gas in the transformer oil in service. This development has helped electric utilities to locate incipient faults in the transformers well in advance and thereby prevent major outages. This service is being availed by many supply undertakings to monitor the condition of the transformer in service in power stations and major grid substations.

#### 4.5 Power Systems Division

The division carried out studies relating to grounding and developed computer programmes. Although the systematic design of grounding system for large capacity is essential, the problem is very complex and intricate. Computer programme was developed to solve this problem using digital computers. The programme is being effectively used in designing grounding system for large substations.

Hot stick was developed for use in the maintenance of high voltage transmission lines. The Himalayan Spruce as wood and available glue, the hot stick was designed after extensive research. The product was an import substitution and help in conserving foreign exchange. The organizations which rendered help in this project include IPMRA, IISc, HP Forest Department,



FIELD STUDIES

CIBA, RRL Hyderabad, NCC Poona and SEB Madras.

Computer programme was developed as a solution to analysis of complex load flow studies in the large network.

Scientist and Engineers of the Institute had developed a Cable fault locator and demonstrated it to the then Union Minister of Irrigation and Power at New Delhi.

#### 5.0 ACHIEVEMENTS IN THE SECOND DECADE (1970–1979)

During 1975, the Committee headed by Sri K B Rao gave its report on review of working of CPRI and recommendations on future growth. It was recommended that CPRI groom its expert groups in the following areas:

- System Engineering
- Relay and Protection
- Transmission and Distribution
- Instrumentation, Telemetry, Telecontrol
- High-Voltage
- Computer
- Energy
- Insulation
- Chemistry
- Physics and Partial Discharge
- Short Circuit
- Thermal Power Station

Based on the recommendation of the Committee, the Institute was organized into an Autonomous organization under Ministry of Power in January 1978 in order to facilitate quicker and better R&D administration.

During fifth, Five Years Plan (1975–1980), the Institute received capital grants of ₹ 152.40 lakhs for Augmenting the four laboratories at Bangalore (Power System, Insulation, High Voltage, Short Circuit). Water and coal analysis,

Gas chromatography facilities were added to the chemistry laboratory. Insulation laboratory was augmented with facilities like evaluation of polymeric and paper insulation materials, insulating varnishes, dielectric loss measurement in capacitors, Endurance test, CT and PT for capacitance measurement. Establishment of Transmission and Distribution division and further augmentation of Tower testing station with Vibration and tensile strength testing facilities were under taken during this time. The establishment of tower testing station with a capacity to test towers of 750 kV and above along with transmission line hardware evaluation facilities was operationalized on 9th September 1977.

All the laboratories hitherto functioning from IISc campus were shifted and commissioned during 1977–1979.

Several useful investigations carried out are as follows:

- Study on protection of transmission line in coastal weather
- Optimum location of stock bridge damper on transmission lines
- Evaluation of stator coils for RDSO, Lucknow
- Compatibility study on transformer insulation
- Compatibility study on PVC cables and semiconducting materials
- Production of quality transformer oil

CPRI received National Award for Development of portable lightning arrester field-testing kit on 10th April 1970. Consultancy was rendered to a few manufacturers for 222 kV double circuit transmission towers. A pollution study was also conducted for RDSO, Railways. Consultancy was rendered to KSEB on magnetic links.

### **6.0 ACHIEVEMENTS IN THE THIRD DECADE (1980–1989)**

This decade was a testing as well as fruit-bearing period with regard to the growth of

the Institute after the organization was recast into an Autonomous society. The revenue of the Institute substantial increased from around ₹ 100 lakhs in 1980s to ₹ 500 lakhs by the end of the decade. More thrust was given to Research and Development. Expertise and expert groups were developed in selected areas during the period. A significant increase in publication of research papers, training and visit of Scientists and Engineers at Internationally reputed institutions like CESI, EDF, EPRI, etc. was observed HVDC transmission is another area which CPRI has stepped into. In-depth investigations are undertaken to efficiently maintain and operate such new technological innovations by way of evaluation of UHVAC and HVDC transmission hardware. Several test and R&D facilities were augmented and upgraded to contemporary demands of developments in the power sector.

