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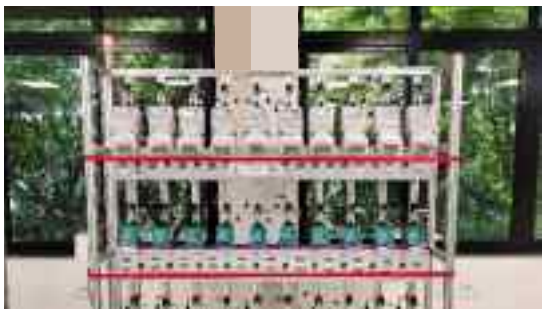
CENTRAL POWER RESEARCH INSTITUTE
बेंगलूर
BANGALORE
स्थापित 1960 ESTD 1960



ANNUAL REPORT

2022-23

CENTRAL POWER RESEARCH INSTITUTE

A Year at a Glance

New Reginal Unit at Raipur
MoU signed with Government of Chattisgarh

Efficiency Performance of DC EV Charger of 50kW
Facility established at CPRI, Bengaluru

Advanced Mereting Infrastructure (AMI) Testing
CPRI appointed as Testing Agency

Salt Fog Test facility for MV Cable Accessories
One of a Kind

Short Circuit Testing of 500MVA, 1ph Station Transformer
Unique Testing

Testing of 949.81 kvar, 6.944 kV HT Series Capacitors
Highest Voltage Rating Tested as per IEEE Std. 824-2012

Research Projects

Areas of Research: Generation, Transmission, Distribution

- In-house R&D (IHRD): 5 completed and 16 in progress
- Research Scheme on Power (RSoP): 9 Completed and 54 in Progress
- National Perspective Projects (NPP): 4 Completed and 15 in Progress
- Ucchatar Avishkar Yojana (UAY): 5 in Progress
- IMPacting Research INnovation and Technology (IMPRINT): 8 in Progress
- Patents Awarded: 14, New Patent Applications Filed: 4, Copyrights Filed: 2

Consultancy

35 Assignments executed for Utility and Industry

- Diagnostic tests on Stator Coils for WBSEDCL, West Bengal
- Earth Resistance Measurement for M/s. Tehri Hydro Power Plant, Tehri
- Corrosion Mapping of Boiler Water wall tubes for NTPC
- Vetting/Check Pile Foundation Design Calculation & Drawings of 400kV Tower for KEC International
- Techno Commercial Study of Haryana Power Transmission System for HVPNL

Important Events

- 69 Conferences/Webinars/Workshops organised during the year

CENTRAL POWER RESEARCH INSTITUTE

Prof. Sir. C. V. Raman Road,
Sadashivanagar P.O., P. B. No. 8066,
Bengaluru – 560 080,
Karnataka, India

Annual Report 2022-23

FOREWORD

I am delighted to present Annual Report for the FY 2022-23, highlighting the noteworthy performance and achievements. Central Power Research Institute (CPRI) being an apex body for initiating and coordinating R&D activities in the field of Power Engineering, has implemented significant R&D schemes in the identified thrust areas leading to new technology development. With highly skilled and experienced professionals engaged in various areas of Research, the projects are aimed at an integrated approach to innovation and to generate cutting edge research for practical applications.

Over the past 60 years, CPRI has set up extensive facilities for testing all characteristics of power equipment. With seven state-of-the-art units functioning across the country; and looking at the country's growing needs of testing & evaluation, CPRI is in process of increasing its testing capacity by setting up new Test Centers at Nashik and Raipur, which will cater to the needs of the electrical Industry in the Western and Central India. The testing capability of High Power Testing facility at Bangalore is also being augmented to enhance the capacity to 7500 MVA.

During the FY, a total of 90,726 evaluations were conducted on 22,559 samples which resulted in serving 4,582 Organisations. We were appointed as Nodal agency for Testing and evaluating "Advanced Metering Infrastructure (AMI) Solution" for pre-bidding under Revamped Distribution Sector Scheme (RDSS). Our laboratories all over the country are accredited as per ISO/IEC17025, while, we are also accredited as per ISO/IEC 17065: 2012 for carrying out Product Certification, thereby the Electrical products tested at CPRI by Indian electrical equipment manufacturers are being exported globally which ultimately contributes to the "Make in India, Make for the World" campaign of Government of India.

Equipped with world-class facility and being a Short-Circuit Testing Liaison (STL) Member, the Institute offers testing services to overseas manufacturers, as CPRI Certificates are accepted by Overseas Utilities. Efforts are also being made to strengthen the brand value of CPRI globally towards enhanced acceptance of its Certificates abroad.

With the continuous guidance and support from Ministry of Power, Government of India, CPRI has drawn its plan of action to create and upgrade its test facilities. By regularly addressing to the increasing needs of Power Sector and focusing on customer satisfaction, CPRI would scale new heights to cope up with future demands of Power Sector in domestic and international arena.

I extend my heartfelt gratitude to all our customers for posing their trust; I also congratulate all the employees and their families for their contribution.

Jai Hind!

(B A Sawale)
Director General

Contents

Governing Council
Central Power Research Institute
(Present Composition)

Shri Pankaj Agarwal, IAS
Secretary, Ministry of Power,
President, Governing Council

Shri Ghanshyam Prasad
Chairperson, CEA
Vice-President, Governing Council

Shri Ashish Upadhyaya, IAS
Special Secretary & Financial Adviser
Ministry of Power
Member, Governing Council

Shri Ajay Tewari, IAS
Additional Secretary
Ministry of Power
Member, Governing Council

Shri Jithesh John
Economic Adviser, Ministry of Power
Member, Governing Council

Shri. B. A. Sawale
Director General
Central Power Research Institute
Member Secretary, Governing Council

Members of CPRI Governing Council

1	The Secretary to the Govt. of India, Ministry of Power	President
2	The Chairperson, Central Electricity Authority	Vice-President
3	The Special Secretary & Financial Adviser, Ministry of Power	Member
4	The Additional Secretary, Ministry of Power	Member
5	The Economic Adviser, Ministry of Power	Member
6	The Member (Power System), Central Electricity Authority	Member
7	The Member (Planning), Central Electricity Authority	Member
8	The Secretary, DSIR, Ministry of Science & Technology	Member
9	The Secretary, Ministry of Commerce & Industry, Dept. of Industrial Policy & Promotion	Member
10	The Secretary, Ministry of New & Renewable Energy	Member
11	The Chairman & Managing Director, Bharat Heavy Electricals Ltd.	Member
12	The Chairman & Managing Director, NTPC Ltd.	Member
13	The Chairman & Managing Director, Power Grid Corporation of India Ltd.	Member
14	The President-IEEMA	Member
15	The Secretary, Central Board of Irrigation & Power	Member
16	The Managing Director, Bangalore Electricity Supply Company Limited (BESCOM)	Member
17	The Managing Director, Dakshin Haryana Bijli Vitran Nigam Ltd. (DHBVN)	Member
18	The Director, Indian Institute of Technology, New Delhi	Member
19	The Director, Indian Institute of Technology, Madras, Chennai	Member
20	The Director, Indian Institute of Technology, Guwahati	Member
21	The Director General, Bureau of Energy Efficiency	Member
22	The Director General, Central Power Research Institute	Member - Secretary

Members of CPRI Standing Committee

1	The Additional Secretary, Ministry of Power	Chairman
2	The Special Secretary & Financial Adviser, Ministry of Power	Member
3	The Member (Power System), Central Electricity Authority	Member
4	The Economic Adviser, Ministry of Power	Member
5	The Director General, Central Power Research Institute	Member - Convener

SECTION - 1

ORGANIZATIONAL SET-UP

ORGANIZATIONAL SET-UP

· CPRI – AN OVERVIEW

Central Power Research Institute (CPRI) was established by the Government of India in 1960, both in Bengaluru & Bhopal, with its Headquarters in Bengaluru. The Institute was re-organised into an autonomous society in the year 1978 under the aegis of the Department of Power, Ministry of Energy, Government of India. The main objectives of setting up the Institute were for it to function as a National Power Research Organization for undertaking applied research in electrical power engineering, to innovate and develop new products, besides functioning as an Independent National Testing and Certification Authority for electrical equipment and components to ensure reliability in the Power System.

· OBJECTIVES OF CPRI

Technical

- Function as a National Power Research Organization for undertaking and / or sponsoring research and development projects in the fields of generation, transmission, distribution and operation of electricity supply systems.
- Provide necessary centralized research and testing facilities for evaluation of electrical materials and performance of power equipment.
- Serve as a National Testing and Certification Authority for the purpose of certification of rating and performance to ensure availability of equipment of adequate quality for use under conditions prevalent in Indian Power Systems.
- Act as an apex body for initiating and co-ordinating the R&D in the field of electric power.
- Evolve criteria for standards of various equipment for operation under Indian conditions and effectively participate in formulation of National Standard specifications.
- Identify problems in the areas of basic and oriented basic research and arrange such studies in National Academic Institutions.
- Co-ordinate R&D activities in the various State Electricity Boards and maintain liaison with other Institutions engaged in research connected with power systems and / or power equipment.
- Collect information and maintain documentation in the field of power engineering and prepare, print and publish technical paper, periodical or report in furtherance of the objects of the Society.
- Establish, maintain and manage laboratories, workshops and other facilities for furthering scientific and technological research and conduct experiments for exploiting the invention or discoveries to the cause of power development in the country.
- Enter into agreement with any enterprise or institutions or person or persons and provide funds to them to carry out research and development programme of the Society.

Financial

- Accept grants of money and other assistance from the Govt. of India and other sources, Indian or foreign or enter into any agreement with them with a view to promote the objectives of the Society provided that in respect of foreign resources prior approval of the Government of India is obtained.
- Acquire by gift or purchase or exchange or lease or hire or otherwise, howsoever, any lands, buildings situated in India, equipment and any other properties movable and or immovable for the furtherance of the objectives of the Society and construct or alter any building which may be necessary for the Society.
- Sell or lease or transfer or exchange or mortgage or dispose of or otherwise deal with any properties whatever belongings of the Society, provided that prior approval in writing of the Central Government is obtained.
- Draw, make, accept, endorse and discount cheques, notes or other negotiable instruments.
- Invest the funds or money of the Society not immediately required in any securities or in such manner as from time to time to be determined by the Governing Council.

Administrative

- Establish and award research studentships, fellowships.
- Retain or employ professional or technical advisors, consultants or workers to further the object of the Society and to pay there of such honorarium, fees or remuneration as may be thought expedient.
- Negotiate and enter into contracts on behalf of the Society and vary or rescind such contracts.
- Create administrative, technical, ministerial and other posts under the Society and to make appointments thereto in accordance with the rules and regulations of the Society.
- Take appropriate measures for training and welfare of the employees.
- Make rules and regulations and bye-laws for the conduct of the affairs of the Society and to add, to amend, to vary or rescind them from time to time with the approval of the Government of India.
- Do all such other lawful acts, deeds or things as are incidental or conducive to the attainment of any of the above objectives.
- Maintain a research and reference Library.

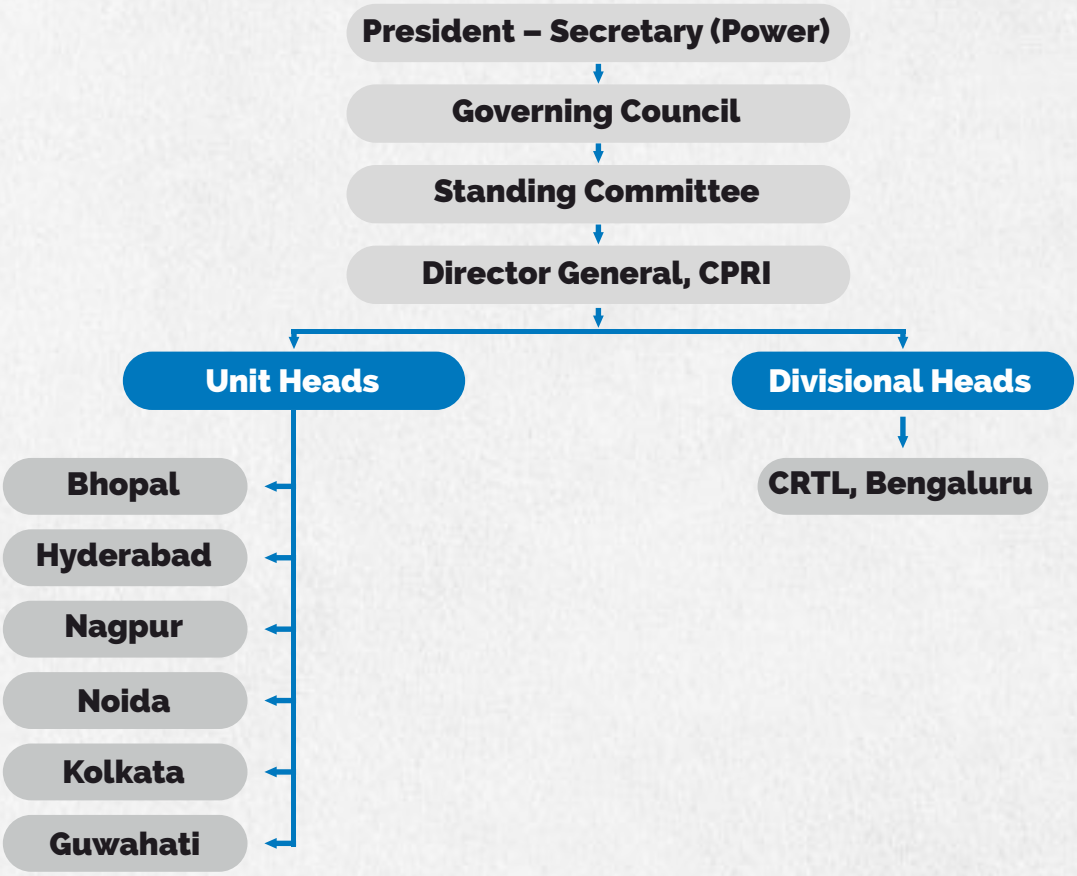
· MANAGEMENT

The Management of the Institute vests in its Governing Council comprising members representing different Utilities, Ministries of the Government of India, Central Electricity Authority, State Electricity Boards, Power Supply Utilities, Indian Electrical & Electronics Manufacturers' Association, and various other academic and R&D organizations of National importance in the field of electric power engineering. The Secretary, Ministry of Power and Chairman, Central Electricity Authority act as the President and Vice-President of the Governing Council respectively, while the Director General of the Institute acts as the Member-Secretary of the Governing Council.

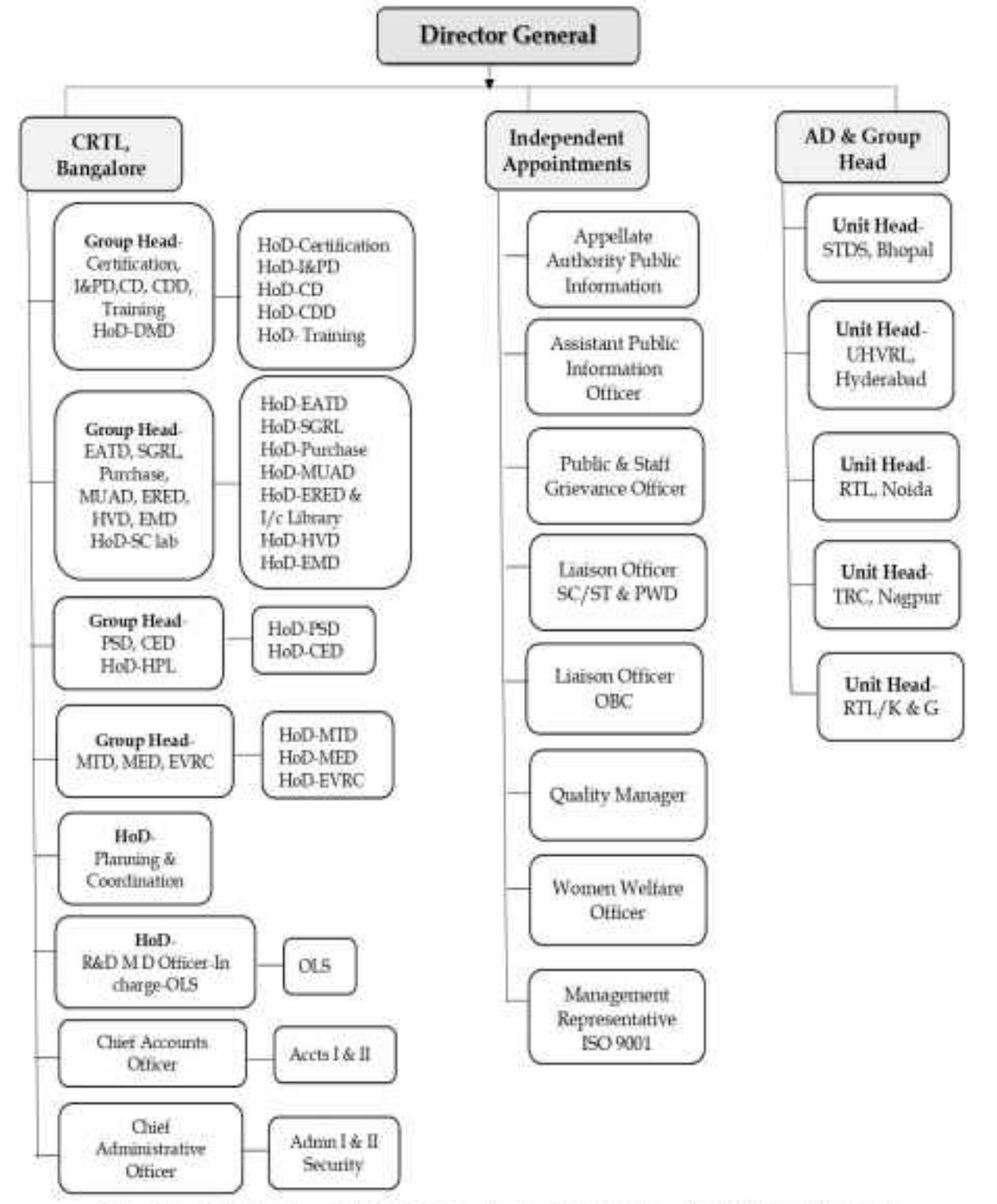
A Standing Committee under the Chairmanship of Special Secretary/Additional Secretary, MoP with Member (Power Systems), Central Electricity Authority, Joint Secretary & Financial Adviser from the Ministry of Power and Joint Secretary looking after CPRI in MoP as Members and the Director General-CPRI as Member-Convener takes decisions on behalf of the Governing Council from time to time on administrative and financial matters. The composition of this committee is described in Appendix - 1.

The composition of Committee on Testing & Certification is in the Appendix-2. The Committee takes decision on test tariff related activities. The Committee is chaired by Member (Power Systems), CEA.

Apex Management of CPRI



· ORGANIZATIONAL CHART OF CPRI AS ON 31ST MARCH 2023



Abbreviations: **I&PD**- Information and Publicity Divn, **CD**-Capacitors Divn, **CDD**-Cables & Diagnostics Divn, **DMD**-Dielectric Materials Divn, **EATD**-Electrical Appliances Technology Divn, **SGRL**-Smart Grid Research Laboratory, **MUAD**-Meter Utility Automation Divn, **ERED**-Energy Efficiency & Renewable Energy Divn, **HVD**- High Voltage Divn, **EMD**- Electrical Maintenance Divn, **PSD**- Power System Divn, **CED**- Civil Engineering Divn, **MTD**- Materials Technology Divn, **MED**-Mechanical Engg. Divn, **EVRC**- Earthquake Vibration Research Centre, **R&D M D**- Research & Development Management Divn, **OLS**- Official Language Section, **STDS**-Switchgear Testing & Development Station, **UHVRL**-UHV Research Laboratory, **RTL**- Regional Testing Laboratory, **TRC**- Thermal Research Centre, **K & G**-Kolkata & Guwahati.

· CPRI UNITS AND ITS LOCATION

Head Office:

1. Central Research & Testing Laboratory (CRTL)
Prof. Sir. C. V. Raman Road,
Sadashivanagar P.O, P. B. No. 8066,
Bengaluru - 560 080
Karnataka

Units:

2. Switchgear Testing & Development Station
Govindpura, Bhopal – 462023
Madhya Pradesh

3. Ultra High Voltage Research Laboratory
Post Bag No. 9, Uppal P.O,
Warangal Highway, Hyderabad – 500098
Telangana

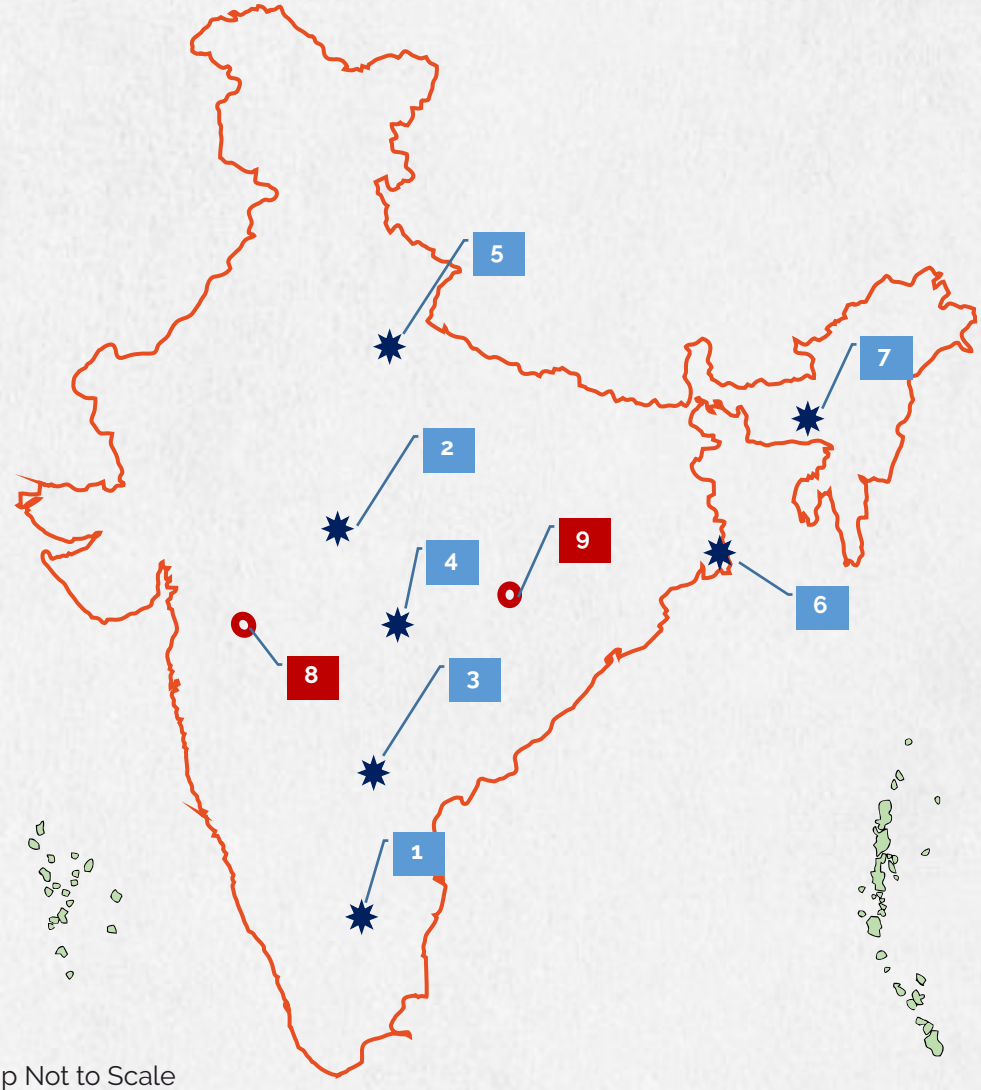
4. Thermal Research Centre
Dhuti, Wardha Road, Dongargaon,
Nagpur-441108
Maharashtra

5. Regional Testing Laboratory
No. 3A, Sector - 62, Institutional Area,
Noida - 201 309
Uttar Pradesh

6. Regional Testing Laboratory
1st Floor, CTD Workshop, WBSEDCL,
Abhikshan Building, BN Block,
Sector - V, Salt Lake City,
Kolkata - 700 091
West Bengal

7. Regional Testing Laboratory
No.4, Type-III (Old A.T.)
A.S.E.B. Colony, Forest Gate, Narangi,
Guwahati – 781 026
Assam

Units of CPRI



Map Not to Scale

		Existing Units of CPRI
✸	1	Central Research & Testing Laboratory, Bengaluru
✸	2	Switchgear Testing & Development Station, Bhopal
✸	3	Ultra High Voltage Research Laboratory, Hyderabad
✸	4	Thermal Research Centre, Nagpur
✸	5	Regional Testing Laboratory, Noida
✸	6	Regional Testing Laboratory, Kolkata
✸	7	Regional Testing Laboratory, Guwahati

		Upcoming Units of CPRI
●	8	Regional Testing Laboratory, Nashik
●	9	Regional Testing Laboratory, Raipur

Divisions under Central Research & Testing Laboratory (CRTL), Bengaluru

- Cables and Diagnostics Division (CDD)
- Capacitors Division (CD)
- Centre for Collaborative and Advanced Research (CCAR)
- Dielectric Materials Division (DMD)
- Earthquake Engineering & Vibration Research Centre (EVRC)
- Electrical Appliances Technology Division (EATD)
- Energy Efficiency and Renewable Energy Division (ERED)
- High Power Laboratory (HPL)
- High Voltage Division (HVD)
- Materials Technology Division (MTD)
- Mechanical Engineering Division (MED)
- Metering and Utility Automation Division (MUAD)
- Power System Division (PSD)
- Short Circuit Laboratory (SCL)
- Smart Grid Research Laboratory (SGRL)

· BRIEF ABOUT CPRI FACILITIES

Central Research & Testing Laboratory (CRTL), Bengaluru

1. Cables & Diagnostics Division

The Division has facilities for type testing of all types of Power Cables of rating 1.1 kV up to 400 kV voltage and Power Cable accessories as per Indian and International standards. Cables laboratory has state of art facilities to take up prequalification test on Power Cables and accessories of rating up to 400 kV rating, for evaluation of EHV cable system for their long term performance as per IEC 62067. In addition to electrical and physical test facilities the laboratory has test facilities for evaluating cables and materials for flame and smoke characteristics.

Power Cables Laboratory offers consultancy on:

- Failure analysis of Power Cables and accessories like Joints/Terminations
- Partial discharge measurements

Expertise is available for Diagnostic, RLA and LE (Remaining Life Assessment & Life Extension) studies on electrical equipment and for detailed investigations of specific problems related to Research and Development in these areas.

Diagnostics Laboratory has been rendering consultancy and field engineering services in the area of diagnostic testing of High Voltage substation and power plant electrical equipment. The Laboratory undertakes condition assessment of insulation system of the substation/ power plant electrical equipment.

Insulation Division

The Insulation Division has specialized facilities and expertise for testing and evaluation of Dielectric materials, to carry out accelerated ageing and corrosion resistance studies on Dielectric materials.

Solid Dielectrics Laboratory has comprehensive, testing and evaluation facilities for solid insulating materials and systems. Insulating materials are evaluated and tested for electrical, mechanical, physical and electro-chemical properties. The laboratory has undertaken consultancy works and sponsored projects for many power utilities and industries. Assistance has been rendered to BIS, in formulation of various standards on enameled winding wires and insulating materials & systems.

Cyclic Corrosion Test Equipment

2. Capacitors Division

View of the Lab

Power Capacitors Laboratory has state-of-the-art facilities to cater to the test requirements of Capacitor Manufacturers within the country and abroad. Research, Testing and Evaluation of Power Capacitors which have applications as Shunt Capacitors, Series Capacitors, Surge Protection Capacitors, Motor Capacitors, Fan Capacitors, Fluorescent Capacitors are carried out as per National and International Standards. Also developmental tests as per Customers' requirements are conducted. Laboratory also has facilities for undertaking tests on Filter Reactors and Series Damping Reactors associated with LV Capacitors. The laboratory with the unique facilities is the first of its kind in this part of the world.

Testing of LV APFC Panels

Tests on LV APFC panels are carried out as per IEC 61921 and IEC 61439. The temperature rise test is carried out on APFC panels with all capacitor units, detuned/damping reactors, if any, and other components connected. Temperature rise test can also be carried out at elevated ambient temperature of 55 °C.

Environmental tests

Environmental tests are carried out on various electrical and non-electrical equipment / components / materials as per relevant standards.

Research and Consultancy

The Division undertakes R&D in the following areas:

- Development of Indian Standard Specification for LV APFC Panels-Bureau of Indian Standards (BIS), New Delhi, Sponsored R&D project.
- Switching transients associated with capacitors.
- Investigation of PD Activity in Model Transformers.
- Selection of appropriate type of Low Voltage Capacitors for Low Voltage distribution system.
- Review of Specification for High Voltage and Low Voltage Capacitor Banks

The Division offers Consultancy and field engineering services for:

- Root cause analysis of premature failure of capacitors.
- Online partial discharge measurement on Power Transformers in service.

3. Centre for Collaborative & Advanced Research

Established in 2006, this Centre facilitates and promotes advanced research, thereby helping the power sector to derive the benefits of latest technology.

The main objectives of the Centre are to:

- Provide infrastructure for professionals to conduct research in power sector development.
- Create a conducive environment for collaborative research between R&D Institutions, Industry, and Academia
- Execute projects based on multi-disciplinary expertise drawn from different Institutions
- Foster healthy interaction and exchange of ideas between research organizations at a global level.

4. Dielectric Materials Division

The Division has comprehensive evaluation facilities for insulating materials and systems. The insulating materials are evaluated and tested for electrical, mechanical, physical & electro-chemical and thermal properties. The Division has the following laboratories:

- Liquid Dielectrics Laboratory
- Polymer Laboratory
- Lubricating Oil Laboratory

The Division has developed several polymeric materials, namely epoxy novolok resin for insulators & electrical grade laminates and FRLS cables for critical safety applications. The Liquid Dielectric Laboratory has developed new techniques for dissolved gas analysis. The Division has Expertise in Furan analysis and interprets the condition of solid insulation in Transformers. It has also developed dielectric fluids based on Rapeseed oil.

High Performance Liquid Chromatograph

The Polymer Laboratory has well-experienced technical personnel to advise the polymer industries on setting up plants, process improvement, etc. and involved in R&D of polymeric insulators for electrical equipment. This division undertakes consultancy work and sponsored projects for different power utilities and manufacturing companies.

The Lubricating Oil Laboratory has been set up to meet the quality assessment needs of industrial lubricating oils, turbine oils, etc.

CPRI is identified as a Nodal agency by Ministry of Environment, Forests and Climate Change (MoEF & CC) for analysis of Lead contents in Household and Decorative points as per ASTM E1613/ASTM E1645 using ICP-OES and dechlorination of PCB contaminated oil using PCB Mobile dechlorination Unit.

5. Earthquake Engineering & Vibration Research Centre

This Division is equipped with facilities for providing testing, research and consultancy services in the area of Seismic and Vibration qualification of instruments/ equipment for nuclear power plants, other generating stations and Railways as per National and International standards. In addition, this Centre offers consultancy services in checking the design adequacy of Structures/Substations for earthquakes.

The Division is equipped with a Triaxial shake table of 3m x 3m size and 10 ton pay load capacity for simulating earthquake vibrations. In addition, the Division has Electrodynamic Shaker Systems for carrying out vibration tests on products and assemblies.

Seismic Test in Progress

6. Electrical Appliances Technology Division

The important activities of the Division include performance evaluation of low voltage electrical power equipment enclosures and other allied equipment, Fans, Refrigerators, Air-Conditioners, Batteries.

The Laboratories under this Division are:

- Ingress Protection Laboratory
- Battery Testing Laboratory
- Fan Testing Laboratory
- Refrigerator and Air Conditioner Testing Laboratory

Balanced Ambient Calorimeter

The Division offers check testing under the standards and labeling programme of the Bureau of Energy Efficiency.

7. Energy Efficiency & Renewable Energy Division

The Division undertakes research and testing activities in the field of renewable energy, efficient and effective utilization of energy, energy audit, energy conservation and field engineering services of power plants. This division also provides Fuel Audit Study, Assessment and fixation of heat rate for regulatory bodies, Ex-bus capacity assessment of power plants and Technical minimum study. The Division is accredited by Bureau of Energy Efficiency (BEE) for conducting Energy audit in thermal power plants, process industries, buildings and commercial establishments.

View of Grid Tied Inverter Lab

The laboratory has facilities for evaluating the following:

- Solar Photovoltaic module test laboratory
- Grid tied inverter test laboratory
- LED test laboratory
- Solar pumping system test laboratory
- Induction motor test laboratory
- Solar Radiation Test Facility
- Photobiological Test Laboratory
- EV Charger Test & Research Laboratory

8. High Power Laboratory

The laboratory is unique in this part of Asia and helps in evaluation of EHV equipment.

The Laboratory is equipped with facilities for testing of EHV Circuit Breakers, Power Transformers, Current Transformers, Isolators, Wave Traps, Reactors, Insulator Strings, etc. It caters, mainly to performance evaluation of the above equipment under Short circuit and other switching conditions.

The facilities available in this Laboratory are:

- Direct testing facility of 2500 MVA capacity at 36/72.5 kV in three phase and 1400 MVA capacity, upto 245 kV in single phase
- Synthetic Testing Facility for high power testing of EHV Circuit Breakers upto 40 kA, 245 kV full pole and unit testing of EHV Circuit breakers beyond 245 kV level

View of High Power Lab

9. High Voltage Division

The Division has facilities for dielectric testing of all major electrical equipment.

The laboratory conducts evaluation of equipment like Distribution Transformers, Power Transformers, Insulators, Potential Transformers, Air Break switches, Isolators, Cables, Bushings, Power Line Accessories, Lighting Arresters etc., up to 400 kV systems.

The following Laboratories are under this Division:

- EHV Test Laboratory
- Pollution Laboratory
- Impulse Current Test Laboratory

Impulse Voltage Generator of 3MV, 150kJ

The division has the facilities and expertise to carry out grounding studies including Generating Stations, EHV Substations and various industries, Pollution level measurements at sites enrouting transmission line.

10. Materials Technology Division

The Division is equipped with advanced and sophisticated materials evaluation facilities aimed at providing testing and consultancy services in the areas of materials engineering, Dynamic testing, wear and erosion resistant materials, electrical steels (CRGO and CRNGO), ceramic materials, failure & root cause analysis, coal and other fuels, industrial waste utilization, Nondestructive testing (NDT), and field engineering & consultancy services viz. condition assessment, Remaining Life Assessment (RLA), Renovation and Modernization (R&M) for power sector.

The laboratories under the Division are:

- Materials Engineering & Characterization and Analytical Laboratory
- Coal Testing & Analysis and Industrial waste utilization Laboratory
- Field Engineering Services & Consultancy Laboratory

Residual Stress Test – XRD based

11. Mechanical Engineering Division

The Division has unique facilities and expertise in testing and evaluation of Transmission Line Towers and accessories like Conductors, Insulator strings, Vibration dampers, and Spacer dampers etc up to 800 kV. It offers consultancy services for evolving optimized tower designs, up-grading/up- rating of existing transmission lines. Expertise is also available to investigate and offer specific R & D activities in these areas.

The Laboratories under the Division are:

- Tower Testing Station Laboratory (TTS)
- Structural Material Testing Laboratory (SMTL)
- Design / Consultancy services
- Vibration Laboratory

220kV Tower under Test

12. Metering & Utility Automation Division

The Laboratory has test facilities for "TYPE TESTING" of electromechanical meters and electronic meter of accuracy class 0.2 to 2.0. By using latest versions of Conformance Test Tool – CTT and Functional Evaluation Tool – FET both Static Energy Meters and Smart Meters can be verified for their compliance respectively. Additionally, Communicability for Smart Meters can also be verified.

The following Laboratories are under this Division:

- Energy Meter Testing Laboratory
- Calibration Laboratory
- Metering Protocol Laboratory

Energymeter Testing

13. Power Systems Division

The Division is involved in the Power Systems consulting services for Power Utilities and Industry. Services encompass a wide spectrum of Power system studies like Power systems Planning, Power systems Stability, Load Flow, Short Circuit Studies, Flexible alternating currents Transmission systems devices, High Voltage Direct current, Grid connectivity, Real time performance analysis of various types of controllers such as FACTS, HVDC, SVC and protection relays, Power systems protection & audit, testing services including type testing of relays and testing of phasor measurement units.

Real Time Digital Simulator

The Division has the following laboratories:

- Relay Testing Laboratory
- Phasor Measurement Unit Laboratory

The Laboratory also offers consultancy services in the area of Generation & Transmission system studies, Protection System studies, Performance evaluation of controllers etc.

With PMUCAL Phasor Measurement Unit Testing & Calibration System 6135A, this Division undertakes: Testing and Calibration of Phasor Measurement Unit (PMU) as per IEC/ IEEE 60255.118.1:2018 standards for both M and P Class. The PMU test and Calibration System provides the required static and dynamic voltage and current conditions that occur in a power distribution grid specified by the standard.