CPRI has established a Fly Ash Utilisation and Demonstration Centre at Raichur Thermal Power Station 1989–1990 at a cost of ₹ 25.00 lakhs as a sponsored project from then Dept. of Power, Min. of Energy, Govt. of India.

### **7.0 ACHIEVEMENTS IN THE FOURTH DECADE (1989–1999)**

One of the growth indicators of CPRI is the revenue increase in various activities including consultancy, field studies and testing. It is interesting to note that the revenue has increased from ₹ 5.00 crores in 1990–1991 to ₹ 24.67 crores in 1999–2000. Institute has diversified its activities into new areas such as Environmental impact studies in Thermal power plant projects, Life Evaluation studies, Renovation and Modernization studies, Power System studies for Electricity Regulatory Commissions, Inspection and selection test contract with Electric utilities, consultancy assignments in fly ash and other waste utilization, etc. The decade witnessed diversification of activities covering Third Party Inspection services to Utilities, RLA and R&M for power plants and Diagnostics for electrical equipment.



CPRI also expanded geographically in the decade by establishing various units. The Regional Testing Laboratory, Muradnagar, Ghaziabad, was set up in November 1992 to help small - scale electrical industries in the Northern region. This center has Cable and Capacitor, High-Voltage and Liquid Di-electric Laboratories.

The 2500 MVA, High Power Laboratory along with the synthetic testing facility was successfully commissioned in the year 1993. Other major independent High power testing Laboratories are available in KEMA in Holland, CESI in Italy, EDF in France and IREQ in Canada. The Synthetic testing facility is adopted when the test power exceeds viable capacity of direct testing station and for developmental tests, it being non-destructive. With a view to manage the growing units of CPRI, corporate management was established in May 1993 as Head Office separately in its Bangalore Campus.

The Ultra High Voltage Research Laboratory along with UHV experimental line was commissioned at Hyderabad Unit of CPRI in August 1993. The laboratory has the necessary infrastructure to simulate actual operating conditions on an experimental line in the range of 220 kV to 1200 kV to evaluate its suitability and adaptability to Indian Power Systems taking into account the climatic, environmental, ecological and biological conditions pertaining to our country. This is a unique facility in this part of the world.

Energy Research Centre, CPRI, Thiruvananthapuram, a unit dedicated to research and testing in the area of Energy conservation and Renewable Energy was also commenced in August 1993.

The testing facilities in some of the major laboratories of CPRI, viz. High Voltage Laboratory, Insulation Laboratory, Short Circuit Laboratory, Materials Technology Division, Switchgear Testing and Development Station, Bhopal, were augmented during 1994–1996 at a sanctioned cost of ₹ 60.50 crores. This was done with a view to keep abreast with the latest developments in the field. The total capital

investment in the Eight Plan (1992–1997) stood at ₹ 186.25 crores.

The project to establish CSET, Centre for Software Engineering and Training was sanctioned in May 1998 with a budget of ₹ 3.74 crores with a duration of 3 years. The Center came into full-fledged operation in the year 2000–2001. Automation of laboratories and divisions has also been taken up under the purview of this project with objective of giving better and reliable service to the customers.

Improvement of material handling facility, Establishment of EMI/EMC facility in Instrumentation Division, Installation of medium voltage test cell at HPL were undertaken during 1998–1999 under capital grants of ₹ 7.23 crores in the Ninth Plan.

A project to set up the Equipment Vibration Center was sanctioned by Ministry of Power, Govt. of India, at the cost of ₹ 28.65 crores in the year 1999. On project completion, this has enabled the Institute to carry out Seismic Qualification tests on electrical equipment and structures and also research in the same area. The total capital investment during the Ninth Plan (1997–2001) stood at ₹ 68.39 crores.