PMU Calibrator

14. Short Circuit Laboratory

This Laboratory has facilities to undertake testing of electrical equipment like Distribution Transformers, Current Transformers, Potential Transformers, Low voltage Switchgear and Control gear equipment (MCB/MCCB/RCCB/ACB/ Fuses/Starter Modules etc.) and associated panel assemblies [LT Panels (PCC/MCC) / Distribution Boards / Feeder Pillars/ LV busways etc.], Power Cables and its accessories, Power connectors, Disconnectors, Load Break Switches, Earth Electrodes, HT Bus ducts, HT Panels etc. and many other related power system apparatus.

50MVA Short Circuit Generator

Heat Run Test Laboratory has facility to carry out Temperature rise test upto 2.5MVA 33/22/11kV class Distribution Transformers, LV/HV Switchgear Equipment like LT Panels, Isolated Phase Bus-ducts, Isolators etc.

Test on LT Panel

15.Smart Grid Research Laboratory

The laboratory houses advanced facilities for carrying out testing and research in the area of Smart Grid which includes Advanced Distribution Automation, Advanced Metering Infrastructure, Interoperability, Communication and Cyber security systems. It includes Smart Grid Test Bed and Technology Demonstration Test Bed for AMI system. These test beds are also useful in performance evaluation of various smart grid components.

AMI System Testing

The Division provides testing of Communication Protocol and Security Conformance for Intelligent Electronic Devices (IEDs) / Gateways/ RTUs as per IEC 61850. The IEC test facility is accredited by UCA IUG as Level 'A'. The Division also provides testing of RTUs / FRTUs for communication protocol and security conformance as per IEC 60870-5-101 / 104 and IEC 62351.

Consultancy services for implementation of Smart Grid and AMI / smart meter implementation, Distribution Automation, SCADA System, substation automation systems, Cyber security and Communication Systems for various utilities, industries, and other organizations are also offered.

UNITS OF CPRI

1. Switchgear Testing & Development Station (STDS), Bhopal

The Unit situated adjacent to the BHEL premises at Bhopal, has two main testing stations for conducting Short Circuit tests. They are:

STATION I:

Direct Short Circuit Testing Station of 1250 MVA capacity at 12kV utilizing two specially designed 1500 MVA short circuit alternators, mainly caters to short circuit tests on High and Medium Voltage Switchgears, Transformers and other allied equipment.

1500MVA Short Circuit Alternator

STATION II:

The On-line Testing Station is drawing power up to 100 MVA from the MPSEB Grid. This station mainly caters to Short Circuit tests on Low Voltage Switchgears, Transformers and other allied equipment.

The Laboratory has Short circuit test facility for LT Circuit Breakers, Contactors, Starters, Disconnector & switches & combination units, MCBs, MCCBs, RCCBs, RCBOs, Short circuit Dynamic and Thermal withstand test facility for Distribution Transformers and low voltage equipment.

Supplementary Test Laboratories:

Prior to and subsequent to the short circuit tests, a variety of tests are to be conducted as stipulated by the standards. These tests are conducted at the following Laboratories:

- High Voltage Lab
- Temperature Rise Test Lab
- CT and VT Test Lab
- Partial Discharge Lab
- Mechanical and Electrical Endurance Lab
- ACB, MCCB, MCB, RCCB, Contactors and Fuse Test Lab
- IP Test lab

Calibration Laboratory:

Services are offered in the area of Electro-technical & Thermal Discipline as per National/International Standards.

Energy Meter Testing Laboratory:

The laboratory has high precision state of art test facilities for all Type tests on Single phase, Three Phase Energy Meters, Transformer operated meters, Prepayment meters, Smart Meters, Data Exchange protocol, Smart meter communicability as per IS 15959 (Part 1, 2 and 3).

2. Ultra High Voltage Research Laboratory (UHVRL), Hyderabad

UHV Research Laboratory, Hyderabad was commissioned in 1993, with the following objectives:

• To provide design data valid for the country's particular climatic, environmental and operating conditions, for transmission system above 400 kV

•To provide necessary facilities for the development and testing of UHV Equipment

View of UHV facilities

The Laboratory has following facilities:

Pollution Test Chamber

The Pollution Test Chamber is one of the largest in the world with a diameter of 24 m and a height of 27 m. Salt fog test can be conducted on insulators, bushings etc., up to 800 kV class.

Power Frequency Laboratory:

The Cascade Transformer, comprising two units rated 800 kV each (total rating is 1600 kV, 9600 kVA) is used for energizing the experimental line, pollution chamber and testing equipment. The tests performed in this laboratory are one-minute dry and wet withstand test, flashover test, Radio interference voltage test, visible corona test, voltage distribution tests, Ferro resonance tests etc.

Impulse Generator

The Impulse Generator is used for Switching Impulse and Lightning Impulse tests on air gaps and equipment insulation. The impulse generator rating is 5 MV, and 500 kJ with 25 stages and a height of 23 m.

This Laboratory has the necessary infrastructure to simulate operating voltage conditions in the range of 220 kV to 1200 kV on an experimental line. It is used to evaluate the suitability and adaptability of UHV systems to Indian power systems taking into account the climatic, environmental, ecological and biological conditions prevailing in our country. The facility can evaluate corona loss, audible noise, radio and television interference, electric field etc., under various voltage and climatic conditions. Besides, the Laboratory has the capacity to cater to investigation and evaluation of equipment rated up to 1200 kV class. This is a 'one of its kind' facility in this part of the world.

DC Laboratory:

Outdoor ± 1200 kV / 200 mA DC test system is a unique facility which was not available in India. The facility helps in conducting research on HVDC transmission as well as facilitating indigenous development & testing of equipment for the new HVDC transmission lines that are coming up in the country.

View of ± 1200 kV DC Test System

Oil Testing Laboratory:

The laboratory has been established to carryout tests on Transformer Oil. The laboratory has facilities to carry out the tests on Transformer Oil as per IS 1866: 2017 and IEC 60422:2013.

UHV Indoor Shielded Laboratory

The Unit has established a new UHV Indoor Shielded Laboratory. The Laboratory is of dimensions 50 m (L) X 35 m (W) X 35 m (H) and is completely shielded from external interferences. The Laboratory has a 1200kV, 2A, AC Test System with partial discharge test

facility for Instrument Transformers, Bushings and other high voltage equipment. The laboratory is equipped with 1200 kV, 20 pF standard capacitor, capacitance and dielectric dissipation factor measuring bridge, Accuracy measurement system for Current transformers and Inductive voltage transformers, 10 kA, 20 V High Current Source. With the above facilities, the laboratory can conduct type tests on Current Transformers and Voltage Transformers.

800kV RIP Transformer Bushing under Partial Discharge test

3. Thermal Research Centre (TRC), Nagpur

The Centre is mainly intended for taking up consultancy and R&D work pertaining to Thermal Power Stations. The Centre carries out Condition assessment, Remaining Life Assessment, Renovation & Modernization, Life Extension studies and Non Destructive Evaluation (NDE) of Power Utilities and Industries equipment like Boilers, Turbines, Condensers etc., Material characterization & failure analysis, Condition assessment of RCC and steel Structures. Consultancy is also offered in operational and maintenance problems of thermal power generation, RLA and R&M.

RLA of Hydro Plant

4. Regional Testing Laboratory (RTL), NOIDA

Regional Testing Laboratory, which was originally situated at Muradnagar, was shifted to Noida in order to provide better services to customers, in the year 2009.

The Laboratory was set up with a view to cater to the testing needs of electrical power equipment manufacturing industry in Northern Region. Various Laboratories housed under this unit are:

- High Voltage Laboratory
- Cables Laboratory
- Oil Testing Laboratory
- Energy Meter Laboratory

1000kV, 100kJ Impulse Voltage Generator

The important facilities under this Unit include Cables Evaluation Laboratory up to 33kV rating. High Voltage Laboratory for evaluation of insulators, Transformers, Control Panels, CT, PT, CT-PT Unit, Various types of bushings, Isolators, AB switch. Transformer Oil Laboratory for testing New and In-service Insulating oils for Transformers. Energy meters testing lab for carrying out Type test, Acceptance test, Anti tamper feature verification and Protocol test for Static meters and Smart Meters.

A Mobile Energy Meter testing laboratory has been established for on-line testing of in-service energy meters at consumer premises on behalf of Power Utilities, Electricity Regulatory Commission and Public Grievances Cell.

5. Regional Testing Laboratory (RTL), Kolkata & Guwahati

The Laboratory was set up with a view to cater to the evaluation & certification needs of the electrical power equipment manufacturing companies, utilities and consumers in the eastern region. The laboratory is equipped with facilities to carry out evaluation of insulating oils in Power Transformers as per IS 1866-2000. The dissolved gas analysis of Transformer Oil in the Power Transformers, an important diagnostic tool, is available at RTL, Kolkata for assessing the internal condition of the Transformers.

View of Unit - RTL, Kolkata

The laboratory has evaluation facilities like High Performance Liquid Chromatography (HPLC) which is an important diagnostic tool for assessing solid insulation in Power Transformers to evaluate Furfural content (Furan Content). The facility is also being used for assessing the inhibitor level in the transformer oil.

This unit co-ordinates the activities of Transformer Oil testing laboratory located at Guwahati, providing services to the North Eastern parts of India.

SECTION - 2

RESEARCH & DEVELOPMENT

RESEARCH & DEVELOPMENT

CPRI is the Coordinating Nodal Agency for the "R&D schemes of the Ministry of Power (MoP) being implemented through CPRI" with details as given below:

1. In-House Research Projects (IHRD)
2. Research Scheme on Power (RSoP) Projects
3. R&D Under National Perspective Plan (NPP)
    a. Projects coordinated by CPRI
    b. Projects under Ucchatar Avishkar Yojana (UAY)
    c. Projects under IMPacting Research INnovation and Technology (IMPRINT-I)

Procedure for screening, review and approval of Project Proposals: CPRI has a comprehensive review and approval mechanism of the proposals received under the R&D Schemes. The proposals are first checked by the R&D Management Division for consistency of information and examined whether the research intent is in line with the Thrust Areas identified in the National Electricity Plan. The proposals are then sent to two domain experts for review of the research content and to evaluate the technical feasibility. Based on the comments, the proposals are put up to a Technical Committee (TC) for recommendation. At present there are four TCs viz. TC on "Hydro", TC on "Thermal", TC on "Transmission" and TC on "Grid Distribution & Energy Conservation" Research. The TCs are chaired by eminent Professors from IITs. The proposals recommended by the TC are put up for consideration of D.G., CPRI/the Standing Committee on Research and Development (SCRD). The SCRD is chaired by Chairperson, Central Electricity Authority, New Delhi and has representations from MoP, Academia, Industry, other Ministries. The representation of other Ministries in the SCRD ensures that overlapping of research under the proposed scheme can be avoided.

The Apex Committee of IMPRINT-I chaired by Secretary (Higher Education), Ministry of Education (MoE) and with members from the participating Ministries has been constituted for approval of the proposals and monitoring the progress of implementation. The Apex Committee has the authority for financial sanction and financial closure of the projects. The National Co-ordinator for IMPRINT-I viz. IIT, Kanpur is responsible for convening the Apex Committee meetings.

IIT-Madras is the National Co-ordinator for implementation of the UAY scheme. Monitoring of the progress of projects under the UAY Scheme is done by an inter-ministerial committee constituted for this purpose.

ADMINISTERING OF R&D PROJECTS

The Apex Committee on R&D namely Standing Committee on R&D (SCRD) is headed by Chairperson, CEA and the composition of the Committee is given in Appendix-3. The Standing Committee on R&D (SCRD) is the apex body that evaluates the research projects and also monitors implementation of the scheme objectives.

Four Technical Committees have been duly constituted to administer the R&D Projects in the areas of Thermal, Hydro, Transmission, Grid, Distribution and Energy Conservation. The composition of Committees are given in Appendix-4 to 7. The four Technical Committees assist SCRD by closely monitoring and steering the projects to successful completion.

Funding Mechanism:

Projects approved under the RSoP and IHRD schemes are fully funded by the MoP. However, in case of projects taken up by the Industries under the R&D under NPP Scheme, the project cost is shared by the concerned Industry and the MoP on 50:50 basis.

For projects approved under the UAY Scheme, half of the project cost is funded by the MoE, 25 % is borne by the MoP and the remaining 25% by Industry.

For Projects approved under 'Energy' domain of IMPRINT-I Scheme, the cost of funding the projects is shared equally between the MoE and the MoP. Thus, funding support to the extent of 50% is extended by the MoP.

Project monitoring:

Quarterly Progress Reports and Utilization Certificates are submitted by the project implementing organization to the R&D Management Division of CPRI. Further, the Four Technical Committees and the SCRD monitor the progress of the on-going projects.

During the 12th Five Year Plan and the subsequent three year action plan period, CPRI has funded 25 projects under the "R&D under NPP" scheme, 63 projects under RSoP scheme and 38 projects under IHRD Scheme. Some of the projects aim at design and development of indigenous technologies with the objective of cost reduction, import substitution and employment generation. The deliverables of the projects help in development of innovative solutions thereby adding to the knowledge capital on the particular priority area and also acts as prior art for the future research.

• IN-HOUSE RESEARCH PROJECTS (IHRD)

In-house research projects serve to develop technology and expertise to cater to the future needs of the Indian power industry. These projects are proposed by officials of CPRI after careful analysis of the current technological requirements and conditions prevailing in the Indian Power Sector. The projects proposed are recommended by the Technical Committee on Transmission, Grid, Distribution and Energy Conservation, Hydro and Thermal Research and then approved by Standing Committee on R&D (SCRD).

Following are the summary of the ongoing In-house Research Projects at CPRI:

Grid, Distribution & Energy Conservation Research					
Sl. No.	**Project Title**	**Division**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
1	Development of Polymeric Films for High Energy Density Capacitors Application	DMD	94.60	1.5	The development of polymeric films for high-energy density capacitors aims to create lightweight, low cost, compact, and reliable capacitors with enhanced energy storage capabilities. These capacitors find applications in various fields, including power electronics, renewable energy systems, and electric vehicles.
2	Design and development of a dynamic protection scheme for utility with bulk electric vehicle charging	PSD	86.46	2.5	The project's purpose is to create and implement a dynamic protection scheme for utilities involved in bulk electric vehicle charging. The scheme aims to safeguard the system effectively during the charging process and ensure smooth operations while handling high volumes of electric vehicle charging activities.
3	Development of High Energy Density Composite Materials for Fast charging Lithium Ion Battery	EATD	84.70	2	The project focuses on developing composite materials with high energy density for fast-charging lithium-ion batteries. The aim is to create materials that can store and release energy efficiently, enabling lithium-ion batteries to charge rapidly while maintaining high energy storage capabilities.

Grid, Distribution & Energy Conservation Research					
Sl. No.	Project Title	Division	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
4	Impact of harmonics on Power Distribution Network due to Electric Vehicle Charging	R&DM	35.80	2	The project involves conducting a harmonic load flow analysis to examine the impact of harmonics generated by EV chargers on the distribution network, with a particular focus on the simultaneous charging of multiple electric vehicles.
5	Development of Poly Aryl Ether Ketone / Polyhedral oligomeric silsesquioxane (PAEK / POSS) nanocomposites for PV cable application	DMD	25.85	2	The Polymer nanocomposites are advanced dielectric materials known for their improved electrical and thermal performance. PAEK, a high-temperature thermoplastic, exhibits properties such as good thermal stability, excellent chemical resistance, resistance to aqueous environments, and moderate UV resistance.
6	New generation Ethylene Vinyl Acetate (EVA) nano-composites with high UV shielding properties for Photovoltaic Modules	INS (CDD)	22.82	2	Ethylene Vinyl Acetate (EVA) nano-composites with high UV shielding properties have been developed and tested. The enhancement in thermal stability particularly up to the low conversion levels has been interpreted in terms of the barrier effect of silica particles on the O2 flow into the sample. The activation energies of degradation up to lower range of conversions have been determined by non–isothermal and isothermal kinetic analyses.

Grid, Distribution & Energy Conservation Research					
Sl. No.	**Project Title**	**Division**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
					The effects of interfacial and orientation polarization on the permittivity and the loss tangent have been studied by dielectric analyses. These have been correlated with the structures of various nanocomposites. An attempt has also been made to support the dielectric results by volume resistivity measurements, measurements of breakdown voltage, and swelling – deswelling kinetic results
Transmission Research					
7	Determination of Stability of Mineral Insulating oils by Rapid Small Scale Oxidation Technique (RSSOT)	DMD	36.74	2	The objective of this project is to devise a new approach to evaluate the stability of insulating liquids, addressing the limitations of the current method (specified in IEC 61125). The existing method demands large oil quantities, numerous equipment, prolonged testing periods, significant manual effort, high expenses, and increased chemical/solvent usage. The project intends to employ the Rapid Small Scale Oxidation Technique to assess the stability of Mineral Insulating oil, aiming for a more efficient and cost-effective evaluation process.

Transmission Research					
Sl. No.	Project Title	Division	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
8	Development of an indigenous RTV coating with enhanced thermal conductivity for use on ceramic insulators	INS, (CDD)	30.00	2	The current project aims to achieve the following objectives: * Enhancing the performance of the existing RTV SR coating. * Developing a locally sourced composition for the coating. * Introducing improved thermal conductivity to extend the lifespan of insulators.
9	Seismic Qualification of Instrument Transformer	EVRC	49.50	2	The project aims to investigate the performance of instrument transformers when subjected to seismic loading.
10	Design and development of narrow based 8- legged transmission line tower insulated cross arms	MED	50.00	2	The project aims to introduce a novel configuration of an 8-legged tower featuring insulated cross arms that significantly reduces weight and allows for construction on a smaller land area compared to the conventional 4-legged tower.
11	Assessment of transformer inrush withstand capability	SCL	46.20	2	The project aims to ascertain the inrush current withstand strength of Transformers i.e. determination of the number of inrush currents that a transformer winding can withstand through Finite Element Method (FEM) simulation and validation through experimental studies

Transmission Research					
Sl. No.	Project Title	Division	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
12	Performance evaluation of completely of self – protected (CSP) transformers under rated load and short – circuit conditions	HPL	49.50	2	The rising adoption of Completely Self-Protected (CSP) transformers in power systems is attributed to their improved functionality compared to conventional distribution transformers. This project seeks to investigate the impact of operating conditions on the lifespan of these transformers under various loading scenarios. Specifically, the research aims to gain insights into the behavior of oil insulation when circuit breakers operate at different current levels.
13	Investigation of Transient Electric fields and Electromagnetic Interferences against the Very Fast Front Transient Overvoltages (VFFTO) in GIS system	UHVRL Hydera -bad	44.00	2	The investigation of transient electric fields and electromagnetic interferences against Very Fast Front Transient Overvoltages (VFFTO) in GIS systems aims to enhance the reliability and safety of gas-insulated switchgear (GIS) by understanding and mitigating potential overvoltage issues during fast transient events.
14	Development of covered conductor outer insulating material with high UV shielding properties	RTL Kolkata	47.08	2	The development of covered conductor outer insulating material with high UV shielding properties finds application in overhead power transmission lines, enhancing their longevity and reliability by providing effective protection against

Transmission Research					
Sl. No.	Project Title	Division	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					ultraviolet (UV) degradation and environmental factors.
15	Development of vegetable ester based nano fluids for transformers	DMD	40.70	2	It was reported that as part of the project, BCZT nanofluids were prepared using the oxalate precursor route. These nanofluids were subsequently subjected to comprehensive characterization, including tests for AC breakdown voltage (BDV), tan delta, resistivity, dielectric constant, flash point, viscosity, acidity, and thermal conductivity, following the standards set by ASTM/IEC/ISO. The results indicated that the nanofluids did not adversely affect any of the physical properties tested. However, they exhibited an improvement in both thermal stability and electrical properties.
Thermal Research					
16	Development Of Heat Pipe Based Super – Heaters And Re-Heaters To Prevent Boiler Forced Outages	MTD	48.73	2	The project's primary objective is to design and develop a superheater and reheater system specifically tailored for power plant applications. The system will be engineered to prevent any single tube failure from causing a complete shutdown of the plant, ensuring continuous and reliable operation.

Following are the summary of the completed In-House Research & Development (IHRD) Projects at CPRI:

Grid, Distribution & Energy Conservation Research					
Sl. No.	**Project Title**	**Division**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
1	Improvement in Composite Polymeric Insulator Characteristics with Nano Filler Additives for Outdoor DC Applications	INS (CDD)	48.47	2	The project successfully achieved grafting a compatible layer of the insulator using dopamine, a sustainable material that can be easily recycled. Notably, the nano-fillers displayed enhanced interaction with HTV silicon, resulting in good tracking and erosion characteristics at a milligrams scale. Additionally, Corona discharges were minimal, and there were no significant changes in hydrophobicity.
Transmission Research					
Sl. No.	**Project Title**	**Division**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
2	Development of test method for studies on pollution performance on composite insulators to be used on DC systems	UHVRL Hydera -bad	164.00	2	The following were achieved under the project: • Created test facility to perform artificial pollution test by solid layer method including leakage current acquisition system • Developed a procedure for application of pollution layer of desired salt deposition density on the surface of composite insulators. More-or-less uniform pollution layer is obtained by dipping

Transmission Research					
Sl. No.	Project Title	Division	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					method. Developed procedure is validated on different composite insulator samples. As per STRI guidelines, transfer of hydrophobicity of composite insulator was observed before application of slurry. • Proposed a test method to perform solid layer artificial pollution test by including rapid flashover test proposed by M/s. STRI Laboratory • As per CIGRE 555, new test method is assessed/validated by Repeatability, Representativeness and Reproducibility • Standard deviation of U50% flashover voltage of proposed test method is 2.5 to 5% and no flashover was obtained before 15 minutes – Hence, as per CIGRE 555 proposed method is considered as repeatable • Pattern of leakage current acquired during withstand test is similar to CIGRE 555 leakage current pattern. More-or-less, flashover pattern is also same as that

Transmission Research					
Sl. No.	**Project Title**	**Division**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
					of guidelines. So, representativeness of proposed method is proved as per CIGRE 555 • Proposed Pollution test procedure – validated on 33 kV, 66 kV Composite insulators and also on Porcelain, Glass disc insulators – found satisfactory as per CIGRE 555. Tests was performed with 0.1 mg/cm2 and 0.2 mg/cm2 salt deposition density.
3	Computational design and Development of Green Insulating fluids for power transformers: Renewable non-edible oil	DMD	27.28	1.5	As part of this project, an alternative insulating fluid for transformer applications has been developed, offering the following advantages: • The fluid is derived from pongamia oil using a single-stage percolation method, specifically designed for transformer application. • The percolation method employed is a straightforward and safe chemical technique. • The absorbent used in the percolation process can be recycled after being washed and dried, promoting sustainability and reducing waste.

Transmission Research					
Sl. No.	Project Title	Division	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					• The insulating fluids meet the requirements outlined in the IEC 62770 standard, ensuring their suitability for use in transformers and similar electrical equipment.

Thermal Research					
Sl. No.	Project Title	Division	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
4	Development of gasification reactor system for conversion of multi fuel to syngas	MTD	91.00	2	In the project three different designs for microwave plasma reactor were made for gasifying the multi-fuels viz a) Single torch reactor system (STRS) to feed pulverized particles through the core of the plasma flame, b) Perpendicular torch system with coaxial plasma flame configuration (PTRS), c) Vertical in-line torch system with sequential plasma flame configuration (VITS). The system (a) was designed for gasifying pulverized solid fuel particles and the systems (b) and (c) were designed to gasify bigger particles of size 6-8mm. Four microwave torches were made with the microwave source of 3KW and 2.4 GHz frequency for each torch. The final flame length obtained was about 3 inches and the diameter was about half inch. The temperature of the inner core of the flame was exceeding 1800

Thermal Research					
Sl. No.	**Project Title**	**Division**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
					deg. C and the edge of the flame was about 600 deg. C. This was due to the low input wattage of the microwave source and by increasing the input wattage to higher levels will increase the plasma core and edge temperature. The gasification experiments were carried out in all the three reactors
Hydro Research					
5	Run-of-the-River low head micro hydroelectric system for off-grid microgrid operation	MTD CPRI	93.50	2	Under the project an artificial vortex-type micro-hydel system for low head and low discharge conditions prevailed in Run of River Schemes is being developed to tap the hydropower energy in remote areas. All the components such as sump tank with multiple discharge pumps, secondary tank, channel system, vortex tank (2m diameter) with inlet and outlet flow controls, turbine blades, discharge chute, etc. have been optimized based on the CFD flow analysis. This system harnesses the energy contained within an artificially induced giant after vortex over a small head. Water flows tangentially into a cylindrical basin with an opening at the bottom. The combined effect of the localized low pressure at the central region and the

Hydro Research					
Sl. No.	Project Title	Division	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					circulation induced as a result of the tangential entry through inlet, causes the water to restructure into a vortex-like flow pattern. The potential energy of the entering water is entirely converted to kinetic energy and extracted through a vertical coaxial turbine coupled with a generator. A vortex-based power generation system for low head upto 2m and flow rates in the range of 120 to 400 LPS has been designed and developed. The parameters affecting the system's overall efficiency have been studied through different configurations. The maximum power output achieved in the system is 3.7 kw. The system's efficiency has been observed to be better than other commercial systems for the flow ranges studied. Commercial systems have been reported with a single input condition of head and flow. The system established in C.P.R.I. has been designed with flexibility for evaluating the performance of the vortex-based system under different parameters affecting the vortex power output and would provide information on selection of parameters for achieving optimum performance.

• RESEARCH SCHEME ON POWER (RSOP) PROJECTS

The project proposals are invited from Academia, Power Utilities, and Research Institutes. The projects proposed by the Scientists and Engineers are recommended by the Technical Committee on Transmission, Grid, Distribution and Energy Conservation, Hydro and Thermal Research and then approved by Standing Committee on R&D (SCRD), for projects above Rs. 50 Lakhs and by Director General, CPRI for projects with outlay upto Rs. 50 Lakhs.

Following are the summary of the ongoing RSoP projects:

Grid, Distribution & Energy Conservation Research					
Sl. No.	**Project Title**	**Organisation**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
1	Investigations on Control Flexibilities of Grid Integrated Solar Photo Voltaic Energy Conversion System	NIT Warangal	31.10	1.5	The project involves developing dedicated control algorithms for effective inverter utilization, providing hierarchy-based ancillary services and Fault Ride Through (FRT) techniques with harmonic compensation. A laboratory-scale prototype will be created for field application purposes.
2	Design, operation, and control of distributed generation (DG) integrated unified power quality conditioner (UPQC) in electric grid	IIT Guwahati	32.28	1.5	The project involves developing a step-by-step procedure for designing components of UPQC (Unified Power Quality Conditioner) using higher-order passive filters. Additionally, it aims to investigate stability concerns in DG (Distributed Generation) integrated UPQC and develop relevant stability criteria, along with a control strategy for efficient power management in the electric grid.

Grid, Distribution & Energy Conservation Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
3	High-Flux Solar Simulator (HFSS) for High-Temperature Solar Thermal Research	IIT Kanpur	60.00	2	The High-Flux Solar Simulator (HFSS) designed under the project is aimed to be utilized for high-temperature solar thermal research, enabling the simulation of intense solar radiation in a controlled environment for studying advanced solar thermal materials and processes, such as high-temperature solar receivers and concentrated solar power systems.
4	Designing and Tailoring of Hierarchical Graphene Carbon Nanotubes and activated Carbon for High Performance Hybrid Supercapacitor	NIT Rourkela	54.38	2	The project involves designing and tailoring hierarchical graphene carbon nanotubes and activated carbon materials for the development of high-performance hybrid supercapacitors, providing efficient energy storage solutions for various electronic devices and renewable energy systems.
5	Development of Metal Nanocomposites for the Enhancement of Efficiency of Solar Cell	NIT Agartala	16.86	2	The project involves developing metal nanocomposites to enhance the efficiency of solar cells, leading to improved light absorption and charge carrier generation, thereby increasing the overall performance and output of solar energy conversion systems.

Grid, Distribution & Energy Conservation Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
6	Development of An On-Board Hybrid Charging System For Hilly-Station Performance Light Electric Vehicle	Tezpur Univer -sity, Assam	31.46	2	The project focuses on developing an on-board hybrid charging system for hilly-station performance light electric vehicles, including the design of the AC/DC drive circuitry for BLDC (Brushless DC) motors.
7	Design and development of wide bandgap semiconductor based three- level neutral-point-clamped converter for single stage grid-connected PV system	IIT Delhi	48.00	2	The project aims to design and develop a three-level neutral-point-clamped (NPC) converter based on wide bandgap semiconductors for a single-stage grid-connected PV system, with a specific focus on creating a 100 KW NPC for grid-connected PV applications.
8	Electrolytic Capacitor Less Six Pulse DC Link Photovoltaic System connected to Grid	IIT (BHU) Varanasi	45.44	2	The research aims to develop a cost-effective power supply solution for small and medium PV systems with grid connection. The resulting product can be deployed in urban as well as semi-rural areas of the country.
9	Design and Development of Grid Interactive Adaptive Controls for Frequency Regulation from Large Scale PV Systems	IIT, Bhubaneswar	39.16	2	The project involves designing and developing grid interactive adaptive controls for frequency regulation from large-scale PV systems.

Grid, Distribution & Energy Conservation Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
10	Development of Single Metal Atom Derived Electrode Materials for Next Generation Hydrogen Production Systems	SRM Institute of Science and Technology Kattank-ulathur	32.52	2	The research focuses on development of electrode materials and catalysts for hydrogen production systems.
11	Development of MXene-Hierarachical transition metal sulfide hybrid nanostructures as electrocatalysts for overall water splitting	Pandit Deendayal Energy Universi-ty, Gandhinagar	48.49	2	The research project aims to develop MXene-hierarchical transition metal sulfide hybrid nanostructures as electrocatalysts to aid in water splitting. The objectives include establishing resource data, synthesizing M-xene, and gaining insights into its efficiency for hydrogen production.
12	Photovoltaic Fed Microgrids: Integrated Intelligent Harmonic Control to Enable Electric Vehicle Charging	BITS Pilani	20.55	2	The project aims the development of intelligent control techniques to track Maximum power point (MPP) of PV system and development of advanced charging schemes for solar assisted wide band gap based EV charger. The real-time validation of proposed system is also planned on controller hardware in the loop (CHIL) testing platform, using MicrolabBox.

Grid, Distribution & Energy Conservation Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
13	Designing High Performance Recharg-eable Zinc Ion Aqueous Batteries	Jain University	34.97	2	The aim of the project work is development of high energy high power and long cycling aqueous Zinc ion battery prototype with performance optimized cathode, coupled with electrodeposited zinc anode with anode loading <300% excess to cathode.
14	Composition-microstructure-property correlation studies of eco-friendly (lead free) relaxor ferroelectrics for pulse power capacitor applications	PEC Chandigarh	37.95	2	The project work aims to design and develop a pulse power capacitor with capacity ~1000 pF for operating temperature range -30 to +100°C, Vmax (DC) ~30kV.
15	Pilot Implementation of Energy Blockchain and P2P Transactive Market	NIT Calicut	19.44	2	The objective of the project is to design and demonstrate blockchain-based peer-to-peer transactive energy markets as a pilot project in the Auroville Community grid.
16	Development of Electricity Based Clean and Efficient Cooking Technology Suitable for Indian Cookware	IIT Kharagpur	36.21	2	In accordance with the project objectives, a 2x2KW induction cooker has been created, equipped with two pans specifically designed for different types of cookware. One pan is designed for flat surface vessels, while the other is suitable for curved surface vessels. The design is to aid in cooking Indian dishes through induction cooker.

Grid, Distribution & Energy Conservation Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
17	Design and Development of Efficient Induction Cooker suitable for Vessels of Different Material	NIT Warangal	14.28	2	A novel induction heating device has been engineered to efficiently heat non-ferromagnetic vessels such as aluminum and copper. The prototype of the device has been successfully developed and rigorously tested in the laboratory.
18	Design and Development of Improved Control Techniques for Unified Power Quality Conditioner with Distributed Generation (UPQC-DG)	BITS Pilani	21.09	2	An optimum design method for UPQC-DG, including sizing series and shunt inverters and passive components was achieved. Real-time simulation and power-hardware development were conducted for UPQC alone and for UPQC integrated with DG. Improved control strategies for UPQC-DG to effectively utilize series and shunt inverters, providing reactive power support to the grid was developed. A FPGA/DSP based controller prototype was developed and implemented using the developed control techniques. Experimental validation of the developed controller using a laboratory-based hardware setup of PV integrated UPQC-DG was carried out

Grid, Distribution & Energy Conservation Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
19	Development of nanocrystalline materials for solid oxide fuel cells working at 600 degree C	Karunya Univesity, Coimbatore	27.46	2	In line with the project's objective, a nanocrystalline material for solid oxide fuel cells (SOFCs) was successfully developed and subjected to testing. The NSCFO cathode exhibited a high power density of 776 mW/cm2 at 800 °C. Moreover, the humidified hydrogen demonstrated a maximum current density of 0.470 A/cm2, and the open circuit voltage (OCV) measured 1.018 V.
20	Design & Development of a Cost-effective & Energy-efficient Grid – connected Pumped Hydro System employed with Sensor-less PMBLDCM	NIT Meghalaya	32.90	2	Conventional pumped storage systems utilized constant-speed synchronous machines, resulting in reduced efficiency. To address this issue, doubly fed induction machines (DFIM) were introduced. However, DFIM has limitations including the need to operate within specific speed limits to avoid stressing the converter, higher ohmic losses leading to lower efficiency, the system being costly and bulky due to the need for appropriate cooling methods, and increased maintenance costs. In this project, a new generation FPGA-controlled sensor-less permanent magnet BLDC machine has been developed to overcome these constraints.

Grid, Distribution & Energy Conservation Research					
Sl. No.	**Project Title**	**Organisation**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
					This system designed showed satisfactory capability for pumping the water in to the storage system.
Transmission Research					
21	Analysis of Performance of Inclined Plate Anchors Embedded in Geosynthetics Reinforced Soils for Transmission Tower Foundations	IISc, Bangalore	31.96	1.5	The analysis of inclined plate anchors embedded in geosynthetics reinforced soils for transmission tower foundations aims to optimize the design and performance of tower foundations, ensuring stability and load-bearing capacity in challenging soil conditions, thereby enhancing the reliability and longevity of transmission towers.
22	Design and development of tools for detection and prevention of cyber-attacks in smart grid energy management systems (EMS)	IIT Bhubaneshwar	49.92	1.5	The project's objective is to formally model and proactively detect potential and novel security attacks in EMS and Substation Automation systems. This will be achieved by considering different attack attributes, their correlations, and the grid's operational topology.
23	Strengthening studies for performance enhancement of existing transmission line towers	CSIR-SERC, Chennai	48.00	2	The project focuses on performance enhancement of existing transmission line towers through component-level investigations on strengthening steel angle

Transmission Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					sections using GFRP (Glass Fiber Reinforced Polymer) angles. The aim is to conduct experimental and parametric studies to develop effective methods for strengthening the towers.
24	Advanced Frequency Response Analysis Method for Identifying Winding Damage or Deformation in Transformer	IIT Kharagpur	34.50	2	A comparison-based method for which three frequency responses are to be concurrently measured on three legs of the transformer followed by their comparisons among each other. For healthy case, these three responses are expected to be identical or nearly identical, whereas for faulty case, they are expected to be distinctly different for higher sensitivity in fault-detection. For this task, a comprehensive study has been carried out in MATLAB using three-phase equivalent ladder-network model of transformer and amongst all possible
25	Agnostic strategies for cyber – physical attacks quantification and mitigation in power networks	IIT Kanpur	30.01	1	The application involves using an advanced frequency response analysis method to identify winding damage or deformation in transformers, enabling early detection of potential faults, ensuring timely maintenance and preventing costly failures in power systems.