In the context of globalization, CPRI has been trying to promote its activities in Asia-Pacific, Middle-East, Far-East regions. Earnings through Dollar rose from US \$61000 in 1998–1999 to US \$130,000 in 1999–2000 and indicates widened activities abroad. CPRI credentials were heightened due to the following.

The credibility of Institute's expertise in the diversified areas is well - recognized. Institute was short listed as a consultant with BB+ and BB grade by Power Finance Corporation for conducting RLA/LE studies in Thermal Power Stations and Hydro Power Stations, respectively. The Central Boiler Board also has recognized CPRI as Remnant Life Assessor for power station boilers in India.

- CPRI is accredited for International quality standard ISO-25/EN 45000 by National Accreditation Board for Testing and Calibration laboratories.
- CPRI has an observer status in Short circuit Testing Liaison (STL).
- Under Writers' Laboratories Inc. USA has recognized CPRI for testing for UL Mark.
- Canadian Standards Association, Canada, has recognized CPRI Laboratories for testing according to the CSA standards.

## 8.0 ACHIEVEMENTS IN THE FIFTH DECADE (2000–2009)

In the beginning of the millennium, the Institute's focus was more on bridging the gap in testing facilities available vis-à-vis the requirement of the Industries. This would widen the base of testing services to not only Indian customers but also of neighboring regions in Asia, Southeast Asia, Gulf countries and African countries.



ADDRESS TO IEEE ENGINEERS, SAUDI 2008

The revenue earning of the Institute rose from ₹ 25.81 crores in 2000–2001 to ₹ 77.41 crores in 2008–2009. The Institute received a total of ₹ 320.00 crores as grant-in-aid for Capital Projects under XI plan (2007–2012).

The Regional Testing Laboratory, Kolkata was established with the co-operation of WBSEB during October 2006 to provide service in the transformer dielectrics.



CPRI MEET IN SAUDI 2008

A Regional Testing Laboratory was also established in July 2007 at Guwahati with the objective of catering to the testing needs of Power Utilities and manufacturers of the North Eastern region.



ELECRAMA 2008



PRESENTATION DURING CPRI SAUDI MEET 2008





MIDDLE EAST EXPO 2009

## 8.1 National/International Accreditations

The quest for Quality is an on-going process at CPRI. The facilities are accredited as per ISO/IEC 17025 norms.

Considering CPRI's contribution according to the Third Party Independent laboratory, it has become Member in many International bodies including Short Circuit Testing Liaison (STL). The Research and Consultancy activities have been certified for ISO 9001:2008. CPRI is a Corporate Member in DLMS UA (Device Language Message Specification User Association) and UCAIUG (Utility Communication Architecture International User Group).



## 8.2 XI Plan Projects

The Institute has been augmenting its Research and Test facilities in tune with the requirements to the Power Sector. The gaps in CPRI facilities

vis-à-vis the power sector requirements have been addressed for meeting the needs and creation of additional infrastructure.

Following are the Projects executed during the XI Five Year Plan:

- Development of a Centre of Simulation of Power System and Failure Analysis
- Modernization of short circuit test facilities and Augmentation of power transformer test facilities
- Modernization and augmentation of switch-gear test facilities at CPRI, Bangalore
- Refurbishment of 50 MVA short circuit test station
- Refurbishment of 1500 MVA s/c generator at STDS, Bhopal
- State-of-the-art Mobile field testing laboratory for onsite accuracy test and condition assessment of EHV class Instrument transformers facility for CT/PT
- Establishment of mobile diagnostic facility for power plant specific equipment for improving performance
- Center for Advanced Energy Research in the Area Energy Efficiency and Energy Audit
- Augmentation of test facilities for optimization of 800 kV AC /DC transmission system
- Setting up of test facilities for pre-qualification test on 400 kV XLPE cable system
- Center of Excellence for Life Cycle Management and Condition Assessment of High Voltage Substation and Power Plant Electrical equipment
- Center of Excellence for Di-electric Studies
- Mechanical Strength Test Facility
- Center for Creep and Mechanical Testing and Augmentation of Wake simulation lab