Transmission Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
26	Impact Analysis and Mitigation of Cyber Attacks on Microgrid SCADA	IIT Roorkee	42.50	1	The project involves conducting impact analysis and developing mitigation strategies for cyber attacks on Microgrid SCADA systems, ensuring the resilience and security of the Microgrid infrastructure against potential cyber threats.
27	Study on Detection of False Data Injection (FDI) Attacks in Smart Grid Cyber - Physical Systems: A Machine Learning Approach	IIT Ropar	14.16	1	The project aims at using a machine learning approach to study the detection of False Data Injection (FDI) attacks in Smart Grid Cyber-Physical Systems, enhancing the security and reliability of smart grid operations against potential cyber threats.
28	Cyber Security of Power Systems through Design-for-Prevention, Real-time Detection and Effective Intervention	IIT Kharagpur	48.74	1	The project envisages implementing design-for-prevention, Real-time Detection, and Effective Intervention techniques to enhance the cyber security of power systems against cyber attacks including hardware trojan attacks, ensuring the integrity and reliability of critical infrastructure.
29	AI and IoT based Attack Detection and Authentication Scheme for Cyber Security in Grid Connected Power	IIT Guwahati	17.78	1	The project aims at developing an AI and IoT-based attack detection and authentication scheme for cyber security in grid-connected power electronic converters, safeguarding against potential

Transmission Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
	Electronic Converters				cyber threats and ensuring the reliable operation of power conversion systems in grid-connected environments.
30	Cyber-Attack Analysis Toolkit for Cyber-Physical Distribution System Security [CyberDiSS]	IIT Gandhin-agar	23.96	1	The project involves simulating physical power networks and developing FDI attack vectors for vulnerability analysis for coming up with mitigation strategies.
31	Development of a real-time cyber-attack detection module and its hardware-in-loop testing for an integrated power network	IIT (BHU) Varanasi	49.92	1	The project aims at setting up a real-time test bed for real-time cyber-attack detection and conducting hardware-in-loop testing for an integrated power network, ensuring enhanced security and resilience against potential cyber threats in power systems.
32	Cyber Physical Modelling and Detection of Cyber Attacks in a Wide Area Damping Controller (WADC) for Smart Grids	IIT Tirupati	47.92	1	The project focuses on cyber-physical modeling and detecting cyber attacks in a Wide Area Damping Controller (WADC) designed for Smart Grids, aiming to ensure the security and reliability of the smart grid system against potential cyber threats.
33	Development and Validation of Security Solutions against Various Cyber Attacks at Substation/Trans mission Level for	IIT Roorkee	49.85	1	The aim of the project work is to develop attack detection and mitigation strategies for different possible cyber-attacks at substation/transmission level of the grid to combat the impact of cyber-attacks on grid and protect the critical cyber-

Transmission Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
	Indian Power Grid Network				physical infrastructure. Further, a cyber physical testbed will also be developed for an interconnected Indian power grid network capable of simulating various attacks.
34	Switching based PID control approach for automatic generation control (AGC) of power system with integration of Renewable Energy (RE) sources	IIT Roorkee	27.04	2	This work aims design of switching PID control approach for frequency control of benchmark power system with renewable energy sources (RES such as Photovoltaic (PV) and wind farm) and development of controller-based simulation model for analysis of the proposed system. Evaluation of proposed control scheme for automatic generation control through RTDS is also planned. Robustness of proposed control Scheme for AGC will be tested under parametric uncertainties, physical constraints such as GRC and GDB, power generation variation and load disturbance of interconnected power system. Further, different stability analysis such as voltage stability will be carried out. A microgrid setup will be developed, and control scheme will be tested in real-time.
35	Characterization and Detection of Power System Ambient,	IIT Patna	43.68	1	The objective of the project includes analysis and detection of forced oscillation in multi-machine power system (of

Transmission Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
	Transient and Forced Oscillations Based on Synchrophasor Data Analytics in Indian Context				ERLDC, POSOCO). Machine learning (ML) techniques will be exploited for detecting the source of forced oscillations. Real Time Digital Simulation (RTDS)platform will be used for this study. Various data sets will be generated from this RTDS to develop an Oscillation Detector Module (ODM) and Oscillation Source Locator Module (OSLM), which can detect the ambient, transient and forced oscillations. The developed ODM will be tested on different cases of real time data sets obtained from PMU/PDC of ERLDC, POSOCO for accuracy.
36	Condition assessment of stator insulation in rotational machines due to thermal and electrical ageing through advanced dielectric response measurements	NIT Calicut	40.72	2	The project aims to develop an offline reliable insulation diagnostic method for condition assessment of stator insulation in rotating machines. The method is expected to be useful in determining the remaining life of the insulation.
37	Design and Development of Artificial Intelligence Based Short Term Load Forecasting Model	NIT Raipur	20.54	2	The project aims to devise and develop AI-based load forecasting scheme for every 15 minutes, hourly, and monthly basis at different voltage levels to enhance the reliability, resiliency and power quality of power system. The developed AI-based load forecasting

Transmission Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					model may be used by Electrical Power Utilities and their Load Dispatch Centre (LDCs) to monitor and control the power flow and provide solution for sustainable load management and Smart Grid Operational Planning.
38	Development of nan-composite moisture transmitter for monitoring ppm moisture in transformer oil through wireless communication system	CSIR-CGCRI	36.58	2	The project aims to develop a small-sized capacitive sensor towards the real time detection of trace moisture contamination in transformer oil with high resolution in 1-10 ppm moisture level. Further, a wireless communication system will also be developed, for transmitting sensor data pertaining to transformer oil trace moisture content, to a distant receiver for necessary visualization on a computer screen using a custom-made UI.
39	Development of tools for Conformance Testing of SCADA communication protocols for security	CDAC-Bangalore	26.84	2	The project work aims at development of tools to conduct the conformance/ interoperability testing of SCADA communication protocols for security.
40	Design & Development of RF sensors for identification and localization of	IITM, Chennai	38.40	2	UHF sensors with enhanced sensitivity for detecting partial discharge (PD) in Gas Insulated Substations (GIS) were developed. Also, algorithms for

Transmission Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
	incipient discharges in GIS				classifying UHF signals associated with common PD activities in GIS were developed. The developed UHF sensors and defect identification methodology can be utilized by power utilities and manufacturers. The gained technical expertise in designing and fabricating UHF sensors can be shared with competent engineers to ensure successful implementation in the industry. This knowledge transfer is particularly significant for advancing GIS, which is still in its early stages of development in our country.
41	Transmission Line Protection in the Presence of Bulk Solar Photo Voltaic Power Plants	IIT Kharagpur	48.40	2	Different control schemes adopted in the renewable energy plant interfacing converters, introduce non-homogeneity in the fault paths in the line connecting such a source. This may result in the erroneous operation of the fault classifier that uses local superimposed current and voltage data. An adaptive fault type classification technique is proposed for such non-homogeneous situations in the presence of renewables. Using local voltage and current data, the sequence current angles in the faulted path are calculated by determining the pure-fault impedance of the renewable

Transmission Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					plant at every instant following the fault detection and applied for fault type classification. Considering the grid to be strong, a distance relaying technique is proposed to calculate the line impedance up to the fault point from the relay by determining the phase angle associated with the faulted loop current. Thereby it obtains the correct protection decision for lines connecting SPPPs even with conventional fixed zone settings. The improved performance of distance relay employing such estimated superimposed components is observed for faults during power swing with changes in fault type, fault location, fault resistance, swing frequency, and fault inception angle. The algorithm also works for different levels of penetration of renewable resources in a system.
Thermal Research					
42	Thermoelectric Power Generator for Clean Energy Generation by Recycling Waste Heat Generated in Power Plant	IIT Kanpur	50.00	1.5	The application of Thermoelectric Power Generators for clean energy generation involves recycling waste heat generated in power plants, converting it into usable electricity, thereby enhancing overall energy efficiency and promoting sustainable power generation practices.

Thermal Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
43	The unsteady aerodynamic response in LP turbine blade and its control under part load conditions	IIT Roorkee	38.64	1.5	The research aims to study the unsteady aerodynamic behavior of a rotor blade in a turbine blade cascade, specifically focusing on its response to incoming separated flow conditions and aerodynamic instability caused by varying turbulence levels.
44	Design Of Cascaded Adaptive Control With O2 And Temperature Data Of Combustion Images For Optimization Of Boiler Combustion Processes In A Thermal Power Plant	Vel. Tech University, Tamil Nadu	29.88	2	The project focuses on designing cascaded adaptive control using O2 and temperature data from combustion images through computer vision algorithms to optimize boiler combustion processes in thermal power plants, aiming to enhance efficiency and reduce emissions.
45	Localized Electricity Generation Through Modular Low Temperature ORC Units	IIT (BHU) Varanasi	48.40	2	The project's main focus is to develop a preheater-based ORC system, optimizing energy conversion by utilizing heat from the refrigerant at the turbine outlet along with an absorption system at the evaporator side.
46	Design and Development of a Screw Drive type Wheeled Snake-like Robot to Access the inaccessible Areas inside the Boiler Tubes and other Enclosures	IIT Bhuban-eswar	38.16	2	The application involves designing and developing a snake-like robot to access hard-to-reach areas inside boiler tubes and other enclosures, enabling efficient inspection, maintenance, and monitoring tasks in industrial settings, enhancing safety and reducing manual intervention.

Thermal Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
47	Development of High Temperature Wear and Corrosion Resistant Graphene Nanoplatelates Reinforced Plasma Sprayed Cr3C2-NiCr composite Coating for thermal power plant	IIT Patna	30.64	2	The objective of the project is to enhance the high temperature performance and durability of the most commonly used steel grades (T22) in fire tube boilers, fluidized bed combustion boiler etc. This will be done by depositing plasma sprayed graphene nanoplatelates (GNP) (1-2 wt. %) reinforced Cr3C2-25(80Ni20Cr) composite coating over the steel substrate (T22). This synthesized coating will be evaluated for its microstructural aspects, mechanical properties, adhesion strength, high-temperature (~800°C) wear, erosion and corrosion resistance. Upon successful completion of the project, this coated steel can be exposed for the field trial in the coal-based power plant
48	Development of epoxy-glass fiber-ceramic composite coatings to combat corrosion, erosion and erosion corrosion in flue gas desulfurization systems	University of Madras Chennai	38.83	2	The project work aims to explore epoxy coatings incorporated with glass fibers and different weight fractions of fillers such as graphitic carbon nitride, alumina and silicon carbide and to evaluate the ability of the epoxy-glass fiber-ceramic composite coatings to offer protection against corrosion and erosion under simulated conditions. The findings of the project will be

Thermal Research					
Sl. No.	**Project Title**	**Organisation**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
					useful towards improvement in corrosion and erosion resistance of various components of the FGD system.
49	Development of a Renewable Energy-based and Fully Grid Independent Radiant Air-Conditioning System	IIT Ropar	26.77	2	The main aim of the project is development of a hybrid (combined compression and absorption chillers) and fully renewable energy-based and grid independent RCS air-conditioning system. An AI-based platform / inverse model will also be developed for quick estimation and evaluation of building HV AC system. The developed hybrid air-conditioning system will be energy efficient, ensure better thermal comfort and will also be superior in terms of indoor air quality as well as in terms of GHG and other emissions.
50	Studies on efficacy of upgradation and utilization of north eastern coal and biomass for gasification in a plant prototype and its scale up	IIT Guwahati	65.94	2	The project aims the development of a 25 kW dual fluidized bed gasifier system for co-gasification of torrefied biomass and coal. Finally, a scale-up design of capacity 100 kW will be delivered.
51	Development of High Temperature Wear and Erosion Resistant Coatings for Thermal Components using High-Velocity Air Fuel (HVAF) Spraying –	NITK Surathkal	56.80	2	This project work aims development of High Temperature Wear and Erosion Resistant Coatings for Thermal Components using High-Velocity Air Fuel (HVAF) Spraying and evaluation of the high temperature (650 to 900°C) wear and erosion properties of the same using pin

Thermal Research					
Sl. No.	**Project Title**	**Organisation**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
	A Robust Cost-Effective Technology				on disc wear tester and erosion tester.
Hydro Research					
52	Investigations in a Modernized Cavitation Channel to Optimize Hydraulic Turbine Operation and Maintenance Issues	IIT Delhi	49.20	2	The project work aims development of laboratory-scale facility for investigation of the cavitation phenomenon in flows around a hydrofoil and also development of numerical methods to accurately predict the cavitation phenomenon in flows around a hydrofoil. Optimization of hydrofoil profiles will be carried out based on the experimental and numerical observations, for minimum cavitation
53	Development of support vector machines based software for cavitation level monitoring in a Francis turbine	NIT Meghalaya	29.90	2	The project aims development of a cavitation monitoring software in MATLAB platform, based on auto-regression (AR) and support vector machines (SVM), which detects and quantifies the cavitation level in a Francis turbine prototype. The developed cavitation monitoring unit prototype is planned to be deployed in a hydro power station for real-time demonstration. Once installed, the condition monitoring unit can reduce the downtime or unwanted shutdown of hydro-electric power plant.

Hydro Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
54	Development of High-Entropy Alloy Coatings for Improved Cavitation and Silt Erosion Resistance of Hydroturbine Components	IITM Chennai	47.93	2	The project aims the development of suitable High-Entropy Alloy (HEAs) coatings for hydro power components and evaluation of the performance of the same when subjected to accelerated combined silt and cavitation damage tests. A process will be developed for preparation of coating and testing under silt and cavitation erosion. The developed process can be suitably utilized for the hydro-turbine operation in hydel power plants. The technology, thus developed, could be transferred to industries such as BHEL, upon successful completion of the project.

Following are the summary of the completed RSoP projects:

Grid, Distribution & Energy Conservation Research (GDEC)					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
1	Model Order Reduction for Simulation Acceleration in Power Electronics	NIT Srinagar	7.02	2	A platform independent simulation framework has been developed for fast simulation of power electronic circuits using model order reduction principles. Memory savings and substantial improvements in speeds have been achieved.

Grid, Distribution & Energy Conservation Research (GDEC)					
Sl. No.	**Project Title**	**Organisation**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
2	Design, Implementation and Analysis of Wireless Power Transfer and PV System for Battery Charging of Passenger e-Bus	NIT Trichy	32.4	2	• A dual input buck-boost type dc–dc converter to integrate various sources such as solar PV and wireless charger is reported in this study. The proposed DIBBC is suitable for battery charging from the different V–I characteristic sources either individually or simultaneously. • The state-space equation is derived from the different modes of operation and the final small signal model of the converter is obtained. • The simulation results validate the effective integration of the input sources using the proposed converter.
Transmission Research					
3	Design and Development of 5m long single phase HTS cable	IIT Kharagp-ur	51.21	2	In this project, a 5 m long single-phase HTS power cable was designed and developed, with a rating of 11 kV and 1 kA. The design and development steps were shared, including the characterization of the HTS tapes used under AC and DC excitation. A tape winding mechanism was created to wind multiple HTS tapes simultaneously, and the cold dielectric used for insulation was characterized. The effect of

Transmission Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					moisture content on the dielectric characteristics was studied. Detailed dimensions, drawings, and component information were provided. The developed 5 m HTS power cable was joined with a 1 m HTS power cable from Phase I, and tests were conducted. AC losses were experimentally determined, and a sub-cooling unit was designed, developed, and tested to cool the HTS power cable using sub-cooled LN2. A cryogenic turbine-based flow meter was calibrated using the developed sub-cooling unit. The HTS power cable underwent leak tests and separate instrumentation tests under AC and DC excitation. The cable was able to withstand high voltage for 6 hours without dielectric breakdown.
4	IEC 61850 Compliant SF6 Monitoring System for Gas Insulated Switchgear	VSSUT, Burla	48	2	A comprehensive set of studies was conducted to achieve the objectives of detecting gas leakage and humidity content inside a SF6 gas vessel of a GIS (Gas Insulated Substation). Two methods were employed for humidity detection. Initially, a smart humidity sensor was developed utilizing a polyvinyl alcohol sensing film deposited on a polyimide substrate. The design aspects of the sensor were verified using COMSOL Multiphysics in comparison to

Transmission Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					the fabricated prototype. Additionally, a capacitive sensor was fabricated using fluorine-doped tin-oxide (FTO) glass as the substrate and silver as the upper electrode. A thin film of porous alumina (Al2O3) served as the sensing layer for moisture detection at the ppm scale. To address the second objective of gas monitoring and leakage detection, a dual-element ultrasonic sensor and a capacitive piezoelectric pressure transducer were employed. These sensors respectively detected and controlled gas density leakage within a limit of 0.5% per annum. The functionality of the sensor was validated using the simulation tool WAVE2000. The effort put into designing, analyzing, and developing the ultrasonic-based gas density sensor has resulted in the publication of a patent.
5	Design, Development and Validation of a New Adaptive Digital Relaying Scheme for Power Transformer	IIT Roorkee	47.73	1.5	A new Fault Detection Ratio (FDR) based method has been developed, derived from quartiles of superimposed differential currents, for the protection of power transformer. It is demonstrated that the derived FDR is capable of distinguishing all types of internal faults from magnetizing

Transmission Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					inrush and over-excitation conditions with the exception of turn-to-turn fault in the presence of the inrush current. The suggested technique detects winding and inter-winding faults including turn-to-turn faults within one power frequency cycle. It is not vulnerable to the influence of CT saturation in case of external as well as internal fault conditions. It remains secure for all types of magnetizing inrush and over excitation situations including noise present in the acquired signals. At the same time, it is equally applicable on different rating and winding connection of power transformer. Moreover, verification of its performance on actual field data (containing energization of faulted transformer and magnetizing inrush condition) reveals its correctness in detecting internal faults and immunity against nuisance trip during non-internal faults
6	Computational feasibility studies on the development of high temperature superconducting magnetic energy storage (SMES) systems	Lovely Professional University, Punjab	19.98	1.5	The research activities carried out can be summarized as follows: • Structural analysis was conducted on the SMES coil to assess the levels of stress and strain exerted on the structure.

Transmission Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					• The investigation focused on mechanical failures resulting from thermal stresses, aiming to predict the performance of the SMES system under both room temperature and cryogenic conditions. • Electrical analysis was performed to estimate AC losses in the proposed work, providing insights into the efficiency of the SMES system. • Magnetic analysis was employed to calculate the Lorentz Forces acting on the SMES, contributing to a better understanding of its behavior. • Considering the total heat load generated by AC losses, efficient cooling strategies were developed for the cryocooling system to adequately compensate for the heat and ensure the overall efficiency of the SMES system.
7	High-Temperature erosion characteristics of boiler tube materials of subcritical and supercritical Thermal power	MTD, CPRI	49.90	2	The design and fabrication of an indigenous test rig was to evaluate high-temperature erosion resistance (HTE) under simulated field conditions, carried out under the project. Presently used boiler tube materials and thermal spray processed hard coatings were

Transmission Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
	plants and prediction of critical erosion regions through CFD modeling				evaluated under a range of temperature conditions up to 650°C. Furthermore, the mechanism involved in the erosion process of different materials was analyzed. Based on the laboratory results, the coatings that have shown optimum erosion resistance have been considered for the field trial in an economizer component of a 210 MW utility boiler at RTPS, Raichur. In addition, CFD-based actual set-up and boiler modelling was carried out to identify critical erosion regions in a typical 500 MW boiler.
8	Bio-processing of Coal Industrial Effluent and Coal Fines Recovery using Aquatic Plants and Phototrophs	CIMFR-CSIR, Dhanbad	36.85	1.5	Under this project Bioprocess technology were developed to evaluate the potential of Azolla and Lemna to treat coal washery effluent (CWE) as well as to study the impact on the biochemical changes of the Azolla and Lemna. After bio-treatment the aquatic biomass was tested for its utilization for biofuel such as bio-methane and bio-ethanol. The harvested biomass also used for fertilizer, poultry feed and fish feed.
9	Development of plasma torch for efficient disposal of municipal solid waste	CSIR-Central Mechanical Engineering Research Institute, Durgapur	21.67	1.5	A prototype of the plasma torch has been designed and fabricated at CSIR-CIMFR. This Project represents the design of a plasma torch for

Transmission Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					producing stable and continuous thermal plasma plume. It has been observed that after design, fabrication and experimentation it is achieved a 30cm long stable plasma plume at gas flow rate of 20-30LPM, by applying of 55V, 220A power supply. It is also observed that plasma torch temperature achieved about 3500K.The developed plasma torch technology can cover a volume 40cm in diameter with up to 30cm long plasma plume, and it will be beneficial for waste destruction.

• NATIONAL PERSPECTIVE PLAN (NPP) PROJECTS

The project proposals are invited from Academia, Power Utilities, Electrical Equipment manufacturing companies and Research Institutes. The proposals are recommended by Technical Committees (Transmission, Grid, Distribution & Energy Conservation, Hydro and Thermal Research) and approved by Standing Committee on R&D chaired by the Chairperson, CEA, New Delhi.

Following are the summary of the ongoing NPP projects:

Grid, Distribution & Energy Conservation Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
1	Advanced Multifunctional Asbestos – Free Thermal Insulating Material – A Gizmo For Energy Conservation	CSIR-AMPRI Bhopal	89.06	2	The project work aims the development of a novel process for making advanced, multi-functional, asbestos-free thermal insulating material using marble waste, rice husk ash and fly ash to overcome the draw backs of conventional thermal insulating materials.

Grid, Distribution & Energy Conservation Research					
Sl. No.	**Project Title**	**Organisation**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
2	Design, Development and Demonstration of a Centralized Protection and Monitoring (CPM) System within a Distribution Substation including DER	IIT Bhubaneswar	192.50	2	The project aims to develop a standardized system, method and architecture for centralized protection and monitoring (CPM) system within a distribution substation, utilizing the novel approach of using mostly off-the-shelf hardware and open-source operating system which will be commercially viable for real-time applications. The proposed CPM system will be demonstrated in the IIT Bhubaneswar campus in collaboration with PGCIL.
Thermal Research					
3	Composition analysis of different types of pellets/briquettes received from unknown sources.	SSS-NIBE, Kapurthala (Punjab)	37.00	1	The basic aim of this work is to determine the percentage of paddy straw content in biomass pellets obtained from different processing units. A methodology will be developed for ascertaining paddy content in biomass pellets using proximate, ultimate and thermo gravimetric analysis techniques.
4	Complete heating and emission analysis of raw biomass and pellets during combustion.	SSS-NIBE, Kapurthala (Punjab)	66.00	2.5	The basic aim of this work is to carry out burning rate, thermal efficiency and emission analysis on biomass pellets obtained from agro residues and to generate a database. A standard protocol will be

Thermal Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					developed by numerical estimation /equation method, for evaluation of heating value of raw biomass and pellets. This will be used as a SOP and standard method for evaluation of thermal and environmental parameters in pellets.
5	Complete Ash Analysis of biomass pellets and co-combusted fuels.	SSS-NIBE, Kapurthala (Punjab)	270.00	3	This project work aims to determine the chloride content, sulphate contents, different metallic oxides, silica contents, ash fusion temperature and viscosity in biomass pellets and generate a database and recommendation for appropriate blending proportion of biomass pellets with coal for meeting the desired standards.
6	Research and development on biomass properties /characteristics.	PAU, Punjab	61.40	2	Under this project, blending of paddy straw with other prospective biomass materials in selected proportions is being studied for improved combustion characteristics of paddy straw briquettes/pellets. Further, this project also studies the effect of storage on gross calorific value of baled paddy straw and densified paddy straw. The knowledge base generated will serve as a guide for long term storage of biomass and for optimal blending of paddy straw with other biomasses.

Thermal Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
7	Characterization and utilization of paddy straw and other agro residues for conversion into pellets for co-firing in thermal power plants (TPP)	ICAR-CIRCOT, Mumbai	493.00	2	This project aims to study Chemical composition of the biomass generated by various crops in terms of cellulose, hemicellulose, ether extractives and protein and mineral composition, to optimize biomass composition for good pellet formation. Torrefaction studies on biomass-based pellets will be carried out for optimization of torrefaction of biomass and biomass compressed products. Further, utilization of biomass ash for production of fertilizers will also be explored. Development of methodology for determination of paddy content in biomass and study of effect of long-term storage on biomass properties are also included in the objectives of the project.
8	Evaluation of various coal, biomass and coal blends - Raw biomass (Coffee husk, Groundnut shell, Coconut shell) blended with different types of coals.	MTD, CPRI	90.00	2	The project work aims to characterize the different types of coal blended with raw biomass (Coffee husk, Groundnut shell, Coconut shell) to assess the heat transfer during co-firing of various biomasses with different coals in respect of the combustion, slagging and fouling characteristics.

Thermal Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
9	Study on combustion kinetics of biomass-coal blend through experiments and predictions on the combustion behavior of biomass-coal blends in the pulverized coal boilers.	MTD, CPRI	82.20	2	The project aims to study combustion kinetics of biomass/torrefied biomass-coal blend through experiments and to predict the combustion behavior of biomass/torrefied -coal blends in the pulverized coal boilers (through calculation of combustion coefficients).
10	Corrosion simulated studies of different boiler tube coatings to mitigate corrosion issues during Co-firing of coal-biomass combustion.	MTD, CPRI	65.00	2	This project aims at characterization of high-temperature corrosion resistance of different boiler tubes under gaseous corrosion conditions at different temperature conditions up to 600oC. Under this project, it is envisaged to design and develop a simulated hot corrosion test rig for assessment of corrosion.
11	Experimental and Simulation studies on ash slagging, fouling and high temperature corrosion behavior during burning of biomass in a PC fired Boilers.	NTPC-NETRA	42.82	2	Under this project, experimental and simulation studies will be carried out to understand ash formation/deposition/clinkering/agglomeration behavior of ash from agro-waste (paddy straw/husk, other straws) so that safe operating condition can be established and corrective actions can be taken by design/operation to prevent ash agglomeration due to co-firing of biomass with coal, since biomasses contain higher alkali

Thermal Research					
Sl. No.	**Project Title**	**Organisation**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
					and alkali earth content than coal, leading to concerns of bulk ash agglomeration /clinkering in boiler. Experimental and simulation studies will also be carried out to evaluate high temperature corrosion, as biomasses contain higher chlorine content which causes high temperature corrosion.
12	Detailed Characterization of biomass and its ash to evaluate its properties with respect to co-firing in PC fired boiler.	NTPC-NETRA	323.44	2	A detailed analysis of pellets prepared from different biomass will be carried out under this project for complete characterization with respect to combustion, ash formation and deposition and high temperature corrosion with higher co-firing ratio. Evaluation of above properties of biomass in different blending ratio with coal needs to be done to establish its behavior within the boiler. The results obtained from the project shall be shared with Sub-Group II of the SAMARTH Mission for evaluation of modifications required in coal fired boilers for higher co-firing of biomass. The outcome of the project will also be used to develop a strategy and plan for experimenting with higher biomass co-firing in one of NTPC's coal fired plants after harvesting season. Due to non-

Thermal Research					
Sl. No.	**Project Title**	**Organisation**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
					availability of biomass, procurement of raw material has been an issue. However, with the harvesting season approaching, adequate supply of biomass may be available soon for carrying out the experiments.
13	Collection of different types of biomass and study the effect of long term storage on GCV.	NTPC-NETRA	36.90	2	This project studies the effect of long term storage on biomass properties. Prior knowledge of combustion behavior of pellets supplied to power plants will lead to ease of boiler operation. The results obtained from the study shall provide the pellet manufacturer the knowledge of the best practices for storing of pellets till next harvesting season, to conserve the properties of pellets. The study will also guide the pellet manufacturers to estimate any deviation in GCV for the pellets supplied after long term storage and help them provide the pellets as per the specifications.
14	Experimental and Simulation analysis and establishing correlation of biomass characte-ristics with PC fired boiler combustion	NTPC-NETRA	99.72	2	The project aims to study the effect of biomass properties on boiler combustion at different co-firing ratio. Experimental studies on co-firing will be carried out on the Drop Tube Reactor of NETRA and in NTPC boiler(s). The experimental analysis shall provide the data for kinetics of volatile release

Thermal Research					
Sl. No.	**Project Title**	**Organisation**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
	process for optimizing and increasing co-firing ration of biomass.				and combustion rate, the same shall be incorporated in Boiler Combustion CFD model to evaluate the effect of higher co-firing of biomass in boiler. The study shall provide the parametric evaluation of boiler combustion at different co-firing levels and will help in evaluating safe limit of higher co-firing ratio.
Hydro Research					
15	Large Eddy Simulation of Flow Instabilities in Hydraulic Turbines at Off-design Operation	Indian Institute of Technology Roorkee	448.17	2	The project work aims to develop a computational platform for large eddy simulation of flow in hydraulic turbines at off-design operations through which it is envisaged to support the hydropower industry by providing investigations/strategies based on accurate time-resolved simulations for improvement in performance / lifespan of hydropower plants. The results obtained from the study will help in accurate prediction of turbine performance, flow instabilities and dynamic loads on turbine structure. It will further help devise strategies to minimise the effects of turbulent flow structures in transient operations in runner and hydropower plant and also help in accurate prediction of the

Hydro Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					vibrations of turbine parts resulting from turbulent flow structures which would in turn help to develop methodology for reduction of vibrations.

Following are the summary of the completed NPP projects:

Grid, Distribution & Energy Conservation Research (GDEC)					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
1	Study of photo-biological safety of LED lamps and luminaire	ERED, CPRI	400.00	2	In this project, the first step involved purchasing different types of light source samples from the Indian market in Bengaluru, Karnataka, between 2018 and 2019. Subsequently, a total of 66 samples (including 45 LED samples) were subjected to photobiological hazard emission tests using the IDR300-PSL with a double monochromator system at the Central Power Research Institute in Bengaluru, Karnataka, India. Based on the experimental data collected, the evaluation and classification of risk groups were determined for each light source. The study conducted by CPRI has provided valuable insights and identified gaps in awareness regarding potential risks to human health from LED light sources. The results indicate that LED sources do pose a

Grid, Distribution & Energy Conservation Research (GDEC)					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					photo-biological hazard, but its impact may not be very high. Most LEDs fall into the RG 1 category, which signifies a low risk of photo-biological hazards. Therefore, normal usage of LED products by the general healthy population does not lead to adverse health effects. The summary of the test results for various types of LED light sources reveals that they pose actinic UV hazard and blue light hazard, placing them in the RG 1 category. The maximum recommended exposure time for the eyes and skin to these LED sources is 2.8 hours. However, street lights operating with DC voltage may exhibit additional infrared hazards along with actinic UV hazards, falling under the RG 2 category of risk groups. The maximum recommended exposure time for the RG 2 category is 10 seconds of visual contact to prevent damage to the retina and skin. It is therefore necessary for LED manufacturers to incorporate classification and labeling for LED products emitting photo-biological hazards before selling them in the market.

Transmission Research					
Sl. No.	**Project Title**	**Organisation**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
2	Development of polymer nano-composites for EHVDC Lines and diagnostics adopting laser induced breakdown spectroscopy (LIBS)	IIT Madras	268.41	2	The research findings can be summarized as follows: • The inception voltage of corona discharge caused by water droplets on epoxy nanocomposites increases with the frequency of the applied supply voltage. Additionally, the Corona Inception Voltage (CIV) demonstrates a direct relationship with the contact angle. • Analysis of the study reveals that epoxy nanocomposites filled with ion trapping particles exhibit the highest contact angle and CIV. They are followed by titania-filled epoxy nanocomposites and the base epoxy resin. This trend remains consistent in both virgin and corona-aged specimens. • Under unaged conditions, silica-micro composites (MC) perform better than silica-nano micro composites (NMC), followed by wollastonite-epoxy composites (IN). However, upon corona aging, IN performs better than MC and NMC due to its filler content, which reduces damage caused by corona aging. It is also observed that relying

Transmission Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					solely on contact angle measurements is insufficient for predicting variations in corona inception voltage under specific conditions. • Charge accumulation studies indicate a significant reduction in both the charge retention capability and mean lifetime of the samples after corona aging. IN demonstrates better performance under aged conditions among the three samples, with a higher mean lifetime indicating less surface carbonization. • LIBS (Laser-Induced Breakdown Spectroscopy) analysis provides information on the elemental composition of the epoxy nanocomposite material. Plasma temperature and threshold fluence serve as useful indicators for classifying material performance. Additionally, the measured plasma temperature correlates with the hardness of the material. The IN specimen shows the least damage from laser abrasion, suggesting higher resistance to discharges, which aligns with the findings from the water droplet discharge damage study.

Transmission Research					
Sl. No.	Project Title	Organisation	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
3	Development of intumescent fire retardant nano-composites for medium voltage cable sheathing applications	The Energy and Resources Institute (TERI), Bangalore	134.00	2	Cable sheaths, which serve as protective coverings for power cables of low and medium voltage, are undergoing a transition away from PVC due to concerns about toxicity and flammability. This project focuses on developing fire retardant nanocomposites specifically designed for medium voltage cable sheaths. An intumescent fire retardant (IFR) has been created, with surface-modified additives and a synthesized charring agent. Various combinations of thermoplastics, including a thermoplastic elastomer, have been formulated. The fire retardant additives have been optimized for both mechanical properties and fire retardancy. Modified MWCNT, ammonium polyphosphate, synthesized charring agent, and talc have been incorporated into HDPE, LLDPE, PP composites, along with EVA and EPDM. Achieving fire retardancy in these composites requires the addition of 10% of IFR additives. Cable sheath molds have been manufactured, and trials have been conducted using HDPE-based composites.

Hydro Research					
Sl. No.	**Project Title**	**Organisation**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
4	Establishing Novel Erosive Wear Test Facility for Testing of Materials Used in Hydro-turbine Components	IITM, Chennai	125.00	2	The hydro power plants across the world face severe erosion due to silt and cavitation induced erosion, which leads to a drastic reduction in the overall efficiency of the hydro power plant. Thus novel coatings are being developed to mitigate the effect of the erosion. One important requirement in developing newer materials and coatings is to test these materials in a controlled yet accelerated environment where combined effects of silt and cavitation erosion may be produced. Thus under this project a stand-alone facility to bring out the combined effects of silt and cavitation has been developed and demonstrated. The developed test facility can also be utilized for observation and generalization of various effects of different kind of cavitation of a wide range of materials. This approach will help in arriving at the suitable mechanistic model for erosion which will help the utilities and manufacturers. This facility can be made accessible to researchers from other institutions that may require the use of such facilities.

The Following is the Summary of Ongoing UAY-II Scheme under National Perspective Plan (NPP) Project

Thermal Research					
Sl. No.	**Project Title**	**Organization**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
1	Development of Highly Efficient Low Cost Insulation for power plants	IIT Jodhpur	93.47	3	• Design of Thermal insulations which improve efficiency and durability at lower costs • Experimental validation of insulation property and performance of insulation when applied to targeted surface. • Numerical tool to predict insulation property and its validation • Transfer of technology for industrial production and vendor development • Documentation of knowledge in terms of publications and patents
2	Understanding the Evolution of Residual Stress During Repair and Refurbishment of Gas Turbine Components via Laser Additive Manufacturing	IITM Chennai	66.04	2	• Experimentally establish the residual stress, along and perpendicular to the build direction using X-ray diffraction through thickness measurements for the Design of experiments (DOE) for 2 different alloys, CoCrMo, SS304, using the DMLS process. • Experimentally establish the residual stress, along and perpendicular to the build direction using X-ray diffraction through

Thermal Research					
Sl. No.	Project Title	Organization	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					thickness measurements for the DOE for 2 different alloys FSX414 and R108, using the DMLD process. Establish correlation of residual stress distribution in coupon samples for build condition variation. • Perform transient thermo-mechanical finite element analysis of LAM processes to predict the magnitude and distribution of residual stresses in LAM deposited components • Perform transient thermal finite element analysis of LAM processes to predict melt pool dimensions and develop process map of cooling rates & thermal gradients using numerical and experimental inputs. • Integrate the experimental measurements of residual stress via a closed loop feedback to numerical simulations, relate thermo-kinetic calculations to inputs for additive manufacturing tool. • Benchmark residual stress distribution of coupon samples across ANSYS methodology and additive manufacturing tool; Effect of heat treatment on the

Thermal Research

Sl. No.	Project Title	Organization	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					evolution of the residual stress distribution. • Establish correlation of residual stress distribution for geometrical and build parameter variation using additive manufacturing tool. • A computational framework to determine residual stress distribution for changes in alloy composition and geometric variations in the coupon. Bridge build conditions such as raster path, layer thicknesses etc., with corresponding simulation conditions to integrate with the computational framework; strategy to identify process conditions for minimal residual stress.
3	Development of Wankel Expander /Compressor based heat pump system for high temperature applications	IITM Chennai	158.12	3	• The project will result in a Wankel type rotary compressor/expander product which will be used for steam expansion and compression (innovations in sealing, design and integration will results in Patents) • A steam compression heat-pump system will be built for demonstration of the use of Wankel expander /compressor

Thermal Research					
Sl. No.	Project Title	Organization	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					• Another heat pump system capable of operating up to 110 C with R245FA as refrigerant will be developed to use as a bottoming cycle for steam compressor • The above systems will be demonstrated at the following levels: • Steam expander: Handling 50 to 100 kg/hr in lab and handling up to 1000 kg/hr in field demonstration • Heat pump: Bottoming cycle using R245FA - up to 14 kW heat delivered and steam compression with mass flow rate up to 50 kg/hr and delivery temperatures up to 150 C
4	Development of Novel SMA Bearing Supports and Retrofit for Enhanced Performance and Durability of Rotating Machinery	IIT Patna	182.26	3	• Demonstration of prototype for showing the superiority of SMA elements integrated bearing support in reducing machine dynamic loads (steady state and transient) reduction • Development of design methodology for such SMA elements including: - Introducing design metrics, - Preliminary HCF, LCF and wear assessment, - Selection of optimal sizing and

Thermal Research					
Sl. No.	**Project Title**	**Organization**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
					configurations of SMA elements • Design charts establishing relationship between strain rates and damping &stiffness change in SMA elements • A constitutive model for evaluation of damping and stiffness change in super elastic SMAs with strain rate effects and for estimating damage for arbitrary cycles of loading. • A finite element framework for element and system level analysis using the developed phenomenological model • Illustration of the outcomes through two typical practical case studies (1) damping driven design (2) stiffness driven design (load reduction)
Transmission Research					
5	Highly porous 3 D graphene composites for protecting electronic equipment from electro magnetic interference (EMI)	IITM Chennai	162.45	2	Design and development of shielding materials with the following objectives: a) EMI shielding of 70 dB and above – based on reflection/ absorption dominated b) With properties of light weight, flexible and thin (less

Sl. No.	Project Title	Organization	Outlay (Rs. Lakhs)	Duration (years)	Application & outcome
					than a millimeter) c) Mechanically, Chemically and Thermally durable d) Cost effective when mass produced e) Final product in the form of prototype delivered to the partner industry for final testing and commercialization. f) Porous 3D graphene (P3DG) foams with metal oxide nanotube (MONT) and suitable polymer blend (PO) MONT-P3DG-PO g) Multi-layered formation for improvement in shielding and controlling flexibility h) Patenting of the product design to claim intellectual property rights. i) Manpower development that trains young minds in the field of materials science and device physics. j) Effective participation from partner industries for fine tuning the design consideration and material management.