- Collaborative research on Emerging Technologies
- Quality Accreditation for new facilities and business development of CPRI
- Augmentation of High Voltage, Diagnostic, Relay, Vibration, LED test facilities and Infrastructure protection
- Plan R&D funding
- Research Scheme on Power
- National Perspective Plan R&D, Phase-2
- Participation of CPRI as the Fifth Equity Partner in JV Company, National High Power Test Laboratory Pvt. Ltd. (NHPTL) at Bina
- Prepaid Energymeter and three phase Energymeters
- Cable fault locator
- Digital impulse measuring system
- Electroless zinc on aluminum and nickel coating on mild steel for corrosive applications
- Polymeric Insulators for outdoor applications
- Design of Compact Towers

## 9.0 CONTRIBUTION OF CPRI TO THE NATION

The greatest contribution of the Institute is its unstinted efforts in aiding the development of the Electrical industry in the country and contribution to Technology development through evaluation of power equipment from 1960s. The facilities have been augmented in tune with the needs and growth of the power sector. Initially, the Short circuit facility had a capacity of 50 MVA to cater to the development of LV equipment in the 60s and graduated to 1500 MVA and 2500 MVA capacities for testing equipment of 400 kV rating. Similarly, the high-voltage facility started with tests for 11 kV rating, then graduated to 400 kV, 800 kV and the Institute has facilities for testing 1200 kV rated equipment.

The Institute has completed over 300 R&D projects and has over 40 patents. Many of them have been commercialized on a non-exclusive basis. To its credit, the Institute has published over 2000 Technical and Research Papers in National and International fora. The Institute has also brought out over 450 Technical Reports which are widely referred to by both the utilities and industry. Over 30 Technologies have been commercialized on a non-exclusive basis to the industry. Some of the Research outcomes are:

- Automatic Streetlight Controller

The Institute coordinates projects undertaken under the Research Scheme on Power involving Academia/Industry and Power Utilities.

The Institute also coordinates Research Projects under National Perspective Plan (NPP) involving Research Institutes, Industry, Power Utilities and Academia.

Contribution to reliability of equipment — Each year around 25000 equipments are evaluated according to the relevant National/International Standards. Around 2500 Customers from Industry and Utilities are serviced every year.

Testing and evaluation of Power equipment upto 1200 kV rating, thereby contributing to the reliability of Power System network.

Standardization: The Scientists and Engineers are also involved in the upgradation of Indian Standards and represent CPRI in various BIS Electro-Technical Committees. CPRI officers also are represented in International Standards Committees like IEC, IEEE, CIGRE, etc.

The Institute significantly contributed in the indigenous development of National High Voltage Direct Current (NHVDC) projects through system simulation and evaluation of controllers and participation in commissioning tests for ushering in HVDC technology.

Diagnostics of power equipment, design evaluation of towers, Seismic qualification and evaluation of 800 kV/1200 kV rated equipment.

CPRI is a Consultant for Design and Development of Smart Grid Pilot Project for BESCO, being taken up for the first time in the country.

The Institute has been involved in all the Power Sector development programmes initiated by Ministry of Power, Govt. of India. CPRI was Advisor-cum-Consultant for the Accelerated Power Development and Reforms Programme (APDRP) and is presently Third Party Independent Evaluation Agency for Energy Accounting and empanelled as SCADA/DMS Consultant under Restructured Accelerated Power Development and Reforms Programme (R-APDRP).

CPRI is offering the Third Party Inspection and supervising work for two states, viz. Karnataka and Kerala under RGGVY Scheme.