The Following is the Summary of Ongoing IMPRINT Scheme under National Perspective Plan (NPP) Project

Grid, Distribution & Energy Conservation Research (GDEC)					
Sl. No.	**Project Title**	**Organization**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
1	A Software Tool for the Planning and Design of Smart Micro Power Grids	Indian Institute of Technology Guwahati	202.92	3	• Development of a design space exploration tool for microgrid design which can guarantee a performance measure in terms of parameters such as QoS in electricity, operator revenues, etc in the face of design perturbations like addition/removal of components (say, generation unit, feeder line or operations control algorithm). • Development of new electricity scheduling and operations control algorithms • Development of hardware test bed for a prototype microgrid
2	Low Cost Indoor Occupancy and Climate Monitoring System for Energy Conservation	Indian Institute of Technology Kanpur	88.75	3	• Development of a cost-effective monitoring system using programmable hardware paired with platform agnostic web interface to provide actionable user/operator feedback and reporting, that would enable identification, implementation and measurement of impact of energy conservation measures in operation of an air-conditioning system.

Grid, Distribution & Energy Conservation Research (GDEC)					
Sl. No.	**Project Title**	**Organization**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
3	Cognition and Control for Demand Management: Sensors, Actuators and Web Services for Smart Consumers	Indian Institute of Technology Bombay	140.04	3	• To provide hardware-cum-software based reliable, easy-to-use and customizable solutions for demand management of consumer loads to improve their Energy Efficiency (EE) and Demand Response (DR) capabilities. • Development of Low cost and energy efficient sensor nodes for gathering relevant information, which would be suitably stored on a server, processed on a web-based platform and accessed through an online interface (computer/mobile phone). • Designing of control strategies to implement EE and DR measures based on user preferences and needs of the grid, and integrated into the web platform to devise the complete solution. • Demonstrated on representative test beds at IITB.
4	Data-Driven modelling, analytics and optimization techniques to manage building thermal demand	Indian Institute of Technology Bombay	202	3	• Reducing energy consumption by improving utilization and reducing wastage, and flattening peak-demand through optimal demand-supply matching based on occupancy and need-based

Grid, Distribution & Energy Conservation Research (GDEC)					
Sl. No.	**Project Title**	**Organization**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
					appliance usage, and timely demand-response strategies, including appropriate scheduling and resource allocation. • Novel smart energy management by combining physics based and data-driven models, off-line planning with timely dynamic decision making and minimal physical sensor infrastructure with sophisticated soft sensors (virtual sensors that can replace physical sensors) based on our notion of observability. • Demonstration of the solutions in campus buildings, and subsequent deployment in partners' premises.
5	Power Converter Design and Implementations for Energy Efficient Applications using Wide-Band-gap Power Devices	Indian Institute of Technology Kanpur	184.38	3	• Design, implementation, and application of SiC based power converters in modern energy efficient applications to overcome the shortcomings of the currently used SiC based converter technologies which hinder the usages of SiC based devices in high frequency power converter design especially for high voltage high power applications.

Grid, Distribution & Energy Conservation Research (GDEC)					
Sl. No.	**Project Title**	**Organization**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
					• To develop new converter topologies, which will enable realization of better power processors with higher switching frequency leading to compact, efficient, and high power-density converter modules. • Application of the new topologies in energy efficient applications like microgrid, high voltage motor drive, and realization of compact solid-state transformers
6	Decentralized Power Generation using Micro Gas Turbines	Indian Institute of Technology Kanpur	398.96	3	• Development of a micro gas turbine system. The design will have a single-stage centrifugal compressor mounted back-to-back with a single-stage radial turbine on a common shaft generating 100 kWe. A recuperator will be incorporated to improve the electrical efficiency, whereas an exhaust heat recovery steam generator will be designed to improve thermal efficiency for CHP applications. An electrical efficiency of 25–35% and thermal efficiency of 70-75% for CHP applications are proposed for the MGT systems. • Testing of individual component for performance

Grid, Distribution & Energy Conservation Research (GDEC)					
Sl. No.	**Project Title**	**Organization**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
					analysis. • Development of a test bed with instrumentation and control systems for performance analysis of the MGT units.
7	Design, Development and Control of High-Speed Switched Reluctance Generator for Direct-Coupled Operation with Thermal Turbo-Machinery	Indian Institute of Science Bangalore	395.00	3	• Experimental studies on magnetic materials and magnetic material selection for high-speed SRG • Electromagnetic design and its verification through finite element analysis and simulations • Structural and dynamic analysis of the SRG rotor and its experimental validation • Cooling system design and its validation through computational fluid dynamics • Complete design procedure ensuring structural robustness, dynamic stability, thermal • Compliance and manufacturability of the high-speed machine • Fabrication of high-speed SRG prototypes (10,000-50,000 rpm, 2-20 kW) • Electrical and overall performance evaluation of the machine

Grid, Distribution & Energy Conservation Research (GDEC)					
Sl. No.	**Project Title**	**Organization**	**Outlay (Rs. Lakhs)**	**Duration (years)**	**Application & outcome**
					• SiC based high-switching-frequency power converter for SRM • Novel control methods for high-speed SRG.
Thermal Research					
8	Development and Application of Small Scale Bending Tests for Residual Property Assessment of High Temperature Materials in Turbines	Indian Institute of Science Bangalore	221.52	3	• Development and demonstration of a new technique of high temperature materials testing that employs small sample volumes, which can be used to predict residual creep properties of in-service component that will allow the designer to make intelligent life predictions.

3 YEAR ACTION PLAN PROPOSALS

"R&D Schemes of Ministry of Power being implemented through CPRI" with an outlay of Rs.90.8284 crore was approved on 20th August 2018, comprising of In house Research Schemes of CPRI (IHRD), Research Scheme on Power (RSoP) and R&D under National Perspective Plan (NPP).

• INFORMATION ON PATENTS

List of Patents flied during the year are:

Sl. No.	Patent Title	Patent Application No.	Date of Filing	Inventors Name
1	A Composition of polydopamine grafted nano alumina based silicone rubber nanocomposite for high voltage insulation	202241031333	12th May 2022	Ashitha P. N Meena K. P
2	Method for determining the state of health of transformer using SFRA measurements.	202341032039	03rd October 2022	Sreeram V. Rajkumar M. Sudhakara Reddy S, T. Gurudev Maroti
3	Adaptive Control Cascaded with Combustion Flame Images for Optimized Combustor of a Thermal Power Plant by Veltech Rangarajan DR. Sagunthala R&D Institute of Science & Technology, Chennai and CPRI.	202241058328	12th October 2022	Prof. A. Selwin Mich Priyadharson, Veltech
4	A fault tolerant control system and method for a paralleled power converter fed large rated asynchronous hydro-generating unit by Indian Institute of Technology, Roorkie & CPRI.	202211061830	31st October 2022	Dr. Thanga Raj Chelliah, IIT Roorkie

List of Patents granted during the year are:

Sl. No.	Patent Title	Patent Application No.	Date of Award	Inventors Name
1	Metal Carbide Coated Electrodes for DC inclined Plane Tracking Test	201641011486	07th April 2022	Ganga
2	An Apparatus and a Process for Optimizing Performance of a Heat Exchanger System	364/KOL/2010	13th April 2022	M. Siddartha Bhatt
3	A Robotic Crawler System Operable under LFET To Conduct Automated Boiler Water Wall Tubes Inspection	379/KOL/2012	24th May 2022	M. Janardhana R. K. Kumar Dr. P. Sampathkumaran Dr. S. Seetharamu
4	Specially Designed Porcelain Long Road Insulators for Highly Contaminated Environment	201641033690	20th June 2022	Dr. N. Vasudev S.Sudalai Shunmugam
5	A Device for Thermo-Mechanical Pre-Stressing of Metal Oxide Surge Arrester	31/KOL/2014	11th August 2022	K. Karunakara M. Kanyakumari Dr. N.Vasudev Dr. R. S. Shivakumara Aradhya
6	An Condenser Device for Cooling Transformer Oil and Converting Heat Energy of Transformer Oil into Electricity	1020/KOL/2014	10th August 2022	T. Mallikharjuna Rao
7	A Scheme for Switching of Multiple Shunt Reactors for Testing of LV Power Capacitors	380/KOL/2012	20th September 2022	Vaidhyanathan Dr. H. N.Nagamani
8	A Secondary Air Pre-Heating System Integrated with an Hot Air Distribution System for achieving Laminar flow Conditions while Administering Preheated Secondary Air into a Drop Tube Furnace	378/KOL/2012	30th November 2022	V. Saravanan R. K. Kumar Dr. S. Seetharamu
9	An Apparatus for On-Line Measuring of Operating Efficiency of Deep well Motors/Bore well Motors In-Situ	383/KOL/2012	14th December 2022	M. Siddhartha Bhatt

Sl. No.	Patent Title	Patent Application No.	Date of Award	Inventors Name
10	Multi-Jet Type High Velocity Silt Erosion Apparatus	377/KOL/2012	27th December 2022	M. Janardhana R. K. Kumar Dr. P. Sampath kumaran Dr. S. Seetharamu
11	A Smart Air Handling Unit (AHU) for Efficient Operation of Centralized Air-Conditioning Systems With Lower Power Consumption	765/KOL/2014	10th January 2023	M. Siddhartha Bhatt S. Jothi Basu
12	Load flow Models for Generators for Power Sub-Transmission and Distribution	351/KOL/2015	23rd February 2023	Dr. Amit Jain James Ranjith Kumar
13	Intelligent forecaster for composite electric heater load on grid	349/KOL/2013	01st March 2023	M Siddhartha Bhatt
14	An Apparatus and Method to Monitor Inlet and Exit Parametric Conditions of Steam in a Thermal Heating System to Achieve Optimal Efficiency	382/KOL/2012	23rd March 2023	M Siddhartha Bhatt

• INFORMATION ON COPY RIGHTS

The following Copy Rights have been filed.

Sl. No.	Title of the Copy Right	Copy Right Application No.	Date of Filing	Inventors Name
1	COSEM (Companion Specification for Energy Metering) sub module in DLMS (Device Language Message Specification)/COSEM Testing tool for Smart Energy Meters	23677/2022-CO/SW	17.11.2022	Viji Bharathi Dhanavath Shankar Jiju K Priya S
2	Parameter Verification sub module for Profile Parameters under Meter Reader Association, in DLMS /COSEM (Device Language Message Specification/ Companion Specification for Energy Meter) Testing tool for Smart Energy Meters	2044/2023-CO/SW	23.01.2023	Viji Bharathi Dhanavath Shankar Jiju K Priya S

SECTION - 3

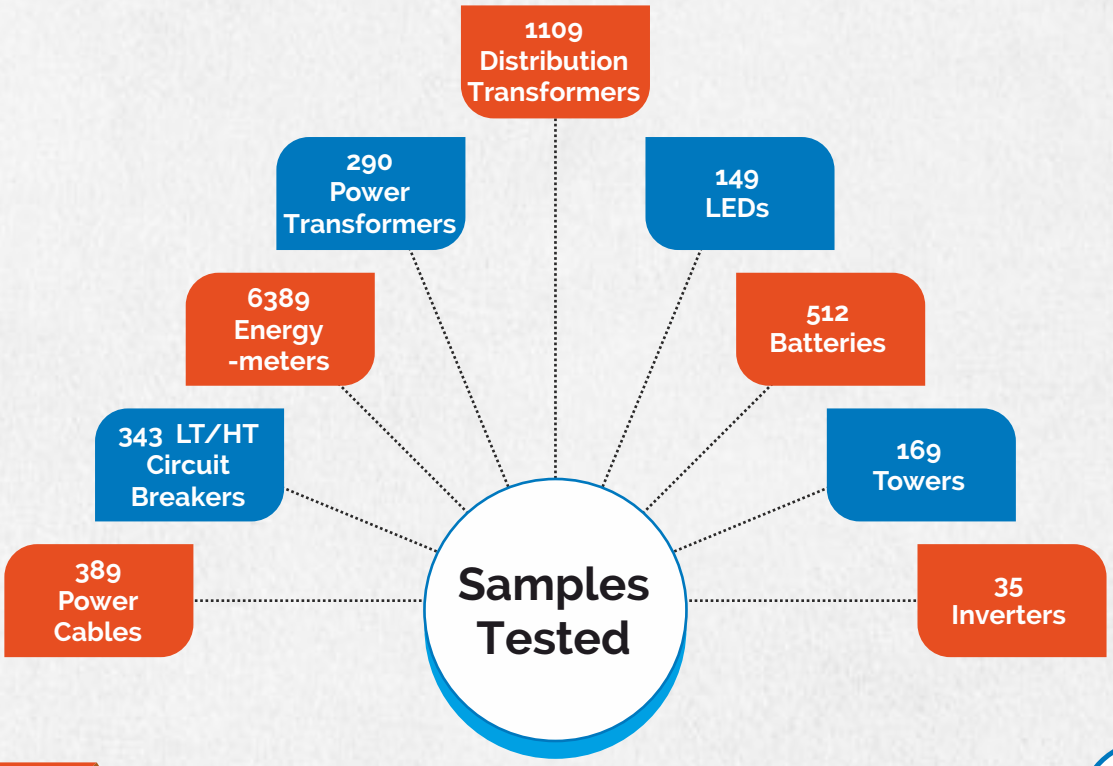
EVALUATION & CERTIFICATION

EVALUATION & CERTIFICATION

Products Tested at CPRI

- Power Transformers
- Voltage Transformers
- Busducts
- Energymeters
- Power Cables
- Circuit Breakers
- Capacitors
- Inverters
- Current Transformer
- Distribution Transformers
- Insulators
- Transformer Oil
- LT, HT Panels
- Conductors
- Towers
- LEDs Batteries

Total Reports Issued → **8418**



For the past six decades, the Institute has been serving the Power Sector in the field of evaluation and certification. CPRI is a Member of Short Circuit Testing Liaison (STL) and the Laboratories are accredited by NABL and NABCB as per IEC/ISO 17025:2017 and ISO/IEC 17065:2012 respectively. The Consultancy Services are certified as per ISO 9001:2015.

During the year 2022-23, a total of 90,726 evaluations were conducted on 22,559 samples for 4582 organizations which includes Central, State & Private Power Utilities, domestic and international electrical equipment manufacturers.

· NABL ACCREDITATION FOR CPRI, RTL-KOLKATA

Regional Testing Laboratory (RTL), Kolkata was awarded with NABL Accreditation for the first time, during the FY 2022-23.

· FIRST – TIME TESTS

Capacitors Division (CD)

- **Over Voltage test on 0.217 F, 14.63kV - 3 Nos. Capacitor Divider Modules**

HV Capacitor Divider Modules of rating 0.217 F, 14.63kV - 3 Nos. were tested for Over Voltage Cycling test at -40 Deg.C, as per special test protocol, for the first time in CPRI.

Over Voltage test on 0.217 F, 14.63kV - 3 Nos. Capacitor Divider Modules

- **Power Electronic Harmonic Filter Capacitor of rating 66.6 µF, 2500 VAC, 50Hz**

Power Electronic Harmonic Filter Capacitor of rating 66.6µF, 2500 VAC, 50Hz was tested as per IEC 61071-2017 & Customer requirements for the first time. All necessary testing infrastructure modifications were carried out internally re-configuring the internal test arrangements. Power Capacitors Laboratory of CPRI is the only test facility for conducting this test in the country.

A view of 66.6 µF, 2500 VAC, 50Hz Power Electronic Capacitor

Destruction Test on 66.6 µF, 2500 VAC, 50Hz Power Electronic Capacitor

- **Compact APFC Panel of rating 564 kVAR, 415V, 3 Phase, 50 Hz**

Compact APFC Panel of rating 564 kVAR, 415V, 3 Phase, 50 Hz was tested for Temperature rise test and Dielectric Performance test as per IEC 61921-2017 & Customer requirements for the first time. Power Capacitors Laboratory of CPRI is the only facility for this test in the country.

Compact APFC Panel of rating 564 kVAR, 415V, 3 Phase, 50 Hz

Cables & Diagnostics Division (CDD)

- Test for Resistance to Fire and Mechanical Shock test on 3 X 2.5 Sq.mm, Copper Conductor Class 2 & ATC Drain Wire Class 2, EI2 Silicone Rubber insulated and LTS-3 thermoplastic outer sheathed unarmoured 300/500 V Fire Alarm Cable as per BS EN 50200 – 2015.

A view of Cable Sample during Resistance to Fire and Mechanical Shock test as per BS EN 50200

- Test for Resistance to Fire and Mechanical Shock on Galvanized Iron LILO Box connected with 3 X 4 Sq.mm, Copper Conductor, XLPE insulated 600/1000 Volts FS Cable connected through a Ceramic Connector as per Customer requirement and test procedure in general accordance with BS EN 50200 – 2015.

A view of GI LILO Box with Cable and connectors during test

- Tests for Circuit Integrity, Resistance to Fire with Water Protocol W and Resistance to Fire with Mechanical Shock Protocol Z as per BS 6387-2013 on 2 Core X 1.5 Sq.mm, Copper Conductor, Silicon Rubber Insulated, Overall Shielded, LSZH Sheathed 300/500 V Cable.

Resistance to Fire with Water on 2 Core X 1.5 Sq.mm, LSZH Sheathed 300/500 V Cable

Resistance to Fire with Mechanical Shock on 2 Core X 1.5 Sq.mm, LSZH Sheathed 300/500 V Cable

Energy Efficiency & Renewable Energy Division (ERED)

- Efficiency Measurement, Harmonic and flicker measurement test on 50 kW DC EVSE with NEXON EV car as per IS 17017-1 / IEC 61851-1, IEC 61000-3-11, 12.

Short Circuit (SC) Lab

- Bus-transfer current switching – Making and breaking test as per sub clause 7.106 of IEC 62271-102: 2018 + AMD1:2022 on 245kV, 2000A Pantograph Disconnector.

Bus-transfer current switching test on 245kV, 2000A Pantograph Disconnector

Regional Testing Laboratory (RTL), Noida

Following tests were conducted for the first time

- Mechanical Endurance for Low Voltage Circuit Breaker.
- Glow Wire test on bus support and Insulator.

Ultra High Voltage Research Laboratory (UHVRL), Hyderabad

- Artificial pollution test by solid layer method on ± 500 kV HVDC Single suspension "V" Insulator string consisting of 2 x 41 Nos. of 210 KN HVDC Porcelain Disc insulators with hardware fittings suitable for ACSR quadruple lapwing conductor was conducted at UHVRL, Hyderabad for the first time in India.

Artificial pollution test ± 500 kV HVDC Single suspension "V" Insulator string.

· NEW TEST FACILITIES CREATED

Cables & Diagnostics Division (CDD)

Salt Fog test on MV Cable Accessories as per IEC 60502-4 by procurement of a three phase 66 kV Source and in-house fabrication of salt fog chamber with spraying system.

Salt Fog test on MV Cable Accessories as per IEC 60502-4

Energy Efficiency & Renewable Energy Division (ERED)

- **EV Charger Test and Research Laboratory**

The Electric Vehicle Supply Equipment (EVSE) Test and Research facility was established in June 2022 at Energy Efficiency and Renewable Energy Division of CPRI, Bengaluru for carrying out Testing & Certification and Research activities up to a capacity of 50kW (AC and DC). The Bureau of Energy Efficiency (BEE) has sponsored this project of creating the Electric Vehicle Supply Equipment (EVSE) Test Facility at CPRI-Bengaluru.

In line with the issued Guidelines of the Ministry of Power, Govt. of India on the Public Charging Infrastructure for Electric Vehicles – in the year 2018 and the subsequent amendment in the year 2022 to accelerate the EV mobility transition in the Country, the guidelines brings out

policy for installation of EVSE and the need for testing of the same as per the relevant National and International Standards. The public charging system envisaged in the guidelines cover all types of charging systems (CCS/CHAdeMO/GBT/Bharat) starting from 3.3 kW and a maximum of 50 kW.

The EVSE (also referred as EV Charger) test facility is capable of testing all types of EV charging systems that are currently available in the world viz. CCS, CHAdeMO, GBT and Bharat EV chargers. The typical starting power capacity that can be tested using our facility ranges from 3.3 kW to 22kW for AC EVSE and 7.5kW to 50 kW for DC EVSE. The facility can be utilized to perform testing and research activities as per the following National (BIS) standards & International standards:-

- IS 17017 (Part-1), IS 17017 (Part-22): 2018, IS 17017 (Part-23): 2018, IS 17017-24
- IEC 61851-1, IEC 61851-23, IEC 61851-24
- ISO 15118 series of standards (Part 1 to 8),
- Bharat Chargers: AC-001 and DC-001
- CHAdeMO Version 2.0 or previous version of the standard, GB/T standards
- Power and Energy Conversion Efficiency of EV Chargers

Layout of the 50kW AC/DC EVSE Test and Research facility

Metering & Utility Automation Division (MUAD)

- Calibration of three Portable Reference Standard Energy Meters simultaneously.

Calibration of three Portable Reference Standard Energy Meters

Power Systems Division (PSD)

- Slow Damped Oscillatory Wave test on Measuring Relays and Protection Equipment as per IEC 60255-26 and IEC 61000-4-18

Test on Measuring Relays and Protection Equipment

Smart Grid Research Laboratory (SGRL)

- Ministry of Power (MoP) appointed CPRI as a Nodal agency for testing functionalities and performance Service Level Agreement (SLA) levels of Prepaid Advanced Metering Infrastructure (AMI) system for empanelment of AMI Service Providers (AMISP) under Revamped Distribution Sector Scheme (RDSS) of Government of India. On a fast-track, considering the urgency of rollout of AMI system in the Country and as per the schedule, a test bench was created during April / May 2022 to handle simultaneously three AMISP applicants to support both single phase and three phase Smart Meters of AMI System testing and further extended to handle simultaneously testing of 10 AMISP AMI Systems at Bengaluru. The facility has a capacity to take up 212 Smart Meters at a time for carrying out

demonstration testing for 10 customers simultaneously.

- The first test commenced in Bengaluru during May 2022 and by the end of March 2023, a total of 64 AMI systems were tested and issued Test Reports.
- This AMI system testing was first of its kind laboratory testing for CPRI, also in India and done in the record time to meet the expectations of Government of India, MoP to enable the rollout of Prepaid AMI Systems across pan India.
- Two numbers of AMI systems at the utility sites (Patna, Bihar, Kolkata and West Bengal) were also tested and issued Test Reports during the year.

View of AMI System Testing

Regional Testing Laboratory (RTL), Noida

The following New test facilities were established during the year:

- Furan Analysis, PCB Content and DBDS Content in Liquid Dielectrics Laboratory
- RF Immunity Test (GTEM Cell) in Energy Meter Laboratory

Switchgear Testing & Development Station (STDS), Bhopal

- ·Head Deflection Test (HDT) on Material Strip of Meter Terminal Block as per all Energy meter standards has been added. The test was also included in BIS & NABL scope of the laboratory

Head Deflection Test (HDT) on Material Strip of Meter Terminal Block

Ultra High Voltage Research Laboratory (UHVRL), Hyderabad

- State-of-the-Art SF_6 puncture withstand test facility on Insulator was established for the first time in India and test was successfully performed on 210 KN Porcelain Disc Insulator as per IEC 61325: 1995. The complete test facility is developed indigenously in UHVRL, CPRI, Hyderabad.

SF6 puncture withstand test facility on Insulator

· SPECIAL TESTS CONDUCTED

Capacitors Division (CD)

- **HV Series Capacitors**

Testing and evaluation of 949.81kVAR, 6.944kV Int. fuse HT Series Capacitors - 3 Nos. was the highest voltage rating tested as per IEEE Std.824-2012, in Capacitors Division during 2022-23.

Short Circuit Discharge test 949.81kVAR, 6.944kV, Int. Fuse Capacitor Unit

- **Low Voltage Capacitors**

About 150 Nos. of LV Shunt Power Capacitors and AC Motor Capacitors (in total) were submitted for conducting all routine and type tests as per IEC 60831-1-2014, IS 13340: 2012, IS 13585: 2012 and as per IS 2993: 1998.

i) The rating of LV Shunt Capacitors are from 1 kVAR to 80 kVAR.

ii) LV Capacitors and AC Motor Capacitors were in the range from 1kVAR to 80kVAR.

Energy Efficiency & Renewable Energy Division (ERED)

- Efficiency performance of DC EV Charger of 50kW Capacity while connected to NEXON EV Car at EV Charger Test and Research Laboratory of ERED, CPRI, Bengaluru. Efficiency testing was carried out using in-house CPRI test procedure as there are no standard test procedure for measuring EV Charger efficiency across the globe.

Efficiency performance of 50kW DC EV Charger

Electrical Appliances Technology Division (EATD)

The following Special Tests were conducted during the year:

- Hybrid Pulse Power Testing of Li-ion batteries for Electric Vehicle.
- Capacity test at various temperatures (-10, 0, 10, 25 and 45°C) and at different C-rate for Li-ion batteries for EV application.

Earthquake Engineering & Vibration Research Centre (EVRC)

The following Special Tests were conducted during the year:

- Seismic test on 420 kV, 1250A RIP Bushing
- Seismic test on 245 kV, 4000 A, SF6 Circuit Breaker
- Vibration test on Top Panel of Wind Turbine

Seismic test on 420 kV, 1250A RIP Bushing

Vibration test on Top Panel of Wind Turbine

High Power Laboratory (HPL)

- Short Circuit testing on 500 MVA, (220/ √3) / (4x6) kV Single Phase Station Transformer was conducted

Short Circuit testing on 500 MVA, Station Transformer

- Induced Current Switching tests on 420kV Earth switch for 420kV Disconnector

Induced Current Switching tests on Disconnector

- Dynamic ability to withstand short circuit test on 96/128/160MVA, 220/132kV three-phase Auto Transformer

Dynamic ability to withstand short circuit test on Auto Transformer

Regional Testing Laboratory (RTL), Noida

- Colour Test for solvents pertaining to Optical Control Systems under IOCL Panipat in Liquid Dielectrics Laboratory was conducted during the year.

Switchgear Testing & Development Station (STDS), Bhopal

The following Special Tests were conducted:

- Advance Metering Infrastructure Services Providers (AMISPs) Demonstration Testing under the Revamped Distribution Section Scheme (RDSS)

Advance Metering Infrastructure Services Providers (AMISPs) Demonstration Testing

- Ability to withstand the dynamic effects of Short Circuit test on 50000/63000kVA, 230/6.3-6.3kV, 3 phase Multi Winding Power Transformer.
- Ability to withstand the dynamic effects of Short Circuit test on 36000/ 48000kVA /60000, 230/6.3-6.3kV, 3 phase Multi Winding Power Transformer.
- Ability to withstand the dynamic effects of Short Circuit test on 750kVA, 21/ 0.2165kV Submersible Underground Transformer.
- Ability to withstand the dynamic effects of Short Circuit test on 16500kVA, 55000/ 27500V, 1 phase Auto Transformer for railway application.
- Single Capacitor bank Breaking Current test, TDsb1 and Tdsb2 on 12kV, 400A, 3 Phase Vacuum Switch.
- Short Time Current test on 765kV, 3000/1A, 50kA Current Transformer.

· TESTING & CERTIFICATION FOR OVERSEAS CUSTOMERS

Capacitors Division (CD)

- Testing and evaluation of 745.5kVAR, 5.625kV Int. fuse HT Shunt Capacitor as per IEC 60871-1-2014 for M/s Hitachi Energy, Sweden.

Thermal Stability Test on 745.5kVAR, 5.625kV, Int. Fuse Capacitor Unit

Test arrangement for Voltage Test between terminals and container under artificial rain on 745.5kVAR,5.625kV, Int.Fuse Capacitor Unit

- Testing and evaluation of 500kVAR, 8kV Int. fuse HT Shunt Capacitor as per IEC 60871-1-2014 for M/s. RTR Energia S L, Spain.

Over Voltage Test on 500kVAR, 8kV, Int. Fuse Capacitor Unit

- Testing and evaluation of 50kVAR, 525V LV Shunt Capacitor as per IEC 60831-1-2014 for M/s. Samwha Capacitors, South Korea.

Thermal Stability test on 50kVAR, LV Shunt Capacitor

Cables & Diagnostics Division (CDD)

- Capacitance & Tan Delta on 22 kV/0.433 kV Transformers for M/s. SGB MY SDN BHD, Malaysia.
- FRLS tests on PVC compound, as per ASTM D 2863, ASTM D 2843 & IEC 60754-1 for M/s. Syarikat Nam AH SDN. BHD, Malaysia.
- Type test on 6.35/11 kV, 3CX 240 Sq.mm, CU/PVC/SWA/PE Cable as per IEC 60502-2 for M/s. Dubai Cable Company, Dubai.
- Type test on 4 X 300 Sq.mm, CU/XLPE/SWA/PVC, 0.6/1 kV Cable as per IEC 60502-1 for M/s. Riyadh Cables Co., Riyadh.
- Type test on 6/10 kV, 3C X 300 Sq.mm, CU/XLPE/SWA/PE Cable as per IEC 60502-2 for M/s. Poly Cable Ind. Ltd., Bangladesh.
- Type test on 18/30 kV Cable Accessories as per IEC 60502-4 for M/s. EL-Massalla Co. For Industrialization of Cable Accessories (EMICA) S.A.E, Egypt.
- Type testing of 1CX630 Sq.mm, Cu/XLPE/PE 18/30 kV Cable as per IEC 60502-2-2014 for M/s. Giza Cable Industries, Egypt.

Energy Efficiency & Renewable Energy Division (ERED)

- Inverter testing as per IS/IEC 61727 and EN 50530 for M/s. Solax Power Network Technology Co. Ltd, P.R. China.

Earthquake Engineering & Vibration Research Centre (EVRC)

- Seismic test on Differential Pressure Transmitters for M/s. Emerson Automation Solutions, U.S.A.

Seismic test on Differential Pressure Transmitters

- Seismic test on Digital Bay Controller for M/s. GE Power Management S.L, Spain.

Seismic test on Digital Bay Controller

- Vibration & shock test on Pressure Transmitter for M/s. Jumo GmBH & Co. KG, Germany.

Vibration & Shock test on Pressure Transmitter

High Power Laboratory (HPL)

- Short time withstand Current test on 1kV, 5000A, 100kA Busduct manufactured by M/s. Henikwon Corporation Sdn. Bhd, Malaysia.

Short time withstand Current test on 1kV, 5000A, 100kA Busduct

High Voltage Division (HVD)

- Chopped Impulse Voltage test on Three Phase Oil Cooled Distribution Transformers with ratings 100kVA, 200KVA, 250kVA, 11000/415V for M/s. Prince Electricals Limited, Dhaka, Bangladesh.
- Chopped Impulse Test on Distribution Transformers with ratings 100 kVA, 33/0.433 kV, 3ø; 50 kVA, 37.5 kVA, 25 kVA, 6.35/0.24 kV, 1ø for M/s. Sylvan Technologies Ltd., Bangladesh.

Short Circuit (SC) Lab

- Ability to withstand the dynamic effects of Short circuit & Temperature Rise tests on 100kVA 11000/415V, 200kVA 11000/415V & 250kVA 11000/415V Three Phase Distribution Transformers as per IEC 60076 - 5: 2006 & IEC 60076-2: 2011 for M/s. Prince Electricals Ltd., Dhaka, Bangladesh.

- Verification of short circuit withstand strength on main, neutral and protective bus bars at various currents (65kA rms for 1 second with 143 kA peak on main bus bars, 39 kA rms for 1 second with 81.9kA peak on neutal & protect bus bar, 50 kA rms for 1 second with 105kA peak on main bus bars & 30kA rms for 1 second with 63kA peak neutal & protect bus bar) on 1250A & 800A Busbar trunking systems (Busways) respectively as per IEC 61439-1: 2020 & IEC 61439-6:2012 for M/s. Henikwon Corporation Sdn. Bhd., Malaysia

Short circuit withstand strength on Busbar trunking systems (Busways)

- Short circuit & Temperature Rise tests on Single Phase Overhead Distribution Transformers (25kVA, 37.5kVA & 50 kVA 6350/240V) as per IEEE C57.12.90: 2010 & IEEE C57.12.00: 2010 and 100kVA 33000/433V Three Phase Distribution Transformer as per IEC 60076 - 5: 2006 & IEC 60076-2: 2011 for M/s. Sylvan Technologies Limited, Dhaka, Bangladesh.
- Ability to Withstand Short Circuit test on 50kVA 33000/420V Three Phase Distribution Transformer as per IEC 60076 - 5: 2006 for M/s. Nairobi Transformer Manufacturers (E.A.) Co. Ltd., Kenya
- Verification of short circuit withstand strength at 50kA for 1 s with 105 kA peak on main bus bars, neutral and earth bus bars and other verification tests (Temperature rise, Dielectric properties, Mechanical operation, Lifting, Marking, Clearances & Creepage distances, Resistance to abnormal heat and fire due to internal electric effects etc.) on 400V, 2500A ACB Panel as per IEC 61439-1: 2020 & IEC 61439- 2:2020 for M/s. Everest Electrical & Building Material W.L.L, Kingdom of Bahrain.
- Verification of short circuit withstand strength at 17kA for 0.25 s with 34 kA peak on main bus bars, at 10.2kA for 0.25 s with 20.4 kA peak on neutral and earth bus bars on 400V, 250A LV Panel as per IEC 61439-1: 2011 & IEC 61439- 2:2011 for M/s. Schneider Electric (Erstwhile American Power Conversion), Philippines.

Short circuit withstand strength 400V 250A LV Panel

- Temperature rise test on 415 V, 160 A single pole Fuse Switch Disconnector as per IEC 60947-3:2020 for M/s. Tenaga Prisma Manufacturing Sdn. Bhd, Malaysia.

Temperature rise test on 415 V, 160 A single pole Fuse Switch Disconnector

- Ability to Withstand the Dynamic Effects of Short Circuit & Temperature Rise tests on 250kVA, 33000/415V Three Phase Distribution Transformer and Temperature Rise Test alone on 550kVA 33kV Three Phase Earthing Transformer as per IEC 60076 - 5 : 2006 & IEC 60076-2 : 2011 respectively for M/s. LTL Transformers (Pvt) Ltd., Sri Lanka.
- Thermal short-circuit tests on Conductor and Screen on Pre molded cold shrink indoor termination, outdoor termination & joint mounted on 3 x 150 sq.mm, Copper conductor, XLPE insulated PVC sheathed 18/30 (36) kV Cable as per IEC 60502-4:2010 & Clauses 11 & 12 of IEC 61442:2005 for M/s. Giza Cable Accessories, Giza, Egypt.

Switchgear Testing & Development Station (STDS), Bhopal

- Ability to withstand the dynamic effects of Short Circuit test on 50 kVA and 100kVA, 11/0.433kV, Three Phase Distribution Transformer for M/s. Nepal Ekarat Engineering Co. Pvt. Ltd., Nepal.
- Ability to withstand the dynamic effects of Short Circuit test on 100 kVA, 200kVA and 250kVA, 11/0.415kV, Three Phase Distribution Transformer for M/s. General Electric Manufacturing Company Ltd., Bangladesh.
- Ability to withstand the dynamic effects of Short Circuit test on 1000kVA, 33/0.415 kV, and 400kVA, 33/0.415 kV, Three Phase Distribution Transformer for M/s. LTL Transformers (Pvt) Ltd., Sri Lanka.

- Measurement of Acoustic sound level test, Demonstration of ability to withstand rated Short time Neutral Current test on 33kV, 800A for 30sec. Oil Immersed Earthing Transformer for M/s. LTL Transformers (Pvt) Ltd., Sri Lanka.
- Ability to withstand the dynamic effects of Short Circuit test on 10/14MVA, 33/11.55kV, 3-Phase, Power Transformer for M/s. Confidence Infrastructure Limited, Bangladesh.
- Impulse withstand Voltage test and Temperature Rise test on 400kVA, 33/0.415kV, Three Phase, Distribution Transformer for M/s. LTL Transformer (Pvt.) Ltd., Sri Lanka.
- Temperature Rise test, Measurement of Acoustic Sound Level test and Measurement of no load loss at 90% & 110% of rated voltage tests on 5 MVA, 33/11kV, Power Transformer for M/s. LTL Transformers Pvt. Ltd., Sri Lanka.

TESTING & CERTIFICATION UNDER UL (Underwriters Laboratories):-

- Verification of short circuit withstand strength on main, neutral and protective bus bars at various currents (65kA rms for 1 second with 143 kA peak on main bus bars, 39 kA rms for 1 second with 81.9kA peak on neutal & protect bus bar, 50 kA rms for 1 second with 105kA peak on main bus bars & 30kA rms for 1 second with 63kA peak neutal & protect bus bar) on 1250A & 800A Busbar trunking systems (Busways) respectively as per IEC 61439-1: 2020 & IEC 61439-6:2012 for M/s. Henikwon Corporation Sdn. Bhd., Malaysia.
- Short time withstand current at 30kA rms for 1s and contact resistance Measurement tests on 600V Terminal Blocks as per IEC 60947-7-1 for M/s. Hirose Electrical Co. Ltd., Japan.
- Short time withstand current at 28.8kA rms for 1s and contact resistance Measurement tests on 1000V, 420A Terminal Blocks as per IEC 60947-7-1 for M/s. Connectwell Industries Pvt. Ltd., Mumbai.
- Short time withstand current at 5.05kA rms for 9 s on Grounding Clamp + ¾" rod + 1/0 AWG copper cable as per UL 467 standard for M/s. Koppel Industries, Kolkata, West Bengal.
- Verification of short circuit withstand strength at 36kA for 1.0 s with 75.6 kA peak on main bus bars, at 21.6 kA for 1.0 s with 45.4 kA peak on neutral bus bar on 415V, 250A 4 Way LV MCCB Panel Board as per IEC 61439-1: 2011 & IEC 61439-2:2011 for M/s. Dorman Smith Switchgear LLC, Dubai, UAE.
- Seismic test on Empty Modular Enclosure with dummy weights for M/s. UL- Underwriters Laboratories, Dubai, U.A.E.

Membership of CPRI officers in International/ National Committees

The officers of CPRI are well represented in standardizing committees both at International and National level, viz., CIGRE Committee, IEEE, Academic Councils, Accreditation Panels, apart from being Empanelled Assessors for Laboratories, Research Committees etc. CPRI contributes to evolve standards by participating in these committees. The details of officers who were part of such committees during the year 2022-23 are provided in Appendix-9.

· APPRECIATION FROM CUSTOMERS

1. ABB, ITALY

From: Roberto Amboni <roberto.amboni@it.abb.com>
Sent: Monday, July 17, 2023 1:08 PM
To: Shelesh Tiwari <shelesh.tiwari@in.abb.com>; Souradeep Mahapatra <souradeep.mahapatra@in.abb.com>
Cc: Fabio Milesi <fabio.milesi@it.abb.com>; Lorenzo Cornago <lorenzo.cornago@it.abb.com>
Subject: ABB Italy visit of CPRI Bhopal

Dear Shelesh and Souradeep
please forward this appreciation email to CPRI Bhopal Team for our recent test session in June.

We, as ABB Italy-Bergamo plant, would like to express our appreciation for the work, efforts, support and availability put in place during our recent tests performed at your Laboratory site.
It has been a very positive experience that permitted us to meet almost all of our targets to share technical aspects and knowledge between our Team and your People.
Last but not least, allowed to creates valuable human relations.

Looking forward for any possible new business in the future, we Thank You for the all that you and your team did.

Fabio Milesi
Lorenzo Cornago
Roberto Amboni

Thank you
Roberto.

Roberto Amboni
R&D Products Certifications and Standards
ABB S.p.A. - Electrification Business
via Pescarina n°5, 24123 Bergamo – Italy
email: roberto.amboni@it.abb.com, Web: www.abb.com

2. PARICHHA THERMAL POWER PROJECT, UP RAJYA VIDYUT UTPADAN NIGAM LTD, JHANSI

OFFICE OF THE
CHIEF ENGINEER 'B' 2×210MW
PARICHHA THERMAL POWER PROJECT
POST-PARICHHA, DISTT-JHANSI, PIN-284 305
U P RAJYA VIDYUT UTPADAN NIGAM LTD.
UPRVUNL G S T NO: 09AAACU4749D2Z9
E-mail- ce.btps.parichha@uprvunl.org
CIN:U40101UP1980SGC005065

No. 116 /C.E.(B) /2×210MW/PTPP/ Dated: 27.01.2023

TO WHOMSOEVER IT MAY CONCERN

We are pleased to certify that the work of RLA study vide PO No. 42/BMD-I/BTPS/CF Dt. 19.01.2021 of Unit # 4 Boiler (2X210MW) has been carried out satisfactorily by CPRI, Nagpur. The team led by Dr. S. K. Nath, Joint Director has done a very good job. All the members of the test team are very professional, sincere, hardworking, and completed the work in stipulated period.

Dr. Nath has executed the work in a very efficient manner. I wish him and his team members success.

(Piyush Kant Pande)
Chief Engineer (B)

No. /C.E. (B)/2×210MW/ Dated:

Copy forwarded to following for information necessary action.

1. Chief General Manager, PTPP, Parichha.
2. S E (O&MC-II), BTPS, Parichha.
3. E E (BMD-I), BTPS, Parichha.
4. Dr. S K Nath, Joint Director, CPRI, Nagpur.

(Piyush Kant Pande)
Chief Engineer (B)

SECTION - 4

CONSULTANCY ACTIVITIES

CONSULTANCY ACTIVITIES

• SPECIAL CONSULTANCY ACTIVITIES

Cables & Diagnostics Division (CDD)

- RLA Studies on Transformers for M/s. HVPNL, Haryana.
- Diagnostics Tests on Stator Coils for M/s. WBSEDCL, Purulia Pumped Storage Plant, West Bengal.
- RLA Studies on Transformers for M/s. NALCO, CPP, Angul, Odisha.
- Diagnostic Tests on Transformers for M/s. BWSSB, Bangalore.
- Diagnostic Tests on Generators and Generator Transformers for M/s. NHPC, Parbati-II Power Station, Himachal Pradesh.

Energy Efficiency & Renewable Energy Division (ERED)

- Performance Assessment of 2 Nos. of Blower and Motor system for M/s. Kewaunee Labway India Pvt. Ltd.
- Performance testing of NDCT and two Condensers for Unit No. 2 of JNSTPP, Nigrie, MP.
- Functionality Analysis of special purpose Motors at different input supply for M/s. Mitsubishi Electric India Pvt. Ltd.
- Dual Input Dual MPPT (static and dynamic) Testing of Solar PV Inverters of 800W and 1600W for M/s. Havells, Bengaluru.

High Voltage Division (HVD)

- Step Response Measurement of 1200kV Impulse Voltage Divider for M/s. Kirloskar Electric Co. Ltd., Mysuru.
- Earth Resistance Measurement at M/s. Tehri Hydro Power Plant, Tehri.
- Earth Mat Adequacy Study of Neora Hydro Power Station for M/s. NHEP Kolkata.
- Validation of Grounding System design for an equipment Installation of Indian Army, New Delhi for M/s. Inter-Tech, New Delhi.
- Earth Resistance Measurement and Adequacy Check of Varahi Underground Power House and Mani Dam Power House for M/s. Sri Annapoorneshwari Electricals, Mysuru.

Materials Technology Division (MTD)

Corrosion Mapping of Boiler Water Wall tubes of Unit No. 5 for M/s. NTPC Limited, Farakka Super Thermal Power Station (FSTPS), Farakka, West Bengal.

Corrosion mapping of Boiler Water Wall tubes for M/s. NTPC Limited, Farakka, West Bengal

- Diagnostic Studies (mechanical) of Hydro Mechanical equipment of Unit No. 1 for M/s. THDC, Rishikesh, Uttarakhand.
- Root Cause Analysis of FRH bend tube of Unit No. 3, 700 MW Boiler of BTPS plant for M/s. KPCL, Bellary Thermal Power Plant, Bellary.
- Corrosion Mapping of Boiler Water Wall Tubes of Unit No. 2 for M/s. NTPC Limited, Simhadri Super Thermal Power Station, Simhadri, Visakhapatnam.
- Corrosion Mapping of Boiler Water Wall Tubes of Unit No.1 for M/s. NTPC Limited, Korba, Chhattisgarh.
- Root Cause analysis of the failure of final Re-heater tubes of 660 MW, Unit No.2 Boiler for M/s. Sembcorp Energy Limited, Nellore.
- Measurement of Oxide layer thickness of Re-heater outlet Boiler tubes of Unit No. 8 for M/s. Panipat Thermal Power Station, Panipat, Haryana.
- RLA of Unit No. 4 Turbine and Generator shafts of Hydro plants for M/s. BBMB, Nangal, Punjab.

Mechanical Engineering Division (MED)

- Vetting/ Checking the Caisson Foundation Design Calculations & Drawings of 220 kV D/C Type "PD+9M (30-60)" Tension pole at Location No-AP-19/0-BH-19, AP-20/0-BH-50, AP-38/0-BH-6, AP-37/0-BH-7 & AP-39/0-BH-8 for M/s. Bajaj Electrical, Mumbai.
- Vetting/Checking the Design Calculation & Drawings of 220/220 kV M/C Type "2PM-1A+0M (Top Circuit: 0-30 with Bisector Type & Bottom Circuit: 0-15 & Exit at 90 with Auxiliary)" Tension Monopole for M/s. Sharavathy Conductors Pvt. Ltd., Bengaluru.
- Vetting/Checking the Pile Foundation Design Calculation & Drawings of 400 kV D/C Type "4DD+18/25M" (Twin Moose) Tower at Sone River Crossing (Location No-50A/0, 50C/0 & 50E/0) for M/s. KEC International, Mumbai.
- Vetting/Checking the Isolated Foundation Design Calculations & Drawing of 132 kV D/C Type "DC (15-30)" Tower up to +6M Body Extensions in Normal Dry, Wet, Partially Submerged & Fully Submerged types of Soil for M/s. K Ramachandra Rao, Hyderabad.
- Design Re-Validation of 132 kV D/C Type "DB (2-15)" Tower with +3M, +6M & +9M Body Extensions (WZ-5) for M/s. Haryana Vidyut Prasaran Nigam Limited, Panchkula.

Power System Division (PSD)

- Protection Audit of ten Power Stations of M/s. NTPC - Jhanor-Gandhar, Ratnagiri and Kawas Gas Power stations; Sipat, Korba, Lara, Gadarwara, Khargone, Mouda and Solapur Super Thermal Power Stations.
- Study of Power System static and dynamic stability for Agra islanding scheme for M/s. UPPTCL, Lucknow.
- System studies for Luhri Stage –I, Stage –II and Sunni Dam for M/s. SJVNL.
- Techno-commercial study of Haryana Power Transmission system for M/s. HVPNL.
- Failure analysis and protection adequacy study of 02 Nos. of 25 MVA Transformer for M/s. MRF, Peramballur, Trichy, Tamilnadu.
- Field testing of Numerical Protection Relays at M/s. NHPC Tanakpur Power Station.

Thermal Research Centre (TRC), Nagpur

- Detailed Project Report (DPR) for the various CHP Improvement Schemes at 2X500 MW, CSTPS, Chandrapur were prepared by the Plant Authorities. In order to validate the technical proposal, CPRI, TRC, Nagpur carried out the Special consultancy work of Inspection of damaged /running/failed parts of Coal Handling Plant of Thermal Power Station based on the huge experience of Power Plant & technical know-how of the individual. The work was well appreciated by the Power Plant Authorities.

Ultra High Voltage Research Laboratory (UHVRL), Hyderabad

- Onsite Measurement of Ground Level DC Electric Field and Ionic Current Density Measurement at ± 800 kV, HVDC Terminal Station of M/s. Power Grid Corporation of India Ltd., Kurukshetra, Haryana.

Electric Field and Ionic Current Density Measurement at ± 800 kV, HVDC Terminal Station of M/s. Power Grid Corporation India Ltd., Kurukshetra, Haryana

SECTION - 5

PROMOTIONAL ACTIVITIES

PROMOTIONAL ACTIVITIES

· IMPORTANT CONFERENCES/WEBINARS/TRAINING PROGRAMMES ORGANISED

1. Webinar on "Cyber Security issues for Advanced Metering Infrastructure", held on 31st May 2022.
2. Three days onsite Training Programme for M/s. JKPDD Engineers on "Power Systems Protection, relay testing and earthing" held at Srinagar from 18th to 20th July 2022.
3. Training program on "Energy Efficiency improvements in Cooling Towers" for Engineers of M/s. JNSTPP, Madhya Pradesh, held at Jaypee Nigrie Super Thermal Power Plant, Madhya Pradesh on 26th September 2022.
4. Workshop on "Condition Assessment of RCC structure of Turbine Generator Deck foundation Unit No.5" held at M/s. NTPC Singrauli Super Thermal Power Station on 19th November 2022.
5. Webinar on "Temperature Rise Tests on HT and LT Switchgear Panels – Requirements and Interpretations as per latest IEC Standards" held on 20th December 2022.
6. Webinar on "Latest trends in Energy Metering Technologies and Calibration" held on 28th December 2022.
7. On-site Training Programme on Condition Monitoring and Diagnostics tests on Power Transformers held at M/s. NHPC, Teesta-V Power Station, Sikkim on 13th February 2023.
8. Webinar on "AMI Technologies and AMI System Testing" held on 16th February 2023.
9. National Conference on High Voltage Engineering and Technology (HVET 2023) held through virtual mode, on 17th March 2023.
10. Webinar on "Lithium Ion Batteries-Cell/ Battery Fabrication, Testing and Standardization" held on 23rd March 2023.

· AWARDS & ACCOLADES

- The Technical Paper titled "National and International Metering Standards-Review, Present status and upcoming changes" presented by Shri. B.A. Sawale, Additional Director, STDS, Bhopal at Metering India-2022 International Conference organized by IEEMA at New Delhi, on 03rd & 04th November 2022 was awarded the second best paper in the Conference.

Second Best Paper Award

- Shri. Jeykishan Kumar K, Engineering Officer Grade 2, CPRI, Bengaluru received "Global Distinguished Young Scientists Awards" for outstanding contribution to Research, on the occasion of IEEE IAS Global Conference on Renewable Energy and Hydrogen Technologies (GlobConHT – 2023) held at The Maldives National University, Male City, Maldives on 11th & 12th March 2023.

· VISIT OF IMPORTANT PERSONS/FOREIGN DELEGATIONS TO CPRI

Cables & Diagnostics Division (CDD)

- Mr. Mazin Aziz, Mr. Humaid Alshamsi, Officers from Dubai Electricity & Water Authority (DEWA), Dubai and Mr. Mohammed Saleh, M/s. Dubai Cable Company Pvt. Ltd., Dubai visited Cables & Diagnostics Division, CPRI, Bengaluru for witnessing of Type test on 11 kV, 3CX 240 Sq.mm, CU/PVC/SWA/PE Cable as per IEC 60502-2 during 12th July 2022 to 03rd August 2022.

Witnessing by DEWA officials- Longitudinal Water Penetration test on 11 kV, 3CX 240 Sq.mm, CU/PVC/SWA/PE Cable

- Mr. Mazin Aziz, Officer from DEWA, Dubai and Mr. Altaf Ahmed, M/s. National Cables Industry, Sharjah, UAE visited Cables & Diagnostics Division CPRI, Bengaluru for witnessing of Type test on 450 /750 V, 1CX 180 Sq.mm, AL/PVC Cable as per BSEN 50525-2-31 for M/s. National Cables Industry, Sharjah, UAE during 12th to 22nd September 2022.

Witnessing of Type test on 450 /750 V, 1CX 180 Sq.mm

Visit of Mr. Hashan Mohamed Elkhawas from M/s. Giza Cable Industries, Egypt

- Mr. Hashan Mohamed Elkhawas, M/s. Giza Cable Industries, Egypt visited Cables & Diagnostics Division CPRI, Bengaluru for witnessing of Type test on 18/30 (36 kV), 3X95 Sq.mm, CU / XLPE / SWA / PVC Cable and 18/30 (36 kV), 3 X 400 Sq.mm, AL / XLPE / STA / PVC (FR) Cables as per IEC 60502-2-2014 during 27th September 2022 to 03rd October 2022.

Energy Efficiency & Renewable Energy Division (ERED)

- Dr. Tom Patrick Heins, Project Coordinator, International Cooperation in Asia, Physikalisch - Technische Bundesanstalt (PTB) visited Energy Efficiency & Renewable Energy Division, CPRI, Bengaluru to discuss about the progress of Indo-German cooperation project "Strengthening of Quality Infrastructure for PV Industry" on 17th March 2023.

High Voltage Division (HVD)

- Mr. Souhe Souhe Gabriel Franck, Mr. Bio N'Gobi Seko Orou Leon, Mr. Bouda Quiraogo, Mr. Mohamadou Douka Sanouss, Mr. Harouna Wali Souleymane, Mr. Khan Imran Ayyub from M/s. Transrail Lighting Limited, Niger, South Africa visited High Voltage Division, CPRI, Bengaluru for witnessing RIV and Corona Tests on 330kV hardware accessories for M/s. IAC Electricals Pvt. Ltd., Kolkata on 19th July 2022.

Visit of Officials from M/S. Transrail Lighting Limited, Niger, South Africa

- Mr. Mohammad Jashim Uddin - Project Director and Mr. Mohammad Nafiz Imtiaz – Sub Division Engineer of M/s. PGCB Ltd., Bangladesh visited High Voltage Division, CPRI, Bengaluru for witnessing tests on 11kV 210kN Disc Insulators for M/s. Aditya Birla Insulators, West Bengal on 29th August 2022.

Visit of Mr. Mohammad Jashim Uddin - Project Director and Mr. Mohammad Nafiz Imtiaz – Sub Division Engineer of M/s. PGCB Ltd., Bangladesh

Short Circuit Laboratory (SCL)

- Mr. Rafiqul Alam, Director and Mr. Md. Ashrafuzzaman, DGM from M/s. Prince Electricals Ltd., Dhaka, Bangladesh visited Short Circuit Laboratory, CPRI, Bengaluru for witnessing the ability to withstand the dynamic effects of short circuit & Temperature Rise tests on 100kVA, 11000/415V, 200kVA 11000/415V & 250kVA, 11000/415V Three Phase Distribution Transformers as per IEC 60076 - 5: 2006 & IEC 60076-2: 2011, during 21st to 29th April 2022.

Visit of Mr. Rafiqul Alam, Director and Mr. Md. Ashrafuzzaman, DGM from M/s. Prince Electricals Ltd., Dhaka, Bangladesh

- Mr. Nilesh Gurjar, Manager - Test field from M/s. SGB MY Sdn. Bhd. & Mr. R. Venkatesan, Inspection Engineer, on behalf of M/s. ABSG Consulting Inc., Singapore visited Short Circuit Laboratory, CPRI, Bengaluru for witnessing the Temperature rise and Determination of Sound level tests on 1000kVA 22000/433 V, 1500 kVA 22000/433 V Three Phase Distribution Transformers as per IEC 60076 - 2: 2011, IEC 60076-10: 2016, for M/s. SGB MY Sdn. Bhd., Malaysia, during 06th to 18th April 2022.

Visit of Mr. Nilesh Gurjar, Manager - Test field from M/s. SGB MY Sdn. Bhd. & Mr. R. Venkatesan, Inspection Engineer, on behalf of M/s. ABSG Consulting Inc., Singapore

- Mr. Mashiur Rahman, Assistant Engineer and Mr. Dibyendu Goan, Senior Manager from M/s. Sylvan Technologies Limited, Dhaka, Bangladesh visited Short Circuit Laboratory, CPRI, Bengaluru for witnessing Short circuit & Temperature Rise on Single Phase Overhead Distribution Transformers (25kVA, 37.5kVA & 50 kVA 6350/240V) as per IEEE C57.12.90: 2010 & IEEE C57.12.00: 2010 and 100kVA 33000/433V Three Phase Distribution Transformer as per IEC 60076 - 5: 2006 & IEC 60076-2: 2011, during 26th to 31st May 2022.

Visit of Mr. Mashiur Rahman, Assistant Engineer and Mr. Dibyendu Goan, Senior Manager from M/s. Sylvan Technologies Limited, Dhaka, Bangladesh

- Mr. Peter Thuo from M/s. Nairobi Transformer Manufacturers (E.A.) Co. Ltd., Nairobi, Kenya visited Short Circuit Laboratory, CPRI, Bengaluru for witnessing the Ability to withstand Short Circuit test on 50kVA 33000/420V Three Phase Distribution Transformer as per IEC 60076 - 5: 2006, on 12th & 13th July 2022.

Visit of Mr. Peter Thuo from M/s. Nairobi Transformer Manufacturers (E.A.) Co. Ltd., Nairobi, Kenya

- Mr. Murugesh S, Engineer from M/s. Everest Electrical & Building Material W.L.L, Bahrain, Mr. Mohamed Jawad Ahmed Salman Dawood and Mr. Ahmed Khalil Ali Ebrahim Hasan Nayem Alhayki - Engineers from M/s. EWA (Electricity & Water Authority), Bahrain visited Short Circuit Laboratory, CPRI, Bengaluru for witnessing Verification of short circuit withstand strength at 50kA for 1 s with 105 kA peak on main bus bars, neutral and earth bus bars and other verification tests (Temperature rise, Dielectric properties, Mechanical operation, Lifting, Marking, Clearances & Creepage distances, Resistance to abnormal heat and fire due to internal electric effects etc.) on 400V 2500A ACB Panel as per IEC 61439-1: 2020 & IEC 61439- 2:2020, during 19th to 30th September 2022.

Visit of officials from EWA, Bahrain and M/s. Everest Electrical & Building Materials W.L.L, Bahrain

- Mr. Roberto Amboni and Mr. Dario Castelli from M/s. ABB Ltd., Italy visited Short Circuit Laboratory, CPRI, Bengaluru for witnessing the tests under Test Seq. I, II, III on various ratings of MCCBs as per IEC 60947-2:2016 with latest Amendment for M/s. ABB India Ltd., Bengaluru, during 07th to 28th November 2022.

Visit of Mr. Roberto Amboni and Mr. Dario Castelli from M/s. ABB Ltd., Italy

- Mr. Nipun Nanayakkara, Manager and Mr. Kushan Kandambi from M/s. LTL Transformers (Pvt.) Ltd., Sri Lanka visited Short Circuit Laboratory, CPRI, Bengaluru for witnessing the Ability to Withstand the Dynamic Effects of Short Circuit & Temperature Rise tests on 250kVA 33000/415V Three Phase Distribution Transformer and Temperature Rise Test alone on 550kVA 33kV Three Phase Earthing Transformer as per IEC 60076 - 5: 2006 & IEC 60076-2: 2011 respectively, during 24th to 28th February 2023.

Visit of Mr. Nipun Nanayakkara, Manager and Mr. Kushan Kandambi from M/s. LTL Transformers (Pvt.) Ltd.

Visit of Mr. Ayman Abdelhakm from M/s. Giza Cable Accessories, Giza, Egypt

- Mr. Ayman Abdelhakm from M/s. Giza Cable Accessories, Giza, Egypt visited Short Circuit Laboratory, CPRI, Bengaluru for witnessing Thermal short circuit tests on Conductor and Screen on Pre molded cold shrink Indoor termination, Outdoor termination & Joint mounted on 3 x 150 sq.mm, Copper conductor, XLPE insulated PVC sheathed 18/30 (36) kV Cable as per IEC 60502-4:2010 & Clauses 11 & 12 of IEC 61442:2005 on 3rd & 6th March 2023.

- Mr. Ganesh Gopalakrishnan, GM - Engg from M/s. Dorman Smith Switchgear LLC, Dubai, U.A.E & Mr. Jaideep S from M/s. Under Writers Laboratory (UL), India visited Short Circuit Laboratory, CPRI, Bengaluru for witnessing Verification of short circuit withstand strength at 36kA for 1.0 s with 75.6 kA peak on main bus bars, at 21.6 kA for 1.0 s with 45.4 kA peak on neutral

Visit of Mr. Ganesh Gopalakrishnan, GM - Engg from M/s. Dorman Smith Switchgear LLC, Dubai, U.A.E & Mr. Jaideep S from M/s. Under writers Laboratory (UL), India

bus bar on 415V 250A 4 Way LV MCCB Panel Board as per IEC 61439-1: 2011 & IEC 61439-2:2011 on 23rd March 2023.

Switchgear Testing & Development Station (STDS), Bhopal

- Er. Ram Kumar Kadariya, DGM from M/s. Nepal Ekarat Engineering Co. Pvt. Ltd., Nepal visited STDS, Bhopal for witnessing Ability to withstand the dynamic effects of Short Circuit test on 50 kVA and 100kVA, 11/0.433kV, 3 Three Phase Distribution Transformer on 02nd & 09th May 2022.
- Mr. Mir Sirajul Ali from M/s. General Electric Manufacturing Company Ltd., Bangladesh visited STDS, Bhopal for witnessing Ability to withstand the dynamic effects of Short Circuit test on 100 kVA, 200kVA and 250kVA, 11/0.415kV, Three Phase Distribution Transformer on 30th May 2022 and 03rd June 2022.
- Mr. Rukshika Pathberiya from M/s. LTL Transformers (Pvt) Ltd., Sri Lanka visited STDS, Bhopal for witnessing Ability to withstand the dynamic effects of Short Circuit test on 1000kVA, 33/0.415 kV, and 400kVA, 33/0.415 kV, Three Phase Distribution Transformers on 17th, 20th and 21st June 2022.

Visit of Mr. Rukshika Pathberiya from M/s. LTL Transformers (Pvt) Ltd., Sri Lanka

- Mr. Nipun Nanayakkara and Mr. Kushan Kandambi from M/s. LTL Transformers (Pvt) Ltd., Sri Lanka visited STDS, Bhopal for witnessing Measurement of Acoustic Sound level test, Demonstration of Ability to withstand rated Short Time Neutral Current test on 33kV, 800A for 30 sec. Oil Immersed Earthing Transformer on 13th March 2023.
- Mr. Saiful Islam and Mr. Shajjad Hossain from M/s. Confidence Infrastructure Limited, Bangladesh visited STDS, Bhopal for witnessing Ability to withstand the dynamic effects of Short Circuit test on 10/14MVA, 33/11.55kV, 3-Phase, Power Transformer on 27th March 2023.

Visit of Mr. Saiful Islam and Mr. Shajjad Hossain from M/s. Confidence Infrastructure Limited, Bangladesh

Ultra High Voltage Research Laboratory (UHVRL), Hyderabad

- Mr. Membo Lameck Mathew, Mr. Mwaseke Josephate Emmanuel & Mr. Achola Gombe Emmanual from M/s. Tanzania Electric Supply Company Ltd., Dodoma, Tanzania visited UHVRL, CPRI, Hyderabad for witnessing tests on 400 kV Glass Insulator Strings of M/s. Advait infratech Ltd, Ahmadabad during 17th to 20th May 2022.

Visit of official from M/s. Tanzania Electric Supply Company Ltd., Dodoma, Tanzania

- Mr. Makanga Timothy Paul & Mr. Mabonga Dickson Khaukha of M/s. Uganda Electricity Transmission Company Limited, Uganda visited UHVRL, CPRI, Hyderabad for witnessing tests on 132 kV Conductor Accessories of M/s. Mosdorfer India Pvt. Ltd, Nashik on 24th May 2022.
- Mr. Gogon Roman & Mr. Ivan Mikoyan from M/s. Massa Izolyator Mehru (P) Ltd., Russia visited UHVRL, CPRI, Hyderabad for witnessing tests on 400 kV RIP Bushing during 12th to 15th September 2022.

Visit of Mr. Gogon Roman & Mr. Ivan Mikoyan from M/s. Massa Izolyator Mehru (P) Ltd., Russia

· PARTICIPATION IN CONFERENCES / EXHIBITIONS

DISTRIBUELEC 2022 Exhibition

- The Institute participated in DISTRIBUELEC 2022, a Power Distribution Show organized by IEEMA from 25th to 27th May 2022 at Bangalore International Exhibition Centre, Bengaluru. The event displayed products, technologies and services in Power distribution and attracted many decision makers from Utilities and Industry. CPRI displayed its facilities and expertise in a Stall during the exhibition. A photograph is placed below:

Visitors at the stall

ELASIA 2022 Exhibition

- The 9th ELASIA, International Exhibition on Power, Electrical & Lighting organized by M/s. Triune Exhibitors Pvt Ltd, Bangalore in association with Electrical Consultants' Association of India (ELCA) was held from 24th to 26th June 2022 at Bangalore International Exhibition Centre, Bangalore. CPRI displayed its facilities and expertise in a Stall during the exhibition. The activities related to Research, Testing, Consultancy/Field Testing and Training were showcased. Apart from these, the recent ISO/IEC 17065 accreditation for Product Certification of CPRI were introduced to the manufacturers. Many manufacturers were impressed and showed interest regarding Product Certification. A Photograph is placed below:

Visitors at the stall

Boiler India - 2022 Exhibition

- The Institute participated in Boiler India - 2022 Conclave and Exhibition held at CIDCO Exhibition and Convention Centre, Mumbai during 14th to 16th September 2022. The event was organized by Directorate of Boiler, Maharashtra. The team of Officers of Thermal Research Centre (TRC), CPRI, Nagpur interacted with the visitors to the Stall. A Photograph of the Exhibition is placed below:

Visitors at the stall

Agni Tattva Exhibition

- Power Foundation (PFI) of India organized Agni Tattva Exhibition during 29th to 31st January 2023 at Marakata Grounds Bangalore. CPRI displayed its facilities and expertise in a Stall during the exhibition. The activities related to Research, Testing, Consultancy/Field Testing and Training were showcased. Apart from these, the recent ISO/IEC 17065 Accreditation for Product Certification of CPRI were introduced to the manufacturers. Photographs are placed below:

CPRI Stall

CPRI Stall Inauguration by Secretary, MoP, GoI

ELECRAMA - 2023 Exhibition

- ELECRAMA 2023, The International Exhibition organized by Indian Electrical & Electronics Manufacturer's Association (IEEMA) during 18th to 22nd February 2023 at India Expo Mart, Greater Noida, NCR. CPRI displayed its facilities and expertise in a Stall during the exhibition. The activities related to Research, Testing, Consultancy/Field Testing and Training were showcased. Apart from these, the recent ISO/IEC 17065 accreditation for Product Certification of CPRI were introduced to the manufacturers. A Photograph is placed below:

CPRI Stall at ELECRAMA 2023

Painting Competition on Energy Conservation

The Bureau of Energy Efficiency (BEE), MoP initiated State Level Painting Competition on Energy Conservation 2022 for the State of Karnataka was conducted by the Training Division at CCAR, CPRI Bengaluru on 14th November 2022. About 50 students from Category A and 50 students from Category B attended the painting competition from all over Karnataka State. The Awards Ceremony was conducted at SJ Auditorium, CPRI, Bengaluru where 13 winners (1st, 2nd, 3rd and 10 consolation prizes) each from Category A and B, were awarded cash prizes and certificates.

Painting Competition Winners PC-2022 Group A

Painting Competition Winners PC-2022 Group B

SECTION - 6

TRAINING ACTIVITIES & PROGRAMMES

TRAINING ACTIVITIES & PROGRAMMES

·WEBINARS / CONFERENCES / WORKSHOPS / TRAINING PROGRAMMES ORGANISED BY CPRI DURING THE YEAR 2022-23

The phenomenal growth in the Indian Power Sector over past few years has magnified the need for absorption of latest technology in all the three spheres of Power Sector activity viz. Generation, Transmission, and Distribution. Coupled with this is the paucity of trained technical personnel and or skilled manpower.

Recognizing this need of the Indian Power Sector, CPRI has been in the forefront amongst many Training Institutes to disseminate the knowledge, assimilated by way of in-house research, through technical training programmes organized for:

- Upgrading the working skills of the Power Sector employees

- Training of personnel from Utilities/ Industries/ Clientele from Companies in the Power Sector in relevant skill for their day to day activities.

Constant efforts are being put up by CPRI in training and continuing education schemes, from basic theoretical knowledge to practical hands-on training in electrical systems. Training Programmes and Courses conducted by CPRI are well designed and have made substantial impact on the confidence level of the engineers actually working on the systems, by way of changing their thought process while working. The training modules are so designed to comprehensively address the specific need of the Power Sector Utilities and have benefitted large number of employees from Indian Electrical Equipment Manufacturers, Generation, Transmission and Distribution Companies for the past several years. The training courses help the technical personnel / engineers by upgrading their occupational skills and improve their performance. This has led to the overall improvement in the efficiency in performance and competitiveness of the Indian Electrical Industry as a whole.

Webinars/ Conferences/ Workshops /Training Programmes/Tutorials organized by CPRI during the year 2022-23:

Capacitors Division

1. On-site Training Programme on "Condition Monitoring of EHV Circuit Breakers on-site", held at M/s. THDC India Ltd., Koteshwar Hydro Electric Power House, Uttarakhand on 10th November 2022.
2. On-site Training Program on "Diagnosis & Condition Monitoring Tests for Generator Transformers at site – offline & Online", held at M/s. NHPC, Chamera Power Station – I, Himachal Pradesh on 10th December 2022.

3. On-site Training Program on "Online Partial Discharge test by Acoustic Emission Technique for Condition Monitoring of Generator Transformers at Site", held at M/s. NHPC, SEWA-II Power Station, J&K on 12th December 2022.
4. On-site Training Program on "Off-line & On-line Diagnostic Tests for Condition Assessment of GT's, UAT's & ST's under RLA Studies at site" for Officials of M/s. NALCO, CPP, Angul, Odisha held at M/s. NALCO, Angul, Odisha on 30th January 2023.
5. On-site Training Program on "Diagnosis & Condition Monitoring Tests – Condition Assessment of Power Transformers at site – off-line and On-line tests" for Senior Officials and Engineers of Asset Management Group of M/s. PGCIL, Gurugram held at M/s. Power Grid Corporation of India Ltd., Gurugram, Haryana, on 02nd March 2023.
6. On-site Training Program on "Capacitors in AC Power System-Application & Failure Analysis", for HVDC Group of M/s. PGCIL, Gurugram held at M/s. Power Grid Corporation of India Ltd., Gurugram, Haryana, on 03rd March 2023.
7. On-site Training Program on "Condition Monitoring of Generator Transformers at site – offline – online techniques" for Senior Officials, Engineers and Technical Staff of M/s. NHPC, Uri Power Station held at M/s. National Hydro Electric Power Corporation (NHPC), Uri Power Station, J&K on 16th March 2023.
8. On-site/ On-line Training Program on "Condition Monitoring of EHV Circuit Breakers at site" for Senior Officials, Engineers and Technical Staff of M/s. NHPC, Uri Power Station held at M/s. National Hydro Electric Power Corporation (NHPC), Uri Power Station, J&K on 16th March 2023.

Capacitors Division

9. On-site Training Programme on "Laying and Bonding of EHV Cable System" for KPTCL Engineers held at 110 kV, Substation, Hubballi during Pre-Commissioning tests on 110 kV Cable System at site on 18th May 2022.
10. On-site Training Programme on "Condition Monitoring and Diagnostics tests on Power Transformers" for the officials of M/s. OPTCL, at site on 01st February 2023.
11. On-site Training Programme on "Condition Monitoring and Diagnostics tests on Power Transformers" for the officials of M/s. NHPC, Teesta-V Power Station, at site on 13th February 2023.

Dielectric Materials Division

12. Training Programme on "Condition Monitoring of Transformers through oil analysis and safe handling of PCB contaminated oil in Transformers", held at M/s. Maharashtra State Power Generation Company Limited, Chandrapur Super Thermal Power Station (CSTPS), Chandrapur, on 11th April 2022.
13. Training Programme on "Condition Monitoring of Transformers through oil analysis", held at M/s. Steel Authority of India Ltd., (SAIL), Chandrapur, on 12th April 2022.

14. Training Programme on "Condition Monitoring of Transformer by Oil Analysis and Safe Handling of PCB Contaminated Oils in Transformers" for the Engineers of M/s. Kerala State Electricity Board (KSEB) Limited, held at Nallalam, Kozhikode, on 30th June 2022.
15. Training Programme on "Condition Monitoring of Transformer by Oil Analysis and Safe Handling of PCB Contaminated Oils in Transformers" for Engineers of Kerala State Electricity Board Limited, Thiruvananthapuram, held on 06th August 2022.
16. Webinar on "Environmentally Sound Management of Polychlorinated Biphenyls (PCBs) containing Transformer Oil in India" for members of Stockholm Convention Regional Centre (SCRC) on POPs for Asia Region, CSIR – National Environmental Engineering Research Institute, Nagpur held on 21st March 2023.

Electrical Appliances Technology Division

17. Webinar on "Test procedure on Environmental Ingress, importance and enclosures protection" held on 24th February 2023.
18. Webinar on "Lithium Ion Batteries-Cell/ Battery Fabrication, Testing and Standardization" held on 23rd March 2023.

Energy Efficiency & Renewable Energy Division

19. Two Days Residential Training Programme on "Solar Inverters and applicable standards" for M/s. Prostarm Info Systems Ltd., Pune held at CPRI, Bengaluru on 14th & 15th July 2022.
20. Two days training program on "Testing of Self Ballasted LED lamps and General Lighting Services- Safety and performance Requirements" for officials of M/s. Energy Management Centre, Trivandrum, Kerala, held at CPRI, Bengaluru, on 22nd & 23rd September 2022.
21. Training program on "Energy Efficiency improvements in Cooling Towers" for Engineers of M/s. JNSTPP, Madhya Pradesh, held at Jaypee Nigrie Super Thermal Power Plant, Madhya Pradesh on 26th September 2022.

Earthquake Engineering &Vibration Research Centre

22. Online tutorial on "Vibration & Seismic testing of Equipment" held on 30th January 2023.

High Voltage Division

23. Webinar on "Best Grounding practices" held on 08th December 2022.
24. Webinar on "High Voltage Electrical Equipment" held on 20th January 2023.
25. Webinar on "Earthing and lighting Practice" for M/s. IIAP, Bangalore held on 14th February 2023.

High Power Laboratory

26. Webinar on 'Role of Switchgear and Controlgear in the Evolving Grid: Highlights and Challenges' held on 02nd March 2023.

Materials Technology Division

27. Workshop on "Corrosion Mapping of Boiler Tubes" held at M/s. NTPC Simhardari on 10th November 2022.
28. Training Program on "Fly Ash Utilisation and Coal Quality Impact on Boiler Performance" held at M/s. Yermarus Thermal Power Station, Yermarus, Raichur on 02nd February 2023.
29. Workshop on "Oxide Scale Thickness Measurement of Super Heater Boiler Tubes" held at Panipat Thermal Power Station (PTPS), Haryana on 10th March 2023.