CPRI has been awarded the assignment of evaluating Niranthara Jyothi Yojana for Hubli Electricity Supply Company Limited (HESCOM), Hubli.

More than 150 National/International Conferences on frontier topics for dissemination of knowledge to all stake holder has been conducted by CPRI. Every year the Conferences/Seminars are conducted for the benefit of Power Utilities, Industries in India.

Training of Utility and Industry personnel: Both general and Customized Training Programmes are being conducted and the Institute has trained over 10000 personnel over the years.


## 9.1 Services for Overseas Customers

CPRI has been addressing the Testing and evaluation requirements of the countries like Nepal, Bhutan, Bangladesh, Thailand, Malaysia, Indonesia, Sri Lanka, Korea, Japan, UK, etc. Besides, the consultancy and Certification services are utilized by the Utilities and Industry of countries in Middle East, South East and Far East Asian and African countries. Today, CPRI services are being sought by countries from USA, Europe, Australia, New Zealand and various other countries.

## 9.2 Vision of CPRI for the coming decade

Today, CPRI is one of the largest Research and Testing Houses in the world with a gamut of facilities under one roof. The vision of CPRI is to emerge globally as the single largest service provider in the next 10 years. In this context, action plan has been drawn up to plug the gaps in facilities, upgrade the Technical manpower skills, focus on customer satisfaction. This could be addressed with support and guidance from Govt. of India and Industries by:

- Improving the quality of existing manpower through continuous training for upgradation of their technical skills and bring in the accountability in all spheres of activities, making continuous education and acquiring skill sets as basic criteria for evaluation.
- Deploying/Recruiting better qualified and skilled experts in various areas in Energy.
- Creation of an invigorating environment for attracting fresh talent in the country.
- An increased collaboration proposed with similar Research Laboratories/Organizations across the globe in the areas of Research, Testing and Consultancy.
- Establishment of Nodal/Liaison Offices/Laboratories in SAARC, Middle East and



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**PRIYAGNI — HIGH EFFICIENCY WOOD BURNING STOVE**


The world-wide energy crisis caused by enormous hike in price of oil and the fast depletion of conventional resources has compelled scientists and technologists to harness new sources of energy and to find methods of using existing resources with improved efficiency.

Firewood is the predominant source of energy supply for rural areas in India, for their cooking and heating needs. Nearly 150 million tonnes of firewood are being burnt every year in the traditional village cookstoves or "Chulhas". Due to a wavering flame with inadequate aeration causing smoky burning, considerable heat is wasted in these "Chulhas". In the absence of a steady flame, frequent blowing of air becomes necessary and, unknowingly, excess fuel is fed to keep the burning continuous. All these factors are responsible for the very low efficiency of about 10% for these mud ovens. Besides, village women now spend several hours trekking over long distances to gather fuel. Smoky kitchens also render womenfolk prone to eye and lung diseases. Research was therefore undertaken to develop new designs of wood burning stoves to achieve higher efficiencies and smokeless combustion. Apart from saving fuel and labour, it would also realise indirect national benefits such as conserving forest wealth and improving ecology.

The Rural Energy Laboratory of CPRI has developed the PRIYAGNI high efficiency wood burning stove for use in rural and semi-urban domestic cooking. It is simple in design and easy to fabricate. Scientifically designed to satisfy the basic requirements of good combustion, PRIYAGNI burns with a nearly smokeless, steady, continuous and well-directed flame.

For better combustion and efficiency, the following conditions are generally necessary in any stove.

a) a well-directed and central flame in the stove



**WOOD BURNING STOVE**

other countries to serve the Customers from Utilities and Industries in the time to come to improve the brand value.

- Effectively making available the expertise and facilities for Research and Consultancy works worldwide by participating in events overseas.
- By raising the Customer Satisfaction and Service to match International expectation levels.

- Expanding the Research and Test facilities to meet future requirements of the Nation.

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