Metering & Utility Automation Division

30. Webinar on 'Latest trends in Energy Metering Technologies and Calibration' held on 28th December 2022.
31. 3 days Training programme on "Numerical Protection IEDs Testing" held at M/s. NHPC, Corporate Office, Faridabad from 22nd to 24th March 2023.
32. 3 days Training programme on "Wide Area Monitoring, Protection and Control" held at M/s. NHPC, Corporate Office, Faridabad from 27th to 29th March 2023.
33. One-day National Workshop on "Development of DLMS/ COSEM Testing Tool for Smart Energy Meter" held at CPRI, Bengaluru on 24th February 2023.

Power Systems Division

34. Webinar on "Findings of Third party protection audit of RGTPP" for the Ramgarh executives and protection engineers, held on 05th May 2022.
35. Webinar on "Cyber security issues for Advanced Metering Infrastructure", held on 31st May 2022.
36. Workshop on "Real Time Digital Simulation of Power Systems on RTDS", held at CPRI, Bengaluru, on 15th June 2022.
37. Training Programme on "Power Systems Protection, relay testing and earthing" for the engineers of M/s. JKPDD held at Srinagar, from 18th to 20th July 2022.
38. Training Programme on "Power Systems Planning and Grid Operational Practices" for the engineers of M/s. JKPDD held at Srinagar, on 21st & 22nd July 2022.
39. Training program on "Power Systems Protection" for Engineers of M/s. IOCL held at CPRI, Bengaluru from 13th to 15th March 2023.

Regional Testing Laboratory, Noida

40. Webinar on "Smart Meter and Advanced Metering Infrastructure" held on 28th February 2023.
41. Webinar on "Diagnostic Techniques for Condition Monitoring of Power Transformers and estimation of shelf life of Liquid and Solid Insulation" held on 06th March 2023.

42. Training programme on "Awareness on LED Test facilities" held at Regional Testing Laboratory (RTL), Noida on 17th March 2023.

RTL, Kolkata

43. Webinar on "Analysis of Liquid Dielectric used in Transformers" held on 28th March 2023.

Short Circuit Laboratory

44. Webinar on "Temperature Rise Tests on HT and LT Switchgear Panels – Requirements and Interpretations as per latest IEC Standards" held on 20th December 2022.

Smart Grid Research Laboratory

45. Webinar on "AMI Technologies and AMI System Testing" held on 16th February 2023.
46. Webinar on "Advanced Metering Infrastructure System" held on 15th March 2023.

Switchgear Testing & Development Station, Bhopal

47. Webinar on "Best practices in Switchgear Design, Testing and Maintenance for Compliance of IS & IEC Standards" held on 20th December 2022.
48. Webinar on "Smart Meter Protocol and AMI Solution Testing" held on 20th January 2023.
49. Webinar on "High Voltage Testing & Measurement Techniques" held on 24th January 2023.
50. Webinar on "Awareness and Testing of LV Switchgear & Controlgear" held on 01st February 2023.
51. Webinar on "Calibration technique for Electro-Technical & Thermal Instruments" held on 17th February 2023.
52. Webinar on "Emerging Trends and Challenges in Transformer Design, Testing and Maintenance as per IS & IEC Standards" held on 28th February 2023.

Training Division

53. A three Weeks Residential Induction Training Programme for Engineers of West Bengal State Electricity Distribution Company Limited, (WBSEDCL), Kolkata, held at CPRI, Bengaluru, from 02nd to 21st May 2022.
54. A three Weeks Residential Induction Training Programme for Engineers of West Bengal State Electricity Distribution Company Limited, (WBSEDCL) Kolkata held at CPRI, Bengaluru, from 20th June to 9th July 2022.
55. Five Days Residential Training Programme on "Testing of Electrical Equipment" for Senior Officers of M/s. Neyveli Lignite Corporation India Ltd., (NLCIL) held at CPRI, Bengaluru, from 11th to 15th July 2022.

56. A three Weeks Residential Induction Training Programme for Engineers of West Bengal State Electricity Distribution Company Limited, (WBSEDCL) Kolkata held at CPRI, Bengaluru, from 25th July to 13th August 2022.
57. Five Days Residential Training Programme on "Testing of Electrical Equipment" for Senior Officers of M/s. Neyveli Lignite Corporation India Ltd., (NLCIL) held at CPRI, Bengaluru, from 16th to 20th August 2022.
58. A three Weeks Residential Induction Training Programme for Engineers of M/s. West Bengal State Electricity Distribution Company Limited, (WBSEDCL) Kolkata, held at CPRI, Bengaluru, from 22nd August to 10th September 2022.
59. A three Weeks Residential Induction Training Programme for Engineers of West Bengal State Electricity Distribution Company Limited, (WBSEDCL) Kolkata held at CPRI, Bengaluru, from 21st November to 10th December 2022.
60. A Three Weeks Residential Induction Training Programme for Engineers of M/s. WBSEDCL, Kolkata held at CPRI, Bengaluru from 16th January 2023 to 04th February 2023.
61. A two Weeks Residential Induction Training Programme for Engineers of M/s. WBSETCL, Kolkata, held at CPRI, Bengaluru from 01st to 16th February 2023.
62. A One Week Training Programme for Officers of Indian Air Force (IAF), Jalahalli, Bengaluru held at CPRI, Bengaluru from 20th to 25th February 2023.

TRC, Nagpur

63. Workshop on "Condition Assessment of RCC structure of Turbine Generator Deck foundation Unit No.5" held at M/s. NTPC Singrauli Super Thermal Power Station on 19th November 2022.
64. Training Program on "Remnant Life Assessment (RLA) of Boiler" held at M/s. UPRVUNL, Parichha Thermal Power Project, Jhansi, U.P on 25th January 2023.

UHVRL, Hyderabad

65. Webinar on "Artificial Pollution test on AC/DC insulators" held on 25th November 2022.
66. Webinar on "Fundamentals of High Voltage Engineering & its Applications" held on 09th December 2022.
67. One day Training programme on "High Voltage Engineering" for the delegates of Engineering Staff College of India (ESCI), held at UHVRL, Hyderabad, on 03rd March 2023.
68. Webinar on "Preventive Maintenance of Transformers Through Transformer Oil Testing" held on 24th March 2023.
69. National Conference on High Voltage Engineering and Technology (HVET 2023) held through virtual mode, on 17th March 2023.

SECTION - 7

Capital Projects

CAPITAL PROJECTS

As the Power sector of the country is expanding, additional power capacity is being added and an addition of 78,000 MW Capacity was planned in the Twelfth Five-Year Plan. This demand for additional power calls for installation of additional equipment for generation, transmission and distribution of power. Additional equipment, in turn, bring in need for augmenting testing facilities. During the XI Five-Year Plan itself, the MoP, GoI approved several projects to enhance the Research and Testing facilities at CPRI.

• XII PLAN PROJECTS

Capital project with an outlay of Rs. 996.10 Crores comprising of two project components titled (i) "Augmentation of High Power Short Circuit Test facilities by installation of two Additional 2500 MVA Generators and associated equipment-Outlay Rs.640.00 Crores" and (ii) "Establishment of New Test Facilities-Outlay Rs.356.10 Crores" under the 12th Five Year Plan, was approved as one project proposal by Finance Ministry & MoP vide order No.5/5/2014-T&R dated 5th January 2015 & is under implementation from April 2015.

RCE proposal for Time Extension & Revised Outlay:

Extension of time duration initially upto March 2023 and revised outlay of Rs. 979.00 Crore in respect of 12th Five Year Plan Capital Project titled "Augmentation of High Power Short Circuit Test facilities by installation of two Additional 2500 MVA Generators and associated equipment" and "Establishment of New Test Facilities" was approved by Ministry of Power, New Delhi, vide Letter No.4/1/2020-T&R dated 14th January 2022.

The details of the Ongoing XII plan projects/schemes are given in the table below:

Sl. No.	Title of the Proposal	Cost (in Crores)
1	**"Augmentation of High Power Short Circuit Test facilities by installation of two Additional 2500 MVA Generators and associated equipment" under XII Plan**	
(i)	Augmentation of High Power Short Circuit Test facilities by installation of two Additional 2500 MVA Generators with associated equipment at High Power Laboratory, CPRI, Bengaluru.	509.00
II	**Establishment of New Test Facilities' under XII Plan Proposals'**	
(i)	Establishment of 40 kA continuous current Temperature Rise test Facility at HPL, CPRI, Bengaluru	15.00
(ii)	Establishment of Total Test Facility for Transformers at CPRI Western Zone	187.73

• DIB PROJECTS

DIB proposal for Augmentation of existing Test Facilities & Establishment of New Test Facilities at various centers of CPRI, was approved by Ministry of Power, New Delhi, with an outlay of Rs. 213.40 Crore vide Letter No.5/1/2021-T&R dated 21st January 2022.

Sl. No.	Project Component	CPRI Units at	Total Cost (in Rs. Cr)
1	Test facilities for Smart Meters, RTUs, and IEDs including cyber security tests.	Bhopal, Hyderabad, Noida, Raipur, Nashik, Bangalore	76.40
2	a) Test facilities for Routine tests, Impulse Test and Temperature Rise Test on Distribution Transformers	Hyderabad, Noida, Raipur	16.00
	b) Setting up of 10/350 micro second Impulse Current Test Facility	Bangalore	16.00
3	Augmentation of Test Facilities Related to Instrument Transformers, Insulators and Power Transformers.	Hyderabad	65.00
4	Modernization of Existing Synthetic test facility at High Power Laboratory, Bengaluru	Bangalore	40.00
		Total	**213.40**

SECTION - 8

ADMINISTRATIVE MATTERS

ADMINISTRATIVE MATTERS

• GOVERNANCE

The following distinguished persons have joined the Governing Council and the Society of CPRI as Members in 2022-23:

1. Shri. Ghanshyam Prasad, Chairperson, Central Electricity Authority has assumed charge as Vice-President, Governing Council of CPRI.
2. Shri. Ajay Tewari, IAS, Additional Secretary, Ministry of Power
3. Shri. Ashok Kumar Rajput, Member (Power System), Central Electricity Authority
4. Dr. N Kalaiselvi, Secretary, DSIR - Ministry of Science & Technology
5. Shri. Bhupinder Singh Bhalla, IAS, Secretary MNRE
6. Shri. Rohit Pathak, President IEEMA and CEO, Birla Copper Hindalco Industries Limited
7. Shri. Mahantesh Bilagi, IAS, Managing Director, Bangalore Electricity Supply Company Ltd.
8. Shri. Asit Singh, Director General, CPRI, became the Member-Secretary of CPRI Governing Council

The following distinguished persons joined the Standing Committee of CPRI as Members in 2022-23:

1. Shri. Ajay Tewari, IAS, Additional Secretary, Ministry of Power has assumed charge as Chairman, Standing Committee of CPRI.
2. Shri. Ashok Kumar Rajput, Member (Power System), CEA.

Details of Governing Council and the Standing Committee meetings of CPRI held during the year 2022-23

1. 87th Meeting of CPRI Governing Council was held through Virtual Mode, on 17th August 2022.
2. 88th CPRI Governing Council Meeting and 45th Annual General Meeting was held through Virtual Mode, on 07th December 2022.
3. 89th Meeting of CPRI Governing Council was held through Virtual Mode, on 15th February 2023.
4. 86th Meeting of Standing Committee was held through Virtual Mode, on 12th October 2022.
5. 87th Meeting of CPRI Standing Committee was held through Virtual Mode, on 14th March 2023.

• IMPORTANT EVENTS

- Bharat Ratna Dr. B.R. Ambedkar's 131st Birthday was celebrated at CPRI, Bangalore on 20th May 2022.
- The Third Meeting of Steering Committee for National Mission on use of Biomass in coal based thermal power plants was held through Video Conferencing mode on 12th July 2022.
- A meeting under the chairmanship of Joint Secretary (Hydro), Ministry of Power was held through Video Conferencing mode, regarding Research & Development efforts made in the Hydro Power Sector, on 03rd August 2022.
- A meeting under the chairmanship of Secretary (Power) was held through Video Conferencing mode, regarding SFC proposal for new research scheme titled "Power Sector Accelerated Research and Application Scheme (PARAS)" on 10th August 2022.
- The Fourth Executive Committee meeting of the SAMARTH Mission was held through Video Conferencing mode, on 24th January 2023.
- A meeting under the chairmanship of Member (Power Systems), CEA was held through Video Conferencing mode, to discuss the issues related to availability of RTC power for production of Green Hydrogen/ Green Ammonia on 31st January 2023.
- A team of experts from VTU Belgaum conducted the Local Inquiry Committee (LIC) visit through Video Conferencing mode, for the renewal of recognition for the Electrical/ Mechanical/ Civil/Chemical Engineering and Chemistry branches of CPRI Research Center, on 20th February 2023.

Meeting of Technical Committees of Research

- Meeting of the Technical Committee on Thermal Research was held on 02nd June 2022, 01st November 2022 & 28th February 2023.
- Meeting of the Technical Committee on Hydro Research was held on 26th May 2022 & 30th September 2022.
- Meeting of the Technical Committee on Grid, Distribution and Energy Conservation Research was held on 03rd June 2022, 18th November 2022, 09th March 2023 & 14th March 2023.
- Meeting of the Technical Committee on Transmission Research was held on 27th May 2022, 02nd November 2022 & 02nd March 2023.
- The 26th Meeting of the Standing Committee on Research & Development (SCRD) was organized under the Chairmanship of Chairperson, CEA, through Video Conferencing mode, on 4th July 2022.
- The 27th meeting of the Standing Committee on Research & Development (SCRD) was held on 22nd December 2022.
- The 28th Meeting of the Standing Committee on Research & Development (SCRD) was held through Video Conferencing mode on 29th March 2023.

• SIGNING OF MoUS

- A Memorandum of Understanding (MoU) was signed between Ministry of Power & Central Power Research Institute on the key performance parameters proposed for the financial year 2022-23, on 11th July 2022.
- A Memorandum of Understanding (MOU) was signed between Government of Chhattisgarh and Central Power Research Institute (CPRI) for establishment of Regional Testing Laboratory at Nava Raipur, Chhattisgarh in presence of Honorable Chief Minister of Chhattisgarh, Shri. Bhupesh Baghel at Raipur on 17th August 2022. A photograph is placed below:

Signing of MoU between Government of Chattisgarh and CPRI

- A Memorandum of Understanding (MoU) was signed between CPWD, Raipur and Central Power Research Institute (CPRI) for construction of the Laboratory buildings and boundary wall for CPRI at Naya Raipur on 17th August 2022.
- The UHV shielded Indoor laboratory was inaugurated by Shri V. S. Nandakumar, Director General, CPRI on 31.10.2022. This laboratory has facility to conduct Partial Discharge measurement, all di-electric tests & special tests viz Ratio error & phase angle measurements on IT's, corona & RIV tests, temperature rise test on IT's & disconnectors etc. upto 800 kV system equipment. The photograph is shown below.

Inauguration of UHV Shielded Indoor Test Laboratory

The foundation stone was laid for the following laboratories.

1. Transformer supplementary/Temperature rise test laboratory.
2. Smart meter and cyber security test laboratory.

Stone Laying Ceremony of Transformer supplementary/Temperature rise Test Laboratory

Stone Laying Ceremony of Smart Meter and Cyber Security Test Laboratory

• ACTIVITIES RELATED TO WOMEN CELL:

The Women's Cell looks after:

- Welfare of the women employees of the organization
- Addresses the issues/ grievances concerning women employees and facilitates redressal of the same
- Manages the Creche in CPRI colony and provides necessary guidelines for its smooth functioning

The internal complaints committee of Women's cell investigates reported cases of sexual harassment of women in CPRI and submits its report to the disciplinary authority by recommending action to be taken against the accused employees. This is carried out as per the CPRI's Internal Policy for Prevention, Prohibition and Redressal of Sexual Harassment of Women at Workplace. The women's cell also looks into any other complaints by Women employees in workplace. The committee consists of five members from CPRI and one external member.

The crèche at CPRI is open for employee's kids and is housed in CPRI colony. It is managed by women's cell with support of CPRI management with two caretakers. Felicitations were arranged by the Women's cell to superannuating women of the Institute during the year.

Inauguration of the Women's Day Celebration

Dignitaries on the Dias

International Women's Day was celebrated on 07th March 2023 at CPRI. Smt. Jayanthi S, Deputy Director General, National Informatics Center, Bangalore was the Chief Guest of the function and delivered the talk on "Digit ALL: Innovation and Technology for Gender Equality & Empowerment".

On Women's day, Smt Mylavarapu Subbalakshamma Award for the Best Women Scientist was presented to Smt R. Arunjyothi, Joint Director, CPRI, Bengaluru and Shri B.M. Naidu Award for the Best Research Paper based on Testing clues/data was presented to Shri. Sreeram V, Engineering Officer Gr.3, CPRI, Bengaluru. The photograph is placed below:

Smt R. Arunjyothi, Joint Director, CPRI, Bengaluru receiving Smt Mylavarapu Subbalakshamma Award for the Best Women Scientist

Statement indicating total number of employees in the Institute and number of women in each category as on 31st March 2023

Sl. No.	Post(s)	No. of employees	No. of women employees	Percentage of women employees
1	Director General	1	-	-
2	Director	0	-	-
3	Additional Director	10	-	-
4	Joint Director	42	7	16.67
5	Chief Accounts Officer (SG)	1	-	-
6	Chief Administrative Officer (OG)	1	-	-
7	Scientists/Engg Officers	135	18	13.33
8	Scientists/Engg Assistants	21	1	4.76
9	Non-Tech Officers	11	5	45.45
10	Office Staff/Stenographer	67	25	37.31
11	Library staff	1	1	100.00
12	Technicians	66	-	-
13	Technical Attendant/Attendant	45	3	6.67
14	Drivers/Cook-cum-care taker	7	-	-
15	Multi-Tasking Staff	27	3	11.11
		435	**63**	**14.48**

Staff Strength of the Institute as on 31st March 2023

Sl. No.	Post(s)	No. of employees
1	Director General	1
2	Director	0
3	Additional Director	10
4	Joint Director	42
5	Chief Accounts Officer (SG)	1
6	Chief Administrative Officer (OG)	1
7	Scientific/Engg. Category	156
8	Technicians	66
9	Administrative & Supporting Staff	113
10	Supporting Technical Staff	45
	Total	**435**

• VIGILANCE ACTIVITIES

'Vigilance Vision' of CPRI is preventive over punitive actions, to enforce meaningful, workable and objective systems/procedures, to develop trust and transparency in all transactions, to prevent financial or other losses due to any malpractices, to promote pride and self-esteem of the Organization and its employees and time bound action in all spheres of activities.

Several system Improvements have undertaken with IT usage and web enabled technologies like display of Status of booking of test dates is available in CPRI website. Technology communication with customers through emails, payment of test and consultancy fees through wire transfer, RTGS, e-tendering, posting of Formats for submission of research proposals, project reports in CPRI website. Transparency in all the technical, financial and administrative activities of CPRI is ensured.

Vigilance Awareness Week 2022, was observed by administering "Integrity Pledge" to all the employees of Head Office and Units on 31st October 2022.

The banners on "Vigilance Awareness Week" were displayed at prominent locations in Head Office and at all the Units of CPRI. Background of the theme of Vigilance Awareness week - 2022 was displayed on the web page of CPRI and hyperlink for Integrity Pledge was provided in CPRI website.

The employees of CPRI who were newly recruited took e-pledge using the hyperlink provided in the website.

Pamphlets on "Vigilance Awareness Week-2022" were displayed on Notice Boards in all Units/ Divisions/ Sections/ Labs and also mailed to all the employees of the Institute.

Essay competition was organized by the Institute in Air Force School, Hebbal to create awareness among the students on the subject "Corruption free India for a developed Nation; भ्रष्टाचार मुक्त भारत - विकसित भारत". The prize amount was distributed to the students of KV Hebbal School, Bengaluru who participated and won in the Essay Competition on 04th November 2022.

Winners of Essay Competition

Observance of the "Vigilance Awareness Week" concluded on 04th November 2022 with an invited talk by Shri. Satishchandra Jha, Deputy Superintendent of Police of Central Bureau of Investigation (Anti-Corruption Bureau), Bengaluru Branch, who was also the Chief Guest for the concluding function. The programme was organized at S.J. Auditorium, CPRI, Bengaluru. The Chief Guest in his address emphasized that everyone must adopt the changes and improvement that are connected to make India corruption free and to free our country from the evil practice of corruption, to stand united and be honest in our endeavors.

He shared his knowledge on malafide intention and bonafide intention on Vigilance and also stressed policy, procedures of Central Vigilance Commission with special reference to Vigilance Awareness Week so as to create a positive environment which is enabler for taking decisions. The Officers/ Officials of the Institute at Headquarters attended the function.

Concluding Function of Vigilance Awareness Week

• VIGILANCE CASES

Nil

• INFORMATION ON RIGHT TO INFORMATION ACT

CPRI has Right to Information (RTI) Cell to respond RTI applications and the RTI Cell consists of CPIO, APIO & Appellate Authority under the Ministry of Power. The nominated RTI Cell office bearer are Dr. P.Thomas, Additional Director as Appellate Authority, Shri. M. Janardhana, Additional Director as Central Public Information Officer and Shri. G. Kishore Kumar, Joint Director as Central Assistant Public Information Officer.

The sumoto disclosure of the organization information is uploaded in web site of CPRI (www.cpri.res.in) under the RTI act 2005, section 4 with all the details of staff, organization and updated on daily, monthly and quarterly basis.

The data on no. of applications received and replies sent to applicants during the year 2022-2023 i.e., from 01.04.2022 to 31.03.2023 is given below:

No. of Applications received	Total Directly received applications	Applications forwarded by MoP	Applications forwarded by others	Applications transferred to other departments	Applications Rejected under the various clauses of section-8 RTI
110	110	18	3	2	9

All the RTI applications responded by RTI Cell is within the specified period.

• LIAISON OFFICER FOR SC/ST & PWD WELFARE ACTIVITIES

Activities relating to Liaison Officer SC/ST & PWD & OBC Welfare Activities:

Shri. P Kaliappan, Joint Director and Shri. T Mallikharjuna Rao, Additional Director, CPRI, Bengaluru served as Liaison Officers for SC/ST & PWD and OBC categories respectively during the year 2022-23. Reservation registers and Roster registers were updated for the year 2022-23.

Representation of Scheduled Caste, Scheduled Tribe & OBC as on 31st March 2023:

Group	Total	SC	ST	OBC	Others
A	162	40	15	36	71
B	143	27	22	33	61
C	103	21	12	32	38
MTS	27	11	3	3	10
Total	435	99	52	104	180
Percentage	-	**22.76**	**11.95**	**23.91**	**41.38**

Shri. Benjamin Karunakaran, Deputy Secretary & Liaison Officer for OBC, Ministry of Power along with Smt.C.Thenmoli, Under Secretary (Reservation), Ministry of Power visited CPRI, Bengaluru on 7th October 2022 to discuss the issues related to OBCs.

Representation of Physically Challenged Employees as on 31st March 2023

Sl. No.	Post(s)	No. of employees	No. of physically challenged employees	Percentage of physically challenged employees
1	Director General	1	-	
2	Director	0	-	-
3	Additional Director	10	-	-
4	Joint Director	42	-	-
5	Chief Accounts Officer (SG)	1	-	-
6	Chief Administrative Officer (OG)	1	-	-
7	Scientists/Engg Officers	135	6	4.44
8	Scientists/Engg Assistants	21	-	-

Sl. No.	Post(s)	No. of employees	No. of physically challenged employees	Percentage of physically challenged employees
9	Non-Tech Officers	11	-	-
10	Office Staff/Stenographer	67	4	5.97
11	Library staff	1	-	-
12	Technicians	66	-	-
13	Technical Attendant/Attendant	45	4	8.89
14	Drivers/Cook-cum-care taker	7	-	-
15	Multi-Tasking Staff	27	-	-
		435	**14**	**3.22**

• PUBLIC & STAFF GRIEVANCE CELL

Central Power Research Institute has a separate cell for redressing the staff and public grievances. The Grievance Redressal Mechanism is a part and parcel of the machinery of CPRI Administration. The role of Public and Staff Grievance Cell is primarily to assist the management in redressing the Staff and Public grievance petitions. The grievance received by the Cell are forwarded to the concerned Section/Division who are dealing with substantive function linked with the grievance for redressal under intimation to the complainant. The complaints are either received in person, by post, Fax, e-media or through online CPGRAMS portal. CPRI web portal has direct link to CPGRAMS portal www.CPGRAMS.IN. The CPGRAMS offers to the staff and public the facility of lodging online grievances, on-line reminders and online view of current status of the grievances. The guideline indeed is that the CPRI deal with every grievance in a fair, objective and just manner. The monitoring of grievances received and disposed of by CPRI under Public & Staff Grievances Cell is on a regular basis.

During the year 2022-23, CPRI has redressed several grievance petitions including 35 grievances from online grievance portal and 6 grievances from other means (through letter, email, RTI etc.). Grievance petitions received from the staff, ex-employees and general public are on matters related to pension, transfer, recruitment and promotion policies, research schemes, medical and staff welfare measures. Suggestions, comments made by the general public have been appreciated and replied.

Summary of online grievances received and disposed:

Grievance Source	B/F Balance	Receipt During the Period	Total Receipts	Cases Disposed of During the Period	Closing Balance as on 31/03/2023	Yet to Assess	At our Office
DARPG	0	0	0	0	0	0	0
Local/Internet	0	16	16	14	2	0	0
Pension	0	0	0	0	0	0	0
PMO	0	19	19	17	2	0	0
Total	0	35	35	31	4	0	0

• CPRI LIBRARY AND INFORMATION CENTRE, BENGALURU

The Library and Information Centre is a specialized facility dedicated to serving the needs of Electrical and Power Engineering. It is situated on the ground and first floor at the centre of the campus.

The Institute has a modern Library with a vast collection of over 65,500 documents which offers a diverse range of resources, including technical books, reports, standards, CD-ROMs, Hindi literature, fiction, audio-visual educational cassettes, and back volumes of journals.

To enhance accessibility and user experience, the Library provides Windows and Ubuntu Computer Systems with internet connectivity. Additionally, the Library offers a dedicated Wi-Fi facility for laptop users, while ensuring the security of premises with CCTV web cameras.

By leveraging the power of KOHA Library Management System, the Library has automated crucial operations such as acquisition, circulation, and cataloguing. The Library also features a Knowledge Management System portal for the archiving of digital documents and standards.

The Institute has established various amenities for the patrons of Library, including a Web Online Public Access Catalogue (Web OPAC) for effortless resource searching, a Knowledge Management portal, an e-resource browsing area, and a designated laptop zone equipped with Wi-Fi connectivity.

In the past year (2022-23), the Library has expanded its collection with the addition of 260 documents, encompassing IEC, ASTM, BIS, ISO standards, and other publications. The total number of Library cardholders is 155 members. The Library has subscribed to nineteen journals, both domestic and International, and newspaper subscriptions in multiple languages, including Hindi, English, and Kannada. Moreover, the Library has secured annual subscriptions to CIGRE Collective Membership, IEEE Xplore Digital Library Enterprise Level 1, the complete set of the Bureau of Indian Standards, and a Grammarly Premium subscription to aid the users.

National Library Week - 2022

During National Library Week in November 2022, the Library arranged a notable event where the Director General of the Institute unveiled a photograph of Shri. S.R. Ranganathan, renowned as the father of Library and Information Science. The Librarian took the opportunity to present a concise overview of the diverse range of resources and services offered by the Library to the esteemed guests in attendance.

The Library & Information Centre is continuously enhancing the services and resources, ensuring that the users always have access to the most up-to-date information in a conducive environment for Research and Learning.

Unveiling of a photograph of Shri. S.R. Ranganathan, renowned as the father of Library and Information Science, at the Library & Information Centre, CPRI, Bengaluru

SECTION - 9

FINANCE & ACCOUNTS

Finance & Accounts

The Institute has done well in its financial performance during the year 2022-23 and earned revenue of Rs.179.26 Crores

Revenue earnings during the past five years are as follows:

Year	Revenue in Rs. (Amount in Crores)
2022-2023	179.26
2021-2022	131.39
2020-2021	149.39
2019-2020	160.08
2018-2019	204.50

During the year under report, as against the revenue realization of Rs.17926.38 lakhs, the expenditure on non-plan activities stood at Rs.17,664.55 lakhs resulting in a surplus of Rs.261.83 lakhs. For the 34th year in succession, the Institute has not drawn any Non-Plan Grant-in-Aid from the Government of India.

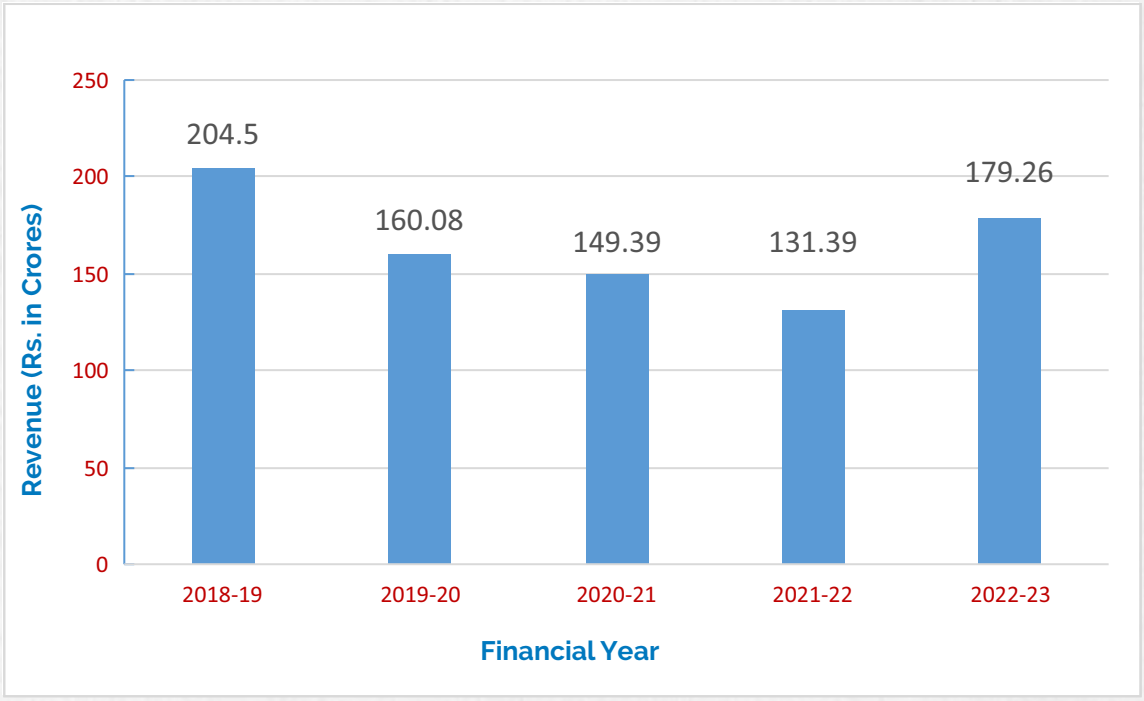
During the year, the expenditure under various heads has been as follows:

Non Plan Expenditure	Rs. 17,664.55 lakhs
Plan Capital Expenditure	Rs. 14,652.98 lakhs
Plan R & D Expenditure	Rs. 287.03 lakhs
RSoP Schemes	Rs. 621.17 lakhs
NPP Schemes	Rs. 903.74 lakhs

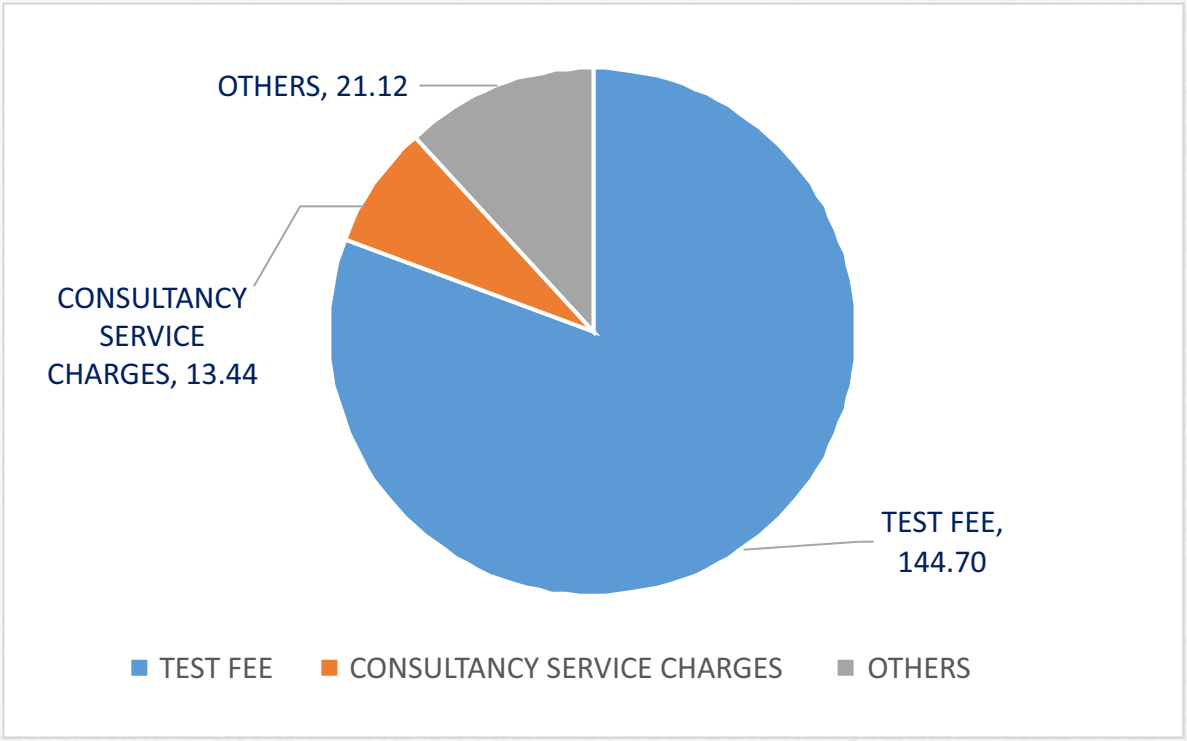
The Institute received grants-in-aid (Plan) of Rs.17,496.04 lakhs from the Government of India during the year. The details along with Auditors Report are furnished in Appendix– 11.

As at the end of March 2023, the capital investment by the Government of India on the Institute has been Rs.1,30,477.53 lakhs.

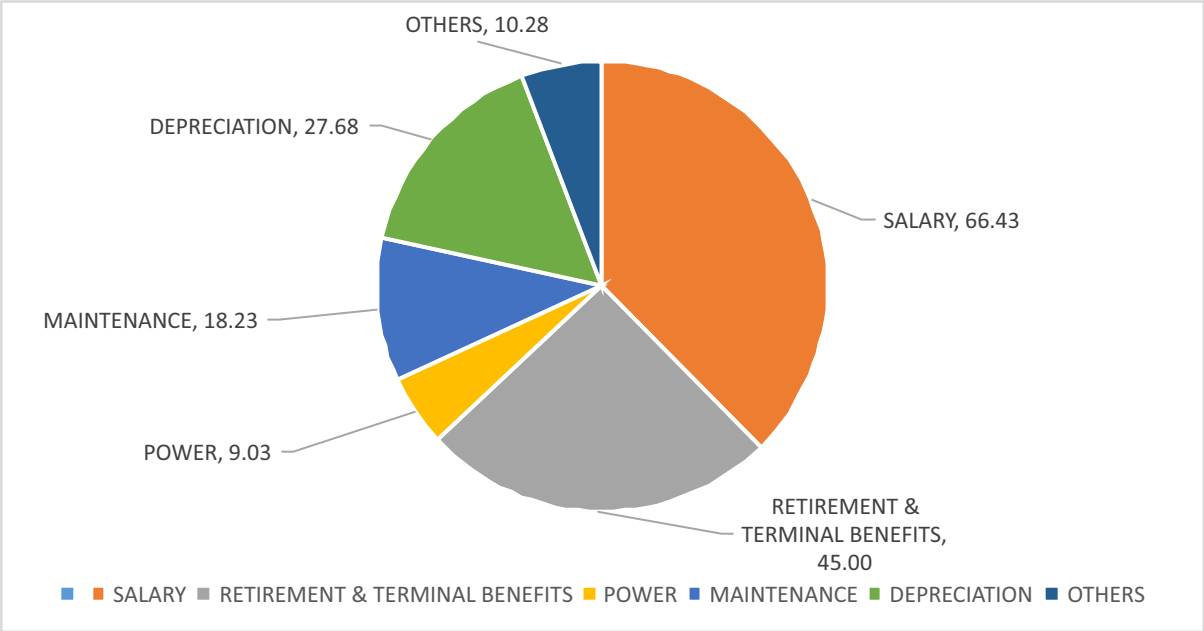
REVENUE EARNINGS DURING THE PAST FIVE YEARS (Rs. in Crores)



REVENUE DURING 2022-23 UNDER MAJOR HEADS (Rs. in Crores)



EXPENDITURE DURING 2022-23 UNDER MAJOR HEADS (Rs. in Crores)



SECTION - 10

ACTIVITIES IN OFFICIAL LANGUAGE: HINDI

ACTIVITIES IN OFFICIAL LANGUAGE: HINDI

Remarkable achievements of the Institute in the field of Official Language Implementation during the year 2022 – 23 are listed below:

· AWARD

- **TOLIC Rajbhasha Shield (First)**

Central Power Research Institute, Bangalore was awarded TOLIC Rajbhasha Shield - First in the Category 3 (more than 50 employees) for its outstanding performance in the field of Official Language Hindi during the year 2021-22, which was given by Shri. L. Manjunath, Chief Post Master General, Karnataka Circle and Chairman, TOLIC (2) during the second meeting of TOLIC held on 10th March 2023 at Indian Institute of Horticultural Research, Bangalore. The photograph is placed below:

Tolic Rajbhasha Award to CPRI

- **NTPC Rajbhasha Shield**

a) The Institute was awarded with 'NTPC Rajbhasha Shield - Protsahan Puraskaar' for its remarkable performance in the field of implementation of Official Language Policy during the year 2018 - 2019. The award was presented by Hon'ble Minister of Power and New and Renewable Energy, Shri. R.K. Singh and Hon'ble Union Minister of State for Power and Heavy Industries, Shri. Krishna Pal to the Director General, CPRI in the presence of Secretary, Power, Shri. Alok Kumar, during Hindi Salahkar Samiti meeting held in New Delhi on 12th May 2022.

Shri. V.S.Nandakumar, Director General, CPRI receiving the Award

b) The Institute was awarded with 'NTPC Rajbhasha Shield - Protsahan Puraskaar' for its remarkable performance in the field of implementation of Official Language Policy for the year 2019 - 2020 also. The award was presented by Hon'ble Minister of Power and New and Renewable Energy, Shri. R.K. Singh and Hon'ble Union Minister of State for Power and Heavy Industries, Shri. Krishna Pal to the Director General, CPRI in the presence of Secretary, Power, Shri. Alok Kumar, during Hindi Salahkar Samiti meeting held in New Delhi on 12th May 2022.

· INSPECTION

a) Inspection by the Second Sub-Committee of the Committee of Parliament on Official Language at UHVRL, CPRI, Hyderabad

The Second Sub-committee of the Committee of Parliament on Official Language conducted inspection meeting of UHVRL, CPRI Hyderabad on 18th June 2022 in the presence of Senior Officers of the Ministry and the Department. The committee reviewed the Official Language-Hindi work being done in the office and gave some suggestions for improvement while appreciating some good works. At the end, Certificate was presented to the Unit Head, UHVRL, Hyderabad by the honourable members.

Unit Head, UHVRL, Hyderabad receiving the certificate from the Hon'ble Members of the Second Sub-Committee of the Committee of Parliament on Official Language

b) Inspection of CPRI, Bangalore by the Second Sub-Committee of the Committee of Parliament on Official Language.

The Second Sub-Committee of the Committee of Parliament on Official Language conducted an inspection program with CPRI, Bangalore on 26th August 2022 in the presence of senior officials of the Ministry and the Department. The Committee reviewed the official language-Hindi work being done in the Institute. The works of CPRI were appreciated and Certificate was presented to the Director General CPRI by the honourable Members.

Director General CPRI receiving the Certificate from the Hon'ble Members of the Second Sub-Committee of the Committee of Parliament on Official Language

c) Inspection of STDS, Bhopal by the Second Sub-Committee of the Committee of Parliament on Official Language:

The Second Sub-Committee of the Committee of Parliament on Official Language held an inspection meeting with STDS, Bhopal on 19th October 2022 in the presence of Senior Officials of the Ministry and the Department. The committee reviewed the Official Language-Hindi work being done in the Unit and gave some suggestions for improvement while appreciating some good works. The Unit Head, STDS Bhopal along with the Director General, CPRI received the Certificate from the Honorable Members.

Unit Head STDS, Bhopal receiving the Certificate from the Hon'ble Members of the Second Sub-Committee of the Committee of Parliament on Official Language

d) Inspection of Thermal Research Centre, Nagpur by the Second Sub- Committee of the Parliamentary Committee on Official Language

The Second Sub-Committee of the Committee of Parliament on Official Language conducted an inspection program with Thermal Research Centre, Nagpur on 19th January 2023. The committee reviewed the Official Language-Hindi work being done in the Institute. Unit Head, TRC, Nagpur was presented with a Certificate by the Honourable Members.

Unit Head, TRC, Nagpur receiving the Certificate from the Hon'ble Members of the Second Sub-Committee of the Committee of Parliament on Official Language

e) Inspection of Regional Testing Laboratory, Noida

Inspection of Regional Testing Laboratory, Noida was carried out by Regional Implementation Office on 12th May 2022. Compliance Report in this regard has also been sent.

f) Inspection of Thermal Research Center, Nagpur

On-line inspection of Thermal Research Centre, Nagpur was carried out by Regional Implementation Office (West), Mumbai on 23rd February 2023. Compliance Report in this regard has also been sent.

· HINDI WORKSHOP

a) Hindi Workshop on "Committee of Parliament on Official Language: Expectations and Preparations"

An online Hindi workshop was organized on the topic "Committee of Parliament on Official Language: Expectations and Preparations" on 13th June 2022. Shri. Srinivasa Rao, Assistant Manager, BEL, Headquarters, Bangalore was the speaker. All the participants interacted enthusiastically and made the program successful.

b) "Official Language Orientation Programme on the topic "Necessary IT tools for Official Language – Unicode : Installation and Usage".

An Official Language Orientation Programme on the topic "Necessary IT tools for Official Language – Unicode : Installation and Usage" was organised under the auspices of the TOLIC - 2 for all the officers and employees associated with the implementation of the official language working in all the Central Government offices located in Bangalore, as well as for the clerical employees of the Institute on 15th December 2022 at S. J. Auditorium. Dr. Malthesh Maillar, MTRDC, DRDO, Bengaluru was the faculty. As the workshop was very useful and relevant, all the officers and employees associated with Official Language participated with great enthusiasm.

Participants of the Orientation Programme

a) Table Workshop

Table workshop regarding implementation of Official Language was conducted on 29th March 2023 for Power System Division. The staff of the Division were given guidance regarding the use of Hindi in their day-to-day activities and submission of correspondence data, Maintaining Headings / titles of registers and files bilingual.

· PUBLICATIONS

a. Annual Report

The Annual Report of the Institute for the year 2021-22 has been published in bilingual.

b. Rajbhasha Samachar

Seventh issue of the annual magazine – Rajbhasha Samachar has been brought out which depicts the achievements of Official Language in the Institute.

c. STDS Darpan

19th issue of the House magazine - STDS Darpan of STDS, Bhopal was brought out during the year.

· HINDI MONTH & HINDI DIVAS

Hindi Month was celebrated from 05th to 16th September 2022. During this period, Hindi Essay, Hindi Song, Translation (Hindi – English – Hindi), Hindi Crossword Puzzle, Hindi Quiz and Antakshari competitions were conducted which were held separately for Officers and employees possessing working knowledge and proficiency in Hindi. Most of the Officers and staff of the Institute participated in all the competitions with great enthusiasm. Under the incentive scheme, original noting and drafting competition was organized in which one first prize, three second prizes and three third prizes were awarded. Technical Article Competition was organized for all the member offices of TOLIC – II at Bangalore. Cash prizes were also awarded to the winners of three best technical articles in Hindi.

Hindi Divas Celebration

Hindi Divas was celebrated on 16th September 2022 at CPRI, Bangalore. The Institute has always given utmost importance to the implementation of Official Language and all precautions are being taken to achieve the specified goals. A report on the implementation of Official Language Policy during the year 2021-22 was presented. Prizes were distributed to the winners of various competitions.

Hindi Divas Celebration

Facility of Hindi in all computers

Unicode has been activated in all computers of Officers and Employees and training has been given to everyone to work on it. Training on VOICE TYPING has also been provided to the clerical staff of the Institute.

Activities of Town Official Language Implementation Committee

a) The first meeting of TOLIC-II was held on 05th July 2022 at GPO, Bangalore. Dr. M.V. Rao, Additional Director, Smt. L.N. Vidya, Senior Hindi Officer and Dr. M. Shamla, Senior Hindi Translator participated in the meeting.

b) The second meeting of TOLIC-II was held on 10th March 2023 at IIHR, Bangalore. Shri. Ramjeet Singh, Additional Director, Dr. M.V. Rao, Additional Director and Smt. L.N. Vidya, Senior Hindi Officer participated in the meeting.

c) Under the aegis of TOLIC-II, Bengaluru, the Institute organized and sponsored a Crossword Puzzle competition under Inter organizational competitions for all the Member Offices on 06th October 2022. Officers and employees from around 25 offices participated in this competition.

d) The Officers and employees of the Institute also participated in the competitions organized by other organizations under TOLIC- II, Bangalore.

· OTHER ACTIVITIES

a. Learn "a word - a day" Scheme

Boards are installed at the Main Gate of the Institute and at the entrance of the Head Office. Two staff members of the Institute have been provided with the administrative terminology sent by the Commission for Scientific and Technical Terminology, with the help of which a Hindi word with its English meaning is being written on these boards every day by the employees specified for this work.

b. Learn "Ten words a Month" Scheme

Under "Learn and use Ten Hindi words per month scheme", Ten Hindi words with their English equivalents are released every month and all the employees are requested to use these words in their day-to-day official work during that month.

c. Tenders in Bilingual

All the Notice Inviting Tenders, E-Tenders, Corrigendum, Addendum, Notice Inviting Quotation etc. from Civil Engineering Division, Mechanical Engineering Division, Purchase Section etc. are issued and published in bilingual in Newspapers. Also, they are uploaded on the CPRI website simultaneously.

d. Advertisements in Bilingual

All the Advertisements relating to Posts are being issued in bilingual and also published in Newspapers in bilingual. They are also uploaded on the CPRI website simultaneously.

9. Website

The website of the Institute www.cpri.res.in is available in Bilingual and is being updated from time to time.

10. Supply of Forms

Three kinds of forms (Hindi / Hindi–Kannada/ Hindi–English) are used in the Institute and are uploaded in CPRI Website.

i. 64 different types of forms are available in Bilingual.

ii. Only Hindi forms are issued to employees possessing the working knowledge of Hindi.

iii. Hindi-Kannada forms are also made available.

11. English-Hindi Phrases and Notings printed on folders

The file folders used in the Institute contain 40 English-Hindi Phrases and 40 English-Hindi Notings printed on each side so that every employee who does desk work can easily access the ready reckoner list of Hindi Phrases and Notings.

SECTION - 11

APPENDICES 1 TO 11

Appendix-1

THE MEMBERS OF STANDING COMMITTEE AS ON 31ST MARCH 2023

Sl. No.	Present incumbent/Nominee	Status
1	**Shri Ajay Tewari, IAS** Additional Secretary Ministry of Power, Shram Shakti Bhawan, Rafi Marg, New Delhi – 110 001	Chairman
2	**Shri Ashish Upadhyaya, IAS** Special Secretary & Financial Adviser, Ministry of Power Shram Shakti Bhawan, Rafi Marg, New Delhi – 110 001	Member
3	**Shri Ashok Kumar Rajput** Member (Power System), Central Electricity Authority, Sewa Bhawan, R.K.Puram, New Delhi – 110 066	Member
4	**Shri Jithesh John** Economic Adviser, Ministry of Power, Shram Shakti Bhawan , Rafi Marg, New Delhi – 110 001	Member
5	**Shri Asit Singh** Director General, Central Power Research Institute, Post Box No. 8066, Bangalore–560 080	Member- Convener

Appendix-2

THE MEMBERS OF COMMITTEE ON TESTING & CERTIFICATION AS ON 31st MARCH 2023

<table>
<tr><td colspan="2">Chairperson
Member (Power Systems)
Central Electricity Authority, Sewa Bhavan, R.K.Puram
NEW DELHI - 110066, Fax: 011-26102721</td></tr>
<tr><td colspan="2">Members</td></tr>
<tr><td>Executive Director
Southern Region Transmission System – II,
Power Grid Corporation of India,
Sahakara Bhavana, 32, Race Course Road,
Bengaluru - 560001</td><td>Scientist F and Head
Bureau of Indian Standards
Peenya Industrial Area, 1st Stage
Tumkur Road, Bengaluru - 560058</td></tr>
<tr><td>General Manager
Solar Business Division,
Bharat Heavy Electricals Ltd.,
Prof. C.N.R Rao Circle, opp IISC,
Malleshwaram, Bengaluru - 560012</td><td>Member (Commercial)
West Bengal State Electricity
Distribution Company Ltd.,
Vidyut Bhavan, Block – DJ Sector – II
Bidhannagar, Kolkatta - 700091</td></tr>
<tr><td>Technical Director
Karnataka Power Corporation Ltd.
82, Shakthi Bhavan,
R. C. Road, Bengaluru - 560001</td><td>Head (Product Development)
Siemens Ltd.,
M. V. Switchgear & Switch Boards
P. B. No. 85, Thane Belapur Road
Thane - 400601</td></tr>
<tr><td>Director General
Indian Electrical & Electronics
Manufacturers Association
501, Kakad Chambers, 132, Dr. A. Besant
Road, Mumbai - 400018</td><td>Executive Director (Engineering)
NTPC Ltd.,
Engineering Office Complex
Sector-24, Noida - 201301 (UP)</td></tr>
<tr><td colspan="2">Member Convenor</td></tr>
<tr><td colspan="2">Director General
Central Power Research Institute
Prof. Sir C.V.Raman Road, P.B. No. 8066,
Sadashivanagar P.O., Bengaluru 560080</td></tr>
</table>

Appendix-3

THE MEMBERS OF STANDING COMMITTEE ON RESEARCH & DEVELOPMENT (SCRD) AS ON 31ST MARCH 2023

Sl. No.	SCRD - Main Committee	Name & Address	Position
1	Chairperson	Shri Ghanshyam Prasad Chairperson Central Electricity Authority Room No. 201 (North), 2nd Floor, Sewa Bhawan, R.K.Puram, Sector-1, New Delhi-110 066	Chairman
2	Addl. Secretary & FA, Ministry of Power, Govt. of India	Shri. Ashish Upadhyaya Special Secretary and FA Ministry of Power, Govt. of India, Shram Shakti Bhawan New Delhi – 110 001	Member
3	Economic Advisor Ministry of Power, Govt. of India	Shri Jithesh John Ministry of Power, Govt. of India, Shram Shakti Bhawan, New Delhi – 110 001	Member
4	Member Planning (R&D)	Shri A. Balan Office of Member Planning Central Electricity Authority, 3rd Floor, Sewa Bhavan, R K Puram, Sector -1, New Delhi – 110 066	Member
5	Chairman of Technical Committee for Thermal Research	Prof. Gautam Biswas Professor Department of Mechanical Engineering Indian Institute of Technology Kanpur, Kalyanpur, Kanpur-208016	Member
6	Chairman of Technical Committee for Hydro Research	Late Prof R P Saini Professor, Former Professor-in-Charge, Greater Noida Extension Centre (GNEC) Department of Hydro and Renewable Energy, (Formerly Alternate Hydro Energy Centre) Indian Institute of Technology Roorkee, Roorkee - 247 667, Uttarakhanda	Member

Sl. No.	SCRD - Main Committee	Name & Address	Position
7	Chairman of Technical Committee for Transmission Research	Prof. K Shanti Swarup Professor Department of Electrical Engineering Indian Institute of Technology Madras, Chennai – 600 036	Member
8	Chairman of Technical Committee for Grid, Distribution & Energy Conservation	Prof. Sukumar Mishra Professor Department of Electrical Engineering Indian Institute of Technology Delhi, New Delhi-110 016	Member
9	DSIR-Scientist-G & above	Scientist 'G' Department of Scientific and Industrial Research New Delhi – 110 016	Member
10	DPIIT-IPR Expert	Shri S Thangapandian Deputy Controller of Patents & Designs, Patent Office, Chennai-600 032	Member
11	CEA	Chief Engineer (R&D) Central Electricity Authority, 3rd Floor, Sewa Bhavan R K Puram, Sector -1, New Delhi – 110 066	Member
12	Director General CPRI	Director General, Central Power Research Institute Prof. C V Raman Road, Sadashivanagar, P.B. No.8066, Bangalore – 560 080	**Convener**
	Special Invitees		
13	BHEL	Executive Director (CDT & CTM) Bharat Heavy Electricals Limited, BHEL House, Siri Fort, New Delhi – 110 049	Member
14	POWERGRID	Executive Director (Incharge of R&D) Power Grid Corporation of India Ltd. 'Saudamini', Plot No. 2, Sector 29, Gurgaon, Haryana – 122 001	Member

Sl. No.	SCRD - Main Committee	Name & Address	Position
15	NTPC (NETRA)	Shri Shaswattam Chief General Manager (NETRA) NTPC-NETRA E3 Ecotech-II, Udhyog Vihar Gautam Budh Nagar – 201 306 (Uttar Pradesh)	Member
16	NHPC	Shri Rajesh Sharma Executive Director, O&M Section, NHPC Office Complex, Sector-33, Faridabad – 121 003	Member
17	MNRE	Scientist G Ministry of New and Renewable Energy Block 14, CGO Complex, Lodhi Road, New Delhi - 110003	Member
18	DST	Dr. J B V Reddy Scientist E Department of Science & Technology, Technology Bhavan, New Mehrauli Road, New Delhi-110 016	Member

Appendix-4

THE MEMBERS OF TECHNICAL COMMITTEE ON THERMAL RESEARCH AS ON 31ST MARCH 2023

Sl. No.	Affiliation	Position	Name & Address
1	Professor from IIT Kanpur	Chairman	Prof. Gautam Biswas Professor Department of Mechanical Engineering Indian Institute of Technology Kanpur, Kalyanpur, Kanpur-208 016
2	ED, NETRA, NTPC	Member	Shri. S Sarkar General Manager (NETRA) E3 Ecotech-II, Udhyog Vihar, Gautam Budh Nagar – 201 306 (Uttar Pradesh)
3	ED- BHEL (Thermal)	Member	Shri Dipesh Palit GM (PEM) Bharat Heavy Electricals Limited, BHEL House, Siri Fort, New Delhi – 110 049
4	Chief Engineer, (TETD),CEA	Member	Shri D K Srivastava Chief Engineer (TE & TD) Central Electricity Authority Sewa Bhawan, 9th Floor; South Wing, R K Puram, Sector-1, New Delhi 110 066
5	Representative of Generating Company (TATA Power Ltd)	Member	Chandra Prakash Tiwari Head-Technology & Process Engineering(G) Tata Power, Trombay Thermal Power Station Chembur - Mahul Mumbai 400074
6	CPRI representative	Member	Dr Saravanan V Joint Director, MTD, CPRI
		Member	Dr. S K Nath, Joint Director, TRC, CPRI, Nagpur

Sl. No.	Affiliation	Position	Name & Address
7	Chief Engineer-R&D / Director-R&D, CEA	Permanent invitee	Chief Engineer (R&D) Central Electricity Authority, 3rd Floor, Sewa Bhavan R K Puram, Sector -1, New Delhi – 110 066
8	CPRI	**Member - Convener**	Dr M Venkateswara Rao Additional Director & HoD R&D Management Division, CPRI

Appendix-5

THE MEMBERS OF TECHNICAL COMMITTEE ON HYDRO RESEARCH AS ON 31ST MARCH 2023

Sl. No.	Affiliation	Position	Name & Address
1	Professor from IIT / IISc	Chairman	Late Prof R P Saini Professor, Former Professor-in-Charge, Greater Noida Extension Centre (GNEC) Department of Hydro and Renewable Energy, (Formerly Alternate Hydro Energy Centre) Indian Institute of Technology Roorkee, Roorkee - 247 667, Uttarakhanda
2	ED- BHEL (Hydro Expert)	Member	Shri S M Ramanathan GM (Hydro) Bharat Heavy Electricals Limited, BHEL House, Siri Fort, New Delhi–110049
3	ED - NHPC (Hydro Expert)	Member	Shri Rajesh Sharma Executive Director, O&M Section, NHPC Office Complex Sector-33, Faridabad – 121 003
4	ED – SJVNL (Hydro Expert)	Member	Er Harish Kumar Sharma Chief General Manager HOD, Electrical Design Department SJVNL, Shakthi Sadan, Shanan, Shimla – 171 006
5	Chief Engineer, CWC, New Delhi	Member	Shri S K Sibal Chief Engineer, Design (N&W) Central Water Commission 4th Floor (South), Sewa Bhawan, R.K. Puram, New Delhi – 110 066
6	Chief Engineer, (HETD),CEA	Member	Chief Engineer (HE & TD) Central Electricity Authority Sewa Bhawan, 7th Floor, North Wing, R K Puram, Sector-1, New Delhi 110 066

Sl. No.	Affiliation	Position	Name & Address
7	Representative from CPRI	Member	Shri Janardhana M Joint Director, MTD, CPRI
		Member	Dr R K Kumar Joint Director, MTD, CPRI
8	Chief Engineer-R&D / Director-R&D, CEA	Permanent invitees	Chief Engineer (R&D) Central Electricity Authority, 3rd Floor, Sewa Bhavan, R K Puram, Sector -1, New Delhi – 110 066
9	CPRI	**Member-Convener**	Dr M Venkateswara Rao Additional Director & HoD R&D Management Division, CPRI

Appendix-6

THE MEMBERS OF TECHNICAL COMMITTEE ON TRANSMISSION RESEARCH AS ON 31ST MARCH 2023

Sl. No.	Affiliation	Position	Name & Address
1	Professor from IITM- Chennai	Chairman	Prof. K Shanti Swarup Professor Department of Electrical Engineering Indian Institute of Technology Madras, Chennai – 600 036
2	ED-BHEL (Transmission)	Member	Smt. Aruna Gulati AGM (TBG) Bharat Heavy Electricals Limited, BHEL House, Siri Fort, New Delhi – 110 049
3	ED-POWERGRID	Member	Executive Director (Technology Development) Power Grid Corporation of India Limited "Saudamini", Plot No. 2, Sector-29, Gurgaon – 122 001, Haryana
4	Chief Engineer (SETD),CEA	Member	Chief Engineer (PSETD) Central Electricity Authority, Sewa Bhavan, 3rd Floor, R K Puram, Sector -1, New Delhi – 110 066
5	Representative of State Transco (KPTCL)	Member	Sri G R Chandrasekharaiah Director (Transmission) Karnataka Power Transmission Corpn. Ltd., Kaveri Bhavan, K.G. Road Bangalore – 560 009
6	Representative of IEEMA	Member	Shri Mustafa Wajid Managing Director MHM Holdings Private Limited #52/1, Basappa Road Shanthinagar, Bangalore – 560 027
			Ms. Aaryaa Satyanarayana Director Venson Electric Private Limited #331, 9th Cross, 4th Phase, Peenya Industrial Area, Bangalore - 560058

Sl. No.	Affiliation	Position	Name & Address
7	Representative of CPRI	Member	Dr. P. M. Nirgude Additional Director, UHVRL, CPRI, Hyderabad
8	Chief Engineer-R&D / Director-R&D, CEA	Permanent invitees	Chief Engineer (R&D) Central Electricity Authority, 3rd Floor, Sewa Bhavan R K Puram, Sector -1, New Delhi – 110 066
9	CPRI	**Member - Convener**	Dr M Venkateswara Rao Additional Director & HoD R&D Management Division, CPRI

Appendix-7

THE MEMBERS OF TECHNICAL COMMITTEE ON GRID, DISTRIBUTION & ENERGY CONSERVATION RESEARCH AS ON 31ST MARCH 2023

Sl. No.	Affiliation	Position	Name & Address
1	Professor from IIT - Delhi	Chairman	Prof. Sukumar Mishra Professor Department of Electrical Engineering Indian Institute of Technology Delhi, New Delhi-110 016
2	Representative from BEE	Member	Shri Sameer Pandita Director Bureau of Energy Efficiency 4th Floor, Sewa Bhawan R.K. Puram, New Delhi – 110 066
3	Chief Engineer (DP&D),CEA	Member	Chief Engineer (DP&D) Central Electricity Authority, R K Puram, Sector -1, 7th Floor, Sewa Bhavan, New Delhi – 110 066
4	Representative from MNRE	Member	Scientist G Ministry of New and Renewable Energy Block 14, CGO Complex, Lodhi Road New Delhi – 110 003
5	Representatives of TANGEDCO	Member	Chief Engineer (IC, R&D) TANGEDCO, 4th Floor, Eastern Wing, 144, Anna Salai, Chennai – 600 002
6	Representative of IEEMA	Member	Shri Mustafa Wajid Managing Director MHM Holdings Private Limited #52/1, Basappa Road Shanthinagar, Bangalore – 560 027
		Member	Ms. Aaryaa Satyanarayana Director Venson Electric Private Limited #331, 9th Cross, 4th Phase, Peenya Industrial Area Bangalore – 560 058

Sl. No.	Affiliation	Position	Name & Address
7	Representative of CPRI	Member	Shri Sudhir Kumar R Joint Director, ERED, CPRI
		Member	Shri Jyotibasu S Joint Director, ERED, CPRI
		Member	Dr Amit Jain Joint Director, PSD, CPRI
8	Chief Engineer-R&D / Director-R&D, CEA	Permanent invitees	Chief Engineer (R&D) Central Electricity Authority, 3rd Floor, Sewa Bhavan R K Puram, Sector -1, New Delhi – 110 066
9	CPRI	**Member - Convener**	Dr M Venkateswara Rao Additional Director & HoD R&D Management Division, CPRI

Appendix-8

PERSONNEL DEPUTED ABROAD FOR MEETING / CONFERENCE / PRE-DISPATCH INSPECTION OF EQUIPMENT / THIRD PARTY WITNESSING DURING THE YEAR 2022-23

Sl. No.	Name & Designation of the officer Shri/Smt./Kum.	Purpose of Visit	Country	Duration
1	Dr. T. Bhavani Shanker Joint Director/HoD CPRI, Bengaluru	Head of Indian Delegation and Participation in for IEC-TC-33 meeting along with MT-13,MT-19,MT-21,WG-23 meetings	Kista-Sweden	07th and 08th September 2022
2	Ashitha.P.N Engineering Officer Gr.2 CPRI, Bengaluru	IEC Young Professionals Programme	San Francisco USA	01st to 07th November 2022
3	Arunkumar S. Engineering Officer Gr.4 CPRI, Bengaluru	Third Party witnessing of routine and type tests on 90MVA, 132/33kV, 3-Phase Transformer of M/s. Malaysia Transformer Manufacturing Sdn. Bhd, Malaysiaa	Malaysia	07th to 24th December 2022

Appendix-9

MEMBERSHIP OF CPRI OFFICERS IN INTERNATIONAL / NATIONAL COMMITTEES

Sl. No.	Name & Designation Shri/Smt./Kum.	Position	Name of the Committee
1	V. S. Nandakumar Director General, CPRI	Chairman	Electro Technical Division (ETD) of BIS
2	M.K. Wadhwani Additional Director STDS-CPRI, Bhopal	Chairman	High Voltage Switchgear & Control Gear Sectional Committee ETD-08 of BIS
		Member	Fuses Sectional Committee ETD - 39
			BIS Power Transformers Sectional Committee ETD-16
3	B.A. Sawale Additional Director STDS-CPRI, Bhopal	Member & Convener of Panel	BIS ETD-13 - Equipment for Electrical Equipment for Electrical Energy Measurement and Load Control
		Corporate Member	IETE
		Member	Expert Committee of Energy Metering-CBIP
			IEC TC13/WG11, WG14, WG15
			State Tariff Advisory Committee for MPSERC, Bhopala
4	Swaraj Kumar Das Additional Director CPRI, Bengaluru	Member	BIS Sectional Committee, ETD – 34 - Instrument Transformers & ETD – 07 – Low Voltage Switchgear & Controlgear
5	Dr. Pradeep M Nirgude Additional Director UHVRL-CPRI, Hyderabad	Principal Member	BIS ETD-48 - UHV AC Transmission Systems - Sectional Committee
			BIS ETD-19-High Voltage Engineering Sectional Committee
			BIS ETD - 36 – Tools & Equipment for Live Working - Sectional Committee

Sl. No.	Name & Designation Shri/Smt./Kum.	Position	Name of the Committee
		Alternate Member	Bureau of Indian Standards (BIS) ETD-30 - Surge Arresters Sectional Committee
			Basic Electro Technical Standards and Power Quality Sectional Committee ETD–01
6	S. Sudhakara Reddy Additional Director CPRI, Bengaluru	Chairman	BIS ETD-16 - Transformers
		Member	BIS ETD-08 - High Voltage Switchgear and Controlgear
			BIS ETD-47 – Railway Electric Traction Equipment
			TC-STL
			NEP-2022-27
			Advisory Board of National Power Training Institute, HLTC, Bengaluru
7	Dr. P Thomas Additional Director CPRI, Bengaluru	Chairman	BIS Sectional Committee ETD-03 – Fluids for Electrotechnical Applications
		Member	ETD-43 – Environmental Standardization for Electrical and Electronic Products and Systems, Bureau of Indian Standards, New Delhi
8	G.R. Viswanath Additional Director CPRI, Bengaluru	Principal Member	ETD-03 – Fluids for Electrotechnical applications – BIS Sectional Committee
9	Shiva Kumar V Joint Director CPRI, Bengaluru	Member	IEC TC 57/WG15 (Power systems management and associated information exchange / Data and Communication Security)
			IEC - TC 57 / WG 21 (Power systems management and associated information exchange / Interfaces and protocol profiles relevant to systems connected to the electrical grid)
			IEC TC 13/WG15 (Electrical energy measurement and control / Smart Metering Functions and Processes.)

Sl. No.	Name & Designation Shri/Smt./Kum.	Position	Name of the Committee
		Member	BIS LITD-10 Power System Control and Associated Communications
			BIS ETD 13 Equipment for Electrical Energy Measurement & Load Control
			ISGF-WG 2: IoT and Smart Metering, AI and Analytics
			ISGF WG3: Digital Architecture and Cyber Security
			ISGAN-SIRFN (International Smart Grid Action Network – Smart Grid International Research Facilities Network)
		Member Convener	BIS-LITD-10, Panel 2: Security
		Member Secretary	BIS LITD-10, Joint Working Group, Security
10	K.P. Meena Joint Director CPRI, Bengaluru	Chairman	BIS ETD-09 Power Cables Committee
11	R. Arunjothi Joint Director CPRI, Bengaluru	Member	BIS ET-09 Power Cables committee
			Dielectrics and Electrical Insulation Society
12	R. Sudhir Kumar Joint Director CPRI, Bengaluru	Principal Member	BIS-Sectional Committee ETD-23 "Lamps and related Equipment"
			BIS-Sectional Committee ETD-28 "Solar Photovoltaic Energy Systems"
			BIS Energy Storage Committee, ETD-52
		Certified "Energy Auditor and Energy Manager"	Bureau of Energy Efficiency, Ministry of Power, Govt. of India
		Member	BIS Illumination Engineering and Luminaires Sectional Committee, ETD-49

Sl. No.	Name & Designation Shri/Smt./Kum.	Position	Name of the Committee
13	S. Jothibasu Joint Director CPRI, Bengaluru	Principal Member	BIS, Solar Pumps Committee
		Accredited "Energy Auditor and Energy Manager"	Bureau of Energy Efficiency, Ministry of Power, Govt. of India
14	Dr. M. Selvaraj Joint Director CPRI, Bengaluru	Main Member	Use of structural steel in overhead transmission line tower and switch yard structures, BIS Committee – CED-7
			Standing committee of experts to investigate the cause of failure of towers, CEA, New Delhi
			Committee for Audit of Transmission lines tower with respect to design & life of Towers - CEA / CEID, New Delhi
		Member Convener	Conductors and Accessories on Overhead Lines, BIS Committee ETD 37, IEC/TC7 & TC11
		Individual Member	SCB2 Overhead Lines, CIGRE, Paris
15	Dr. V. Saravanan Joint Director CPRI, Bengaluru	Alternate Member	Clay and Stabilized soil products for construction, CED -30
		Member	Sub Group-4 (National Mission on the Utilization of Biomass in Thermal Power Plants, Ministry of Power)
			Biomass utilization relaxation Committee (CEA, Ministry of Power)
16	Dr. Amit Jain Joint Director CPRI, Bengaluru	Principal Member	BIS-LITD 10 (Power System Control and Associated Communications Sectional Committee)
		Member	Task Force to develop the framework for promotion of application of artificial intelligence and machine learning, big data, block chain technology, etc. in Power Sector, constituted by the Ministry of Power

Sl. No.	Name & Designation Shri/Smt./Kum.	Position	Name of the Committee
17	T. Bhavani Shanker Joint Director CPRI, Bengaluru	Chairman	Sectional Committee on Power Capacitors ETD-29 of BIS, New Delhi
		Member	MT 14 "Series capacitors for Power systems" under IEC/TC 33
			Technical Evaluation Committee for setting up of calibration facility for C & tan delta bridges at NPL, New Delhi
			WG-23 "Shunt capacitors of Self healing type for voltages above 1000V for Power systems" under IEC/TC 33
			MT 21 "Shunt capacitors for voltages up to and including 1000V for Power systems" under IEC/TC 33
			MT-19, "Shunt capacitors for voltages above 1000V for Power systems" under IEC/TC 33
			MT-25, "Special application capacitors" under IEC/TC 33
			WG-15 -"Dynamic field data including validation" under IEC/TC 104-Environmental conditions, classification and methods of test
		Alternate Member	Environmental testing procedures Sectional Committee LITD 01 of BIS.
18	S Shyam Sundar Joint Director CPRI, Bengaluru	Member	Sectional Committee of BIS, ETD 50 - LVDC Power Distribution Systems
19	Dr. J. Sreedevi Joint Director CPRI, Bengaluru	Principal Member	HVDC Power Systems Sectional Committee, ETD-40
20	G Pandian Joint Director CPRI, Bengaluru	Alternate Member	BIS Sectional Committee, ETD-36 – Tools & Equipment for Live Working
21	P Kaliappan Joint Director CPRI, Bengaluru	Principal Member	ETD 35 - Power Systems Relaying Committee
		Secretary	Panel 4 of LITD 10 PMU panel for PMU Testing and Certification

Sl. No.	Name & Designation Shri/Smt./Kum.	Position	Name of the Committee
22	P. Sadasiva Murthy Joint Director CPRI, Bengaluru	Member	ETD-03 – Fluids for Electrotechnical applications – BIS Sectional Committee
23	B. R. Vasudevamurthy, Joint Director, CPRI, Bengaluru	Member	BIS Sectional Committee ETD – 07 – Low Voltage Switchgear & Controlgear
24	Manohar Singh Takkher Joint Director STDS-CPRI, Bhopal	Member	High Voltage Switchgear & Control Gear Sectional Committee ETD-08
25	Sumbul Munshi Joint Director STDS-CPRI, Bhopal	Member	BIS Committee on Low Voltage Switchgear & Control gear ETD – 07
26	N. Rajkumar Joint Director CPRI, Bengaluru	Principal Member	BIS Safety of Machinery Sectional Committee (ETD- 44)
		Alternate Member	BIS Lamps and related equipment Sectional Committee (ETD- 23)
			BIS Solar Photo-voltaic energy Sectional Committee (ETD -28)
			BIS Solar Pumps Sectional Committee
		Accredited "Energy Auditor and Energy Manager"	Bureau of Energy Efficiency, Ministry of Power, Govt. of India
27	Yugal Agrawal, Joint Director STDS-CPRI, Bhopal	Member	BIS Sectional Committee ETD-47, Electrical Traction Equipments
28	G. Girija Joint Director CPRI, Bengaluru	Member	BIS Sectional Committee for Environmental Testing Procedures – LITD- 01
29	Dr. P. Chandrasekhar Joint Director CPRI, Bengaluru	Member	Bureau of Energy Efficiency (BEE), S&L Program of Refrigerator & AC
30	Dr. R. K. Kumar Joint Director CPRI, Bengaluru	Member	MTD-4, BIS - Flat Steel Products Subcommittee, MTD 4.3

Sl. No.	Name & Designation Shri/Smt./Kum.	Position	Name of the Committee
31	K. Devender Rao Joint Director UHVRL – Hyderabad	Member	CIGRE, India
32	K.A. Aravind Joint Director CPRI, Bengaluru	Alternate Member	Bureau of Indian Standards (BIS), ETD-19 - High Voltage Engineering Sectional Committee
33	G. Kishore Kumar Engg. Officer Gr.4 CPRI, Bengaluru	Member	Clay and Stabilized soil products for construction, CED -30 of BIS
			MTD-4, BIS - Flat Steel Products Subcommittee, MTD 4.3
34	Pradish M Engg. Officer Gr.4 CPRI, Bengaluru	Corporate Member	UCA, International Users Group, USA
		Member	BIS - LITD 10 Sectional Committee on Power System Control and Associated Communications
			BIS – LITD 10 – Panel 1: Subcommittee on Interoperability
			BIS – LITD 10 – Panel 2: Subcommittee on Security
			BIS – LITD 10 – Panel 3: Subcommittee on Common Information Model
			ISGF Working Group-2: IoT, Smart Metering, AI and Analytics
			ISGF Working Group-3: Digital Architecture & Cyber Security group
			IEC - TC 57 / WG 10: Power systems management and associated information exchange / Power system IED communication and associated data models
			IEC - TC 57 / WG 21: Power systems management and associated information exchange /Interfaces and protocol profiles relevant to systems connected to the electrical grid

Sl. No.	Name & Designation Shri/Smt./Kum.	Position	Name of the Committee
35	Thirumurthy Engg. Officer Gr.4 CPRI, Bengaluru	Member	BIS ETD - 09 Power Cables Committee
36	Viji Bharathi Engg. Officer Gr.4 CPRI, Bengaluru	Official Member	DLMS UA, Switzerland
		Member (I-Alternate)	BIS ETD 13: Sectional Committee on "Equipment for Electrical Energy Measurement & Load Control"
		Member Convener	BIS ETD13 Panel 1: Maintenance of IS 15959 series
		Member	Panel 4: Maintenance of IS 16444 (Parts 1 and 2)
			BIS ETD13 Panel 1/ WG1: Draft Amendment No.3 to 15959-2
			BIS ETD13 Panel 1/ WG3: HLS mechanism for security related tests of 15959 series
			BIS ETD13 Panel 4/ WG2: Communication requirements for IS 15959 series
			IEC TC 13/WG 14 - Data exchange for meter reading, tariff and load control
37	Dr. Kuldeep Singh Rana Scientific Officer Gr.4 CPRI, Bengaluru	Principal Member	BIS ETD- 10 – Primary Cells and Batteries & ETD-11 – Secondary Cells and Batteries
		Member	ETD-51 – Electro technology in Mobility
			S&L program for Advanced Chemistry Cell (ACC) & Batteries for electric vehicle, BEE
			Quality Council of India, Steering Committee drone certification (Battery)
			Sub-Group-3-Technology Group on Storage Technologies of Policy Frame work to promote Energy Storage in Power Sector, MoP/CEA

Sl. No.	Name & Designation Shri/Smt./Kum.	Position	Name of the Committee
38	Dr. Neha Adhikari Engg. Officer Gr.4 RTL-CPRI, Noida	Member	BIS ETD 09 - Power Cables Committee
39	Dharmesh Yelamanchi Engg. Officer Gr.4 CPRI, Bengaluru	Alternate Member	BIS Sectional Committee, ETD-06 – Electrical Insulators and Accessories
			BIS Sectional Committee, ETD-19 – High Voltage Engineering
40	V. Vaidhyanathan Engg. Officer Gr.4 CPRI, Bengaluru	Principal Member	Power Capacitors Sectional Committee ETD-29 of BIS
		Member	MT-21 "Shunt capacitors for voltages upto and including 1000V for power systems" under IEC/TC 33
			MT – 24, "AC motor capacitors" under IEC/TC 33
			MT-19 "Shunt capacitors for voltages above 1000V for power systems" under IEC/TC 33
41	Shaileshwari M U Engg. Officer Gr.4 CPRI, Bengaluru	Member	BIS LITD-10, Panel - 2 on Security
42	Rajaram Mohanrao Chennu Engg. Officer Gr.4 CPRI, Bengaluru	Member	ETD-16 – Transformers, BIS
43	Dilip Kumar Puhan Engg. Officer Gr.4 CPRI, Bengaluru	Member	Standardization of the Management of Assets in Power Network Sectional Committee, ETD-53, BIS
44	D. Venkatesh Engg. Officer Gr.3 CPRI, Bengaluru	Principal Member	ETD-32 – Electrical Appliances, BIS
			MED 03 - Refrigeration and Air Conditioning, BIS
45	Dr. Moumita Naskar Scientific Officer Gr.3 CPRI, Bengaluru	Member	Winding wires Sectional Committee, ETD- 33
46	Ramesh Patil Engg. Officer Gr.3 CPRI, Bengaluru	Member	Bureau of Indian Standards (BIS) Under LITD -10 Group Adoption CIM for Indian Utility

Sl. No.	Name & Designation Shri/Smt./Kum.	Position	Name of the Committee
47	Dr. Manohar Singh, Engg. Officer Gr.3 CPRI, Bengaluru	Alternate Member	ETD -35 Power Systems relaying Committee
			ETD -42 Wind Turbines Sectional Committee
48	K. Vijaya Kumar Engg. Officer Gr.3 CPRI, Bengaluru	Alternate Member	Standing Committee of experts to Investigate Cause of failure of Towers, Central Electricity Authority (CEA), New Delhi
			Use of Structural Steel in Overhead Transmission Line Tower and switch yard Structures, BIS Committee CED-7
			Committee for Audit of Transmission line tower with respect to design & life of Towers, Central Electricity Authority CEA/CEID, New Delhi.
49	Dr. P. Raja Mani Engg. Officer Gr.3 UHVRL-CPRI, Hyderabad	Alternate Member	ETD 40 HVDC Power Systems, BIS
50	Mridula Jain Engg. Officer Gr.3 RTL-CPRI, Noida	Member	BIS ETD 13 - Equipment for Electrical Energy Measurement & Load Control
51	Jithin Pauly P Engg. Officer Gr.3 CPRI, Bengaluru	Member	IEC TC 37 MT4
			IEC TC 37 MT10
			IEC TC 37 PT 60099-11
			IEC TC 81 MT14
			IEC TC 81 PT62561-9
		Alternate Member	Sectional Committee ETD-30 – Surge Arresters, BIS
			Sectional Committee, ETD-48 – Standardization in the Field of UHV AC Transmission System, BIS
			Sectional Committee ETD-20 –Electrical Installation

Sl. No.	Name & Designation Shri/Smt./Kum.	Position	Name of the Committee
52	Sreeram V Engg. Officer Gr.3 CPRI, Bengaluru	Member	ETD-53 - Standardization of the Management of Assets in Power Network Sectional Committee, BIS
			CIGRE NSC A3
53	Ashitha P N Engg. Officer Gr. 2 CPRI, Bengaluru	Principal Member	Solid Electrical Insulating Materials and Insulation Systems Sectional Committee, ETD-02
54	K Jeykishan Kumar Engg. Officer Gr.2 CPRI, Bengaluru	Principal Member	BIS Committee ETD-46: Grid Integration of Renewablesa
		BIS Young Professional (Alternate Member)	BIS Sectional Committee on Electrotechnology in Mobility (ETD-51)
55	Shailesh Kapoor, Engg. Officer Gr.1 CPRI, Bengaluru	Member	BIS LITD-10 Power System Control and Associated Communications Joint working group: Security

Appendix-10

PAPERS PRESENTED / PUBLISHED INDICATING EVENT / VENUE / JOURNAL FOR 2022-23

Capacitor Division

1. V. Vaidhyanathan, T. Bhavani Shanker, Uka Ram, A. Sheik Mohamed, titled, "Temperature Co-efficient of Primary Capacitors used in Capacitive Voltage Dividers – Case Studies" at IEEE 6th International Conference on Condition Assessment Techniques in Electrical Systems (CATCON 2022) held at NIT Durgapur during 17th to 19th December 2022.
2. T. Bhavani Shanker, V. Vaidhyanathan, R. Shyam, titled, "Condition Assessment of Oil-filled Rectifier Transformer in a Smelter Plant by On-line Acoustic Emission Technique – Case Studies" at IEEE 6th International Conference on Condition Assessment Techniques in Electrical Systems (CATCON 2022) held at NIT Durgapur during 17th to 19th December 2022.
3. T. Bhavani Shanker, V. Vaidhyanathan, A. Sheik Mohamed, titled, "Experience of Testing and Evaluation of HV Capacitors for Endurance Testing with Reference to IEC Standards" at the National Conference on High Voltage Engineering and Technology (HVET 2023), held at UHVRL, CPRI, Hyderabad on 17th March 2023.
4. V. Vaidhyanathan, T. Bhavani Shanker, Uka Ram, A. Sheik Mohamed, titled "Characteristics of the Reactive Power Output of Metallized Polypropelene Capacitors at Thermal Stability Conditions", at the National Conference on High Voltage Engineering and Technology (HVET 2023), held at UHVRL, CPRI, Hyderabad on 17th March 2023.

Cables & Diagnostics Division

5. Arunjothi R, K. P. Meena titled "Measurement of Heat Release of Cushioning and Insulating Foam Materials" at International Online Conference on Foamed Polymers (ICFP 2022) held at Mahatma Gandhi University, Kottayam, Kerala, India, from 08th to 10th July 2022.
6. Arunjothi R, K. P. Meena titled "Evaluation of Toxic Gas Emission of Foam Materials" at International Online Conference on Foamed Polymers (ICFP 2022) held at Mahatma Gandhi University, Kottayam, Kerala, India, from 08th to 10th July 2022.
7. Arunjothi R, Thirumurthy, K.P.Meena titled, "Smoke Emission of Cables and Visibility with respect to cable configuration", at 9th International Conference on Cables, Wires & Accessories CABLEWIRE 2022 held on 25th & 26th August 2022.
8. K.P.Meena, Thirumurthy, Arunjothi R, Raja G K, P.V.Satheesh Kumar titled "Effect of Improper Grounding on Integrity of 66 kV Cable System", at 9th International Conference on Cables, Wires & Accessories CABLEWIRE 2022, held on 25th & 26th August 2022.

9. Moumita Naskar, K.P Meena, titled, "Effect of hydraulic oil on Silicone Rubber at elevated temperature" at International Conference on High Voltage Engineering and Application (ICHVE 2022), held at Chongqing University, China from 25th to 29th September 2022.

10. Ashitha P. N., Akhil S., K. P Meena, titled "Preparation and Corona Aging Studies on Nano alumina/Micro ATH Co-Filled HTV Silicone Rubber Composites", at 9th International Conference on Condition Monitoring and Diagnosis 2022 (CMD 2022) held at IEEE Japan from 13th to 18th November 2022.

11. Dillip Kumar Puhan, Rajat Sharma, K.P Meena, titled "Comprehensive Diagnostic Testing of Generator Rotor Winding to Enhance Reliability - A Case Study", at 17th India Doble Power Forum International Conference held at New Delhi, on 07th & 08th December 2022.

12. Moumita Naskar, K. P Meena, titled "Electrical insulation and thermal expansion behavior studies on ethylene vinyl acetate nano composites for photovoltaic encapsulation" at IEEE 6th International Conference on Condition Assessment Techniques in Electrical Systems (CATCON 2022) held at NIT Durgapur, India, from 17th to 19th December 2022.

13. Dillip Kumar Puhan, Rajat Sharma, Thirumurthy, K. P. Meena titled "Detection of Partial Discharges of Corona Type in Paper Oil Insulation System by Optical Method", at IEEE 6th International Conference on Condition Assessment Techniques in Electrical Systems (CATCON 2022) held at NIT Durgapur, India, from 17th to 19th December 2022.

14. Moumita Naskar, K.P Meena, titled "Intrinsically Heat Tolerant, UV Resistant EVA/ LDPE thermoplastic elastomeric encapsulant – An alternative for conventional crystalline silicon PV module encapsulant", at 14th International Conference on Materials Manufacturing and Characterization held at Gokaraju Rangaraju Institute of Engineering and Technology (GRIET), Hyderabad from 24th to 26th March 2023.

15. Arunjothi R, Thirumurthy, K. P Meena titled "Circuit Integrity Assessment of Fire-Resistant Cables" at National Conference on "High Voltage Engineering and Technology" (HVET - 2023) held at UHVRL, CPRI, Hyderabad on 17th March 2023.

Dielectric Materials Division

16. Ann Pamla Cruze titled, "Compatibility of Construction Materials with Mineral Insulating Liquid for Power Transformers" at the International Conference on Advance Materials, Manufacturing and Industrial Engineering AMMIE – 2023, organized by Vellore Institute of Technology (VIT), Chennai, on 23rd & 24th March 2023.

Electrical Appliances Technology Division

17. Kuldeep Rana, Jairam CDM, Mruttanjay SA, titled "Analysis of open circuit voltage and state of charge of high power lithium ion battery", in International Journal of Power Electronics and Drive System, Vol. No.13, Issue No. 2, June 2022.

18. Kuldeep Rana, Srilekha N, titled "Analysis of Internal Resistance and Peak Power of High Power Commercial Li-Ion Battery by Using Hybrid Pulse Power Characterization", at online International Conference on 'Battery Science and Technology 2022' held from 02nd to 04th June 2022.

19. Kuldeep Rana, N. Srilekha, P.Chandrasekhar titled, "Fast Charging Behaviour of High-Power Li-Ion Cell at Different Temperatures and Effect on Capacity and Internal Resistance" in National Journal of 'Power Research', Vol.No.18, Issue No.2, Page 139-147.

Earthquake Engineering & Vibration Research Centre

20. Yamini Gupta, R. Panneer Selvam and D. Nagesh Babu titled, "Challenges in seismic qualification of substation equipment" in the 17th Symposium on Earthquake Engineering held at IIT Roorkee during 14th to 17th November 2022.

21. Yamini Gupta, R. Panneer Selvam and D. Nagesh Babu titled, "Performance of 420kV Instrument Transformers under Earthquake" in National Conference on High Voltage Engineering and Technology held at CPRI, UHVRL, Hyderabad on 17th March 2023.

Energy Efficiency & Renewable Energy Division

22. K. Jeykishan Kumar and Richa Sharma, titled "Studies on the Role of Knowledge Management in Performance Enhancement and Promotion of Renewable Energy Industries in India", in International Journal of Information & Knowledge Management, Vol. No.21, Issue No.1, May 2022 ISSN: 1793-6926, DOI: https://doi.org/10.1142/S021964922250040X (Scopus and SCI Indexed Impact factor: 1.8).

23. S. Jothibasu, titled "Improvements in Pumps of Water treatment plants" in National Journal of Electrical India, Vol. No. 62, Issue No.9, September 2022, page 28-31.

24. Jeykishan Kumar K., titled, "Steady State Electroluminescence Imaging on Perovskite Solar Cells" at the 6th edition of IEEE International Conference on Emerging Electronics (ICEE 2022) organized by IEEE Electron Devices Society and Indian Institute of Science, Bangalore at Hilton Manyata Techpark Bangalore during 11th to 14th December 2022.

25. N. Rajkumar, titled "Impact of Controllable losses on Generation and Net Heat Rate" at National Conference on "Reducing Net Heat Rate - 2023" organized by Mission Energy Foundation, Mumbai at Hyatt Centric, New Delhi on 02nd February 2023.

26. Jeykishan Kumar K, titled "Response of single phase grid tied Solar PV Inverter during utility voltage and frequency fluctuations" at IEEE IAS Global Conference on Renewable Energy and Hydrogen Technologies (GlobConHT-2023), organized at The Maldives National University, Male City, Maldives on 11th & 12th March 2023.

27. Jeykishan Kumar, Kuldeep Rana titled, "Battery Swapping Stations - A Viable Option for

Faster Adoption of EVs in India" in National Journal of 'Power Research', Vol. No. 18, Issue No.2., Page 171-177, https://doi.org/10.33686/pwj.v18i2.1107

High Voltage Division

28. B. V. Nagachandra titled, "Importance of Transformer Neutral Earthing in a Substation - A Case Study" at the National Conference on "Failure of Major Equipment of substation-Case Studies" organized by Central Board of Irrigation and Power and CIGRE India, New Delhi on 23rd February 2023.
29. Jithin Pauly.P., titled, "Impact of Time Duration on Energy Injected During the Test to Verify Repetitive Charge Transfer Rating", at CPEEE 2023 International Conference, held in Tokyo during 25th to 27th February 2023.
30. Jithin Pauly.P. titled, "Measurement of Soil Resistivity for an HVDC Electrode Station using High Current DC Source" at CPEEE 2023 International Conference, held in Tokyo during 25th to 27th February 2023.
31. Jithin Pauly.P, titled, "Design and validation of Plate Earthing System for Equipment Earthing" at the National Conference on High Voltage Engineering and Technology (HVET 2023) held at UHVRL, CPRI, Hyderabad on 17th March 2023.
32. Dharmesh.Y, titled "Failure Analysis of Transformer under Impulse Test" at the National Conference on High Voltage Engineering and Technology (HVET 2023) held at UHVRL, CPRI, Hyderabad on 17th March 2023.
33. Dharmesh.Y, titled "Tracking and Erosion Performance of Silicone Rubber with ZnO & MgO Fillers" at the National Conference on High Voltage Engineering and Technology (HVET 2023) held at UHVRL, CPRI, Hyderabad on 17th March 2023.

High Power Laboratory

34. Sreeram V, S. Arunkumar, S. Sudhakara Reddy, T. Gurudev and Maroti, titled, "Comparative Analysis of Transients in AIS and GIS With Vacuum Interrupters," in International Journal of IEEE Transactions on Plasma Science, Vol. No.50, Issue No. 9, pp. 2681-2686, September 2022, doi: 10.1109/TPS.2022.3202339
35. Sreeram V, Meena K P, Arunjothi R, Thirumurthy, S. Sudhakara Reddy, titled "Sheath Potential Induced Failure Modes and Influencing Factors of Bonded Cable System" at 9th International Conference on Condition Monitoring and Diagnosis 2022 (CMD 2022), organized by IEEE Japan during 13th to 18th November 2022.
36. Sreeram V, Dillip Kumar Puhan, Rajkumar M, S. Sudhakara Reddy, T Gurudev titled, "Dissecting SFRA measurements for physical parameters: A Practical Approach" at 17th India Doble Power Forum International Conference organized by Doble Engineering Company, Vadodara at New Delhi on 07th & 08th December 2022.

37. Sreeram V., Rajkumar M., S. Sudhakara Reddy, Gurudev T & Maroti M titled "Short Circuit Testing of Cables: HPL Experience" in National Journal of Power Research - A Journal of CPRI, Volume 18, Issue No. 1, June 2022 https://doi.org/10.33686/pr.v18i1.1094

Materials Technology Division

38. T.Mallikharjuna Rao, titled "Analysis of Power stations more efficaciously and reforms by heat pipe" in International Journal of Ambient Energy- Taylor & Francis Publication, Vol.43, Issue No.1, 8067-8079, August 2022.

39. Kishore Kumar Gulipilli titled, "Evaluation of the Characteristics of Blending of High Ash Indian Coal with Groundnut Shell for Power Generation Application" at "Chemcon 2022" - International Conference on "Sustainability in Chemical Processes through Digitalization, Artificial Intelligence and Green Chemistry" organised by Indian Institute of Chemical Engineers, Kanpur at HBTU campus during 27th to 30th December 2022.

40. Kishore Kumar Gulipilli & V.Saravanan titled, "Study the Combustion behavior of Coal and Rice husk blend by Computation Fluid Dynamic analysis" at "Chemcon 2022" - International Conference on "Sustainability in Chemical Processes through Digitalization, Artificial Intelligence and Green Chemistry" organised by Indian Institute of Chemical Engineers, Kanpur at HBTU campus during 27th to 30th December 2022.

41. M Janardhana, Arvind Kumar titled "Oxide Scale Deposition in Super Heater Boiler Tubes in Super Critical Thermal Power Plant - A case study" at the International O&M conference IPS 2023 held in Raipur, Chhattisgarh on 13th & 14th February 2023.

42. Kishore Kumar Gulipilli titled, "Evaluation of Rice husk Biomass and Blending with Coal for Power Generation Application" at the International Conference on Advances in Materials, Ceramics and Engineering Sciences (AMCES-2023), organised by Dayananda Sagar College of Engineering (DSCE), Bangalore during 13th to 15th March 2023.

Metering & Utility Automation Division

43. Shankar D, V Suresh titled "Smart meters DLMS Data Exchange Protocol testing methodologies – Part 1" in National Journal of Electrical India, Vol.No.62, Issue No.7, July 2022.

44. Shankar D, V Suresh titled "Smart meters DLMS Data Exchange Protocol testing methodologies – Part 2" in National Journal of Electrical India, Vol. No. 62, Issue No.8, August 2022.

Power System Division

45. Janmejaya Pradhan, Manohar Singh titled "Performance of Distance Relaying Scheme under High Penetration of RES", in International Journal of Research Square (Online) DOI - doi.org/10.21203/rs.3.rs-1552568/v1.

46. Mahima, Manohar Singh, titled "Power System Stability Investigation with Renewable Integrations', at 10th IEEE Power India International Conference (PIICON 2022) organised by NIT, Delhi at New Delhi during 25th to 27th November 2022.

47. Manohar Singh, Dinesh Patil titled "An Operational Practice for Voltage Control & Reactive Power Management in National Grid", at 22nd National Power System Conference, NPSC 2022 hosted by Indian Institute of Technology - Delhi during 17th to 19th December 2022.

48. Ved Prakash Yadav, Jithin Pauly, C. Prabhakar, J. Sreedevi, titled, "Impact of Tower footing resistance on back flash over in 220 kV Transmission System" at the International Conference on "Latest Trends and Innovation in Cables and Overhead Lines" held in New Delhi, on 09th & 10th March 2023.

Research & Development Management Division

49. Krishna Chaitanya Ghanakota, Yugandhara Rao Yadam, Sarathi Ramanujam, and Kavitha Arunachalam titled "Study of Ultra High Frequency Measurement Techniques for Online Monitoring of Partial Discharges in High Voltage Systems", IEEE Sensors Journal, Vol 22 Iss 12, Page no. 11698 – 11709, 15th June 2022.

50. Yadam, Yugandhara Rao, Sarathi Ramanujam, and Kavitha Arunachalam titled "Numerical and experimental investigations on influence of internal defect parameters on partial discharge induced UHF signals in gas insulated switchgear", IEEE Access, Iss 10, Page no. 110785 – 110795, 10th October 2022.

51. Gaurav Khare, Abheejeet Mohapatra, and S. N. Singh titled "Identifying the Attack Probability of Measurements in Nonlinear State Estimator", Indian Institute of Technology Delhi, New Delhi, 17-19 December 2022.

52. Gaurav Khare, Abheejeet Mohapatra, and S. N. Singh titled "State vulnerability assessment against false data injection attacks in AC state estimators", IET Energy Conversion and Economics, Vol 3 Iss 3, Page no. 319-322, October 2022.

53. Ankit Kumar and Shailendra Kumar Shukla titled "Simulation and Comparative Study of ORC System with R123 Refrigerant using Aspen Plus", 3rd International Conference on Science, Engineering and Management (ICASEM-2022), Lords Institute of Engineering and Technology (Autonomous), 18-19 November 2022.

54. S. Paladhi, J. R. Kurre, and A. K. Pradhan titled "Source-Independent Zone-1 Protection for Converter-Dominated Power Networks", IEEE Transactions on Power Delivery, 1st November 2022 (https://doi.org/10.1109/TPWRD.2022.3218615).

55. Subal Beura and Bibhu P. Padhy titled "A Novel Reduced-Order H_∞ Filter for Simultaneous Detection and Mitigation of FDI-Attacks in AGC Systems", IEEE Transactions on Instrumentation and Measurement, November 2022.

56. Subal Beura and Bibhu P. Padhy titled "Effect of Cyberattack on Event Detection Algorithm in Distribution System using Synchrophasor Measurements", NPSC conference IIT Delhi, 17-19 December 2022.

57. Abhineet Prakash, Kundan Kumar and S.K Parida titled "A Modal Transformation Approach to Design Reduced Order Functional Observer-Based Wadc for Low-Frequency Oscillations", Ieee Transaction on Power System, Page no. 12, Early access, August 2022.

58. Mrityunja Y Kumar Mishra and S.K Parida titled "A Game Theoretic Horizon Decomposition Approach for Real- Time Demand-Side Management", IEEE Transaction on Smart Grid, Vol 13 Iss 5, Page no. 14, September 2022.

59. S. Anand, K. Kalita and S.K Parida titled "A Novel Transmission System Protection Scheme using Optimal Wide-Area Measurements", Journal in Electric Power Systems Research, Page no. 15, November 2022.

60. Indrajit Koley, Asim Datta, Goutam Kumar Panda and Sanjoy Debbarma titled "TLBO Optimised PIDD Controller for Coordinated Control in a Hybrid AC/DC Microgrid", Proc. of 2022 4th International Conference on Energy, Power and Environment, e-ISBN:978-1-6654-7124-4, p-ISBN:978-1-6654-7125-1, INSPEC Accession Number: 21799900, 20th June 2022.

61. Ranjit Debnath, Prasanta Sutradhar and Mitali Saha titled "Design of porous graphene materials from organic precursors", Crystal Research & Technology, International (SCI indexing).

62. Prasanta Sutradhar, Ranjit Debnath and Mitali Saha titled "Biogenic synthesis of silver nanoparticles and optimization of current-voltage properties of solar cell", Letters in Applied Nanobioscience, International (Scopus indexing).

63. A. Shankar and G Maduraiveeran titled "Hierarchical bimetallic iron-cobalt phosphides nano-island nanostructures for improved oxygen evolution reaction", Journal of Electroanalytical Chemistry, Vol 923, Page no. 116806, October 2022.

64. M. Arivazhagan and G. Maduraiveeran titled "Gold-dispersed hierarchical flower-like copper oxide microelectrodes for the sensitive detection of glucose and lactic acid in human serum and urine", Biomaterials Science, Vol 10 Iss 16, Page no. 4538, June 2022.

65. A. Shankar and G. Maduraiveeran titled "Bimetallic iron cobalt oxide nanoclusters embedded on three-dimensional flower-like iron cobalt oxide nanosheets for improved oxygen evolution reaction", Energy Advances, Vol 1, Page no. 562, July 2022.

66. R. Beniwal, P. Gawas, C.P. Charan, V. Nutalapati and B.M.K. Mariserla titled "Effect of hydroxy groups on nonlinear optical behaviour of encapsulated freebase porphyrin thin films in a borate glass matrix", Materials Science and Engineering B, Vol 284, Page no. 115908, July 2022.

67. Isaac de Souza, Harris K. Hassan, Abhik Sarkar, Maalika Sarkar, Abhay Singh Gour and Vutukuru Vasudeva Rao titled "Jointing techniques for HTS power cables", National Symposium on Cryogenics and Superconductivity (NSCS-28), IIT Kharagpur, 18-21 October 2022.

68. Isaac de Souza, Ankit Anand, Abhay Singh Gour and Vutukuru Vasudeva Rao titled "Effect of magnetic fields due to electric currents in an HTS power cable and estimation of stress", National Symposium on Cryogenics and Superconductivity (NSCS-28), IIT Kharagpur, 18-21 October 2022.

69. Maalika Sarkar, Isaac De Souza, Abhik Sarkar, Abhay Singh Gour and Vutukuru Vasudeva Rao titled "Comparison of PPLP wrapping techniques for HTS power cables", National Symposium on Cryogenics and Superconductivity (NSCS-28), IIT Kharagpur, 18-21 October 2022.

70. Isaac De Souza, Ankit Anand, Harris K. Hassan, Sumit K. Chand, Abhay Singh Gour and Vutukuru Vasudeva Rao titled "Numerical Studies on Two-Phase Flow of Liquid Nitrogen to Cool HTS Power Cables", IOP Conference Series: Materials Science and Engineering, Vol 1241 Iss 1, Page no. 012039, 2022.

71. Harris K. Hassan, Pankaj Sagar, Abhay Singh Gour and V V Rao titled "Feasibility study of a novel capacitance based quench detection sensor for HTS power transmission cables", IOP Conference Series: Materials Science and Engineering, Vol 1240 Iss 1, Page no. 012145, 2022.

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74. Sandeep Hanwate and Yogesh V. Hote titled "An Optimal Control Design for Solar Tracker System via Contrast Controller Approach", 10th IEEE Conference on Power Electronics, Drives, and Energy Systems (PEDES, 2022), MNIT Jaipur, 14-17 December 2022.

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76. Appu Raushan, Yogesh V. Hote, and Ganesh B. Kumbhar titled "Adaptive Control Policy Via Switching Controller for Load Frequency Control Using Improved Particle Swarm Optimization", 2022 IEEE 1st Industrial Electronics Society Annual On-Line Conference (ONCON), Online IEEE Conference, 9-11 December 2022.

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78. Dwijasish Das, Rampelli Manojkumar and Chandan Kumar titled "Power Loss Minimization in Smart Transformer Enabled Low Voltage Islanded Meshed Hybrid Microgrid", IEEE access, Page no. 1-11, November 2022.

79. Manojkumar Rampelli, Chandan Kumar, Sanjib Ganguly, Hoay Beng Gooi, Saad Mekhilef and Joao Catalao titled "Rule-based Peak Shaving Using Master-Slave Level Optimization in a Diesel Generator Supplied Microgrid", IEEE Transactions on Power System, Page no. 1-12, 29th June 2022.

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81. Arunima Dutta, Sanjib Ganguly and Chandan Kumar titled "Model Predictive based Coordinated Voltage Control of Active Distribution Networks with Distributed Generation and Electric Vehicles", 2022 4th International Conference on Energy, Power and Environment (ICEPE), Shillong, 29th April 2022 – 01st May 2022.

82. Manish Dhangar, Kamna Chaturvedi, Mohd. Akram Khan, A.K. Srivastava and Sarika Verma titled "Development of thermal insulating material using waste (Rice Husk Ash)", International Conference on Emerging Materials for Sustainable Development (EMSD - 2022), CSIR-CSIO, Chandigarh, 9th -11th October 2022.

Short Circuit Laboratory

83. S. Arjuna Rao, G. Girija, Rakesh K.G, N. Maheswara Rao, B.R. Vasudevamurthy, Swaraj Kumar Das titled, "Verification of Temperature rise on Bus ducts – Study", in National journal of Electrical India, Part 1 was published in December 2022 issue and part 2 was published in January 2023 issue.

Smart Grid Research Laboratory

84. Shyam Agarwal, Pradish M, Shailesh Kapoor, Shivakumar V, Amit Jain, B A Sawale, titled "AMI System Evaluation of Service Providers with Prepaid Features" at the 09th Edition of Metering India-2022 National Conference organized by IEEMA at New Delhi on 03rd & 04th November 2022.

85. V. Shivakumar and Veena M B, titled "Information Security Management for Smart Power Grid - Standards Based Approach'' at 10th IEEE Power India International Conference (PIICON 2022) organised by IEEE PES – IAS Delhi Chapter and IEEE PELS – IES Delhi Chapter and National Institute of Technology - Delhi held at National Institute of Technology - Delhi, during 25th to 27th November 2022.

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Training Division

89. M. G. Anandakumar and M. Venkateswara Rao, titled "A Lab Scale Study on Various Properties and Behavior of Indian and Imported Coal Blend" at the International Conference - Metwaste-2023, held at IIT BHU, Varanasi on 27th & 28th February 2023.

RTL – Kolkata

90. Prabhat Kumar Maiti, titled "A Comparative Study of Blended Ester and Mineral Oil with Variances in Refining Processes" at International Conference of 97th IEEE CEIDP 2022 (97th IEEE Conference on Electrical Insulation and Dielectric Phenomena) held in Denver, CO, USA from 30th October 2022 to 02nd November 2022.

91. Prabhat Kumar Maiti titled "Assessment of Solid Insulation by Analyzing Oil in Service Transformers and Laboratory Ageing Studies" at 2022 IEEE 6th International Conference on Condition Assessment Techniques in Electrical Systems (CATCON 2022)" held at NIT Durgapur during 17th to 19th December 2022.

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Switchgear Testing & Development Station, Bhopal

93. B.A. Sawale titled "National and International Metering Standards-Review, Present status and upcoming changes" at Metering India-2022 International Conference organized by IEEMA at New Delhi, on 03rd & 04th November 2022.

94. K. Sharat Kumar, Diptiranjan Sahoo, Yugal Agrawal, Manoher Singh Takkher, M.K. Wadhwani titled, "Pre-requisites for short circuit withstand test on transformers & its failure analysis" in International Conference "IEEE PEDES 2022 Power Electricals, Drives & Energy Systems" Organized by MNIT, Jaipur during 14th to 17th December 2022.

95. K. Sharath Kumar, Diptiranjan Sahoo, Yugal Agrawal, Manohar Singh Takkher, titled "High Voltage Motor Current Switching Tests: It's Motive & Evaluation" at the International Conference on "Power Instrumentation Energy and Control: IEEE PIECON" organized by Aligarh University during 10th to 12th February 2023.

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97. Abhishek Verma, Sarita Dongre, Leena H. Roy, titled "Failure Analysis of Current Transformer in service condition- A Case Study" at the National Conference on "Failure of Major Equipments of Sub Station –Case Studies" organized by Central Board of Irrigation and Power and CIGRE India, New Delhi on 23rd & 24th February 2023.

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99. Gaurav Gupta, B. A. Sawale, Priyamvada Chandel, Deepa Warudkar, titled "Advance Metering Infrastructure solution Testing-A Case Study" at the National Conference on "Failure of Major Equipment of Substation – Case Studies" organized by Central Board of Irrigation and Power and CIGRE India, New Delhi on 23rd & 24th February 2023.

100. Prabhakaran T., M.K. Wadhwani, Sumbul Munshi, Himangshu Roy, Saumitra Pathak titled, "Failure Analysis of OLTC during Transition Resistor Test" at the National Conference on High Voltage Engineering and Technology (HVET 2023), held at UHVRL, CPRI, Hyderabad on 17th March 2023.

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Thermal Research Centre, Nagpur

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103. Homeshwar Nagpure, S.K.Nath, titled "Effect of Change in Startup Cycle Time on Transient Thermal Stresses in Steam Turbine Rotor" in National Journal of SAMRIDDHI – A Journal of Physical Sciences, Engineering and Technology (S-JP SET) (UGC care journal), Vol 14, Issue No.3, July-Sept 2022 Issue.

104. Homeshwar Nagpure, S.K.Nath, titled "Green's Function – an Approach for Estimation of Transient Thermal Stress in High Pressure Turbine Rotor" in Scopus Indexed Springer International conference on Recent Evolutions in Energy, Drives and e-Vehicles – REEDev 2022 held at St. Vincent Pallotti College of Engineering & Technology, Nagpur on 16th & 17th September 2022.

105. S. K. Nath, titled "Effect of Scanning Surface in Reliability Analysis of Complex Geometry Time of Flight Diffraction Inspection" in NDE2022 Conference and Exhibition organised by Indian Society for Non-destructive testing (ISNT) at Gandhinagar, Gujarat during 24th to 26th November 2022.

UHVRL, Hyderabad

106. K. Devender Rao, P. Rajamani, B. Krishna, Pradeep M. Nirgude, titled "Artificial Pollution Testing of HVDC Insulators", at the National Conference on High Voltage Engineering and Technology (HVET 2023), held at UHVRL, CPRI, Hyderabad on 17th March 2023.

107. P. Rajamani, K. Devender Rao, Pradeep M Nirgude, titled "Effect of common in-service defects of different insulators on radio frequency interference emission from 765 kV insulator string" at the National Conference on High Voltage Engineering and Technology (HVET 2023), held at UHVRL, CPRI, Hyderabad on 17th March 2023.

108. K. Urukundu, K. Sandhya, K. Govardhanachari, G. Ramesh titled, "Interpretation of IS/IEC & IEEE standards for Dielectric type testing of Instrument Transformers", at the National Conference on High Voltage Engineering and Technology (HVET 2023), held at UHVRL, CPRI, Hyderabad on 17th March 2023.

Appendix-11

V.K. Niranjan & Co.
Chartered Accountants

Phone : 080 - 2335 7769
Mobile : +91 87624 42895
E-mail : reachus@vkrnca.com

INDEPENDENT AUDITOR'S REPORT

To,
The Governing Council
Central Power Research Institute
Bangalore.

Report on the financial statements

Opinion

We have audited the accompanying financial statement **of CENTRAL POWER REASEARCH INSTITUTE** ("the Institute"), which comprise the Balance Sheet as at March 31, 2023, the Income and Expenditure Account for the year then ended of the Institute for the year thereto and a summary of significant accounting policies and other explanatory information.

In our opinion, except for the effect on the financial statements of the matters described in the basis for **Emphasis of matter** paragraph, the financial statements have been properly prepared.

a. In the case of the Balance Sheet, of the state of the affairs of the Institute as at March 31,2023. And

b. In the case of the Income and Expenditure Account, of the excess of income over expenditure for the year ended as at that date.

Basis for Opinion

We conducted our audit in accordance with the Standards on Auditing (SAs). Our responsibilities under those Standards are further described in the Auditor's Responsibilities for the Audit of the Financial Statements section of our report. We are independent of the Company in accordance with the Code of Ethics issued by the Institute of Chartered Accountants of India together with the ethical requirements that are relevant to our audit of the financial statements and we have fulfilled our other ethical responsibilities in accordance with these requirements and the Code of Ethics. We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our **opinion**.

1049, "Maria Arcade" Dr. Rajkumar Road, 4th 'M' Block, Rajajinagar, Opp. SJR High School, Bengaluru - 560010
Branches : Hyderabad | Tiruvalla

In our opinion and to the best of our information and according to the explanations given to us, except for the effects of the matter described in the Emphasis of Matter section of our report, the aforesaid financial statements give a true and fair view in conformity with the accounting principles generally accepted in India, of the state of affairs of the Institute as at March 31st, 2023 and its excess of income over expenditure for the year ended as on that date.

Emphasis of Matter

We draw attention to the following in Schedule No. 7 of the financial statements;

a) CPRI has invested Superannuation fund with M/s LIC of India to the extent of Rs.839.59 Crores for the year ended 31.03.2023 with current year provision of Rs.45 crores. CPRI has received two Actuarial valuation reports as follows.
   a. Estimation received from M/s Transvalue Consultants is Rs.976.76 Crores.
   b. Estimation received from M/s LIC of India is Rs.703.22 Crores.

   Hence the surplus for the year has been overstated Rs. 137.17 Crores (as per M/s Transvalue Consultants valuation) and excess provision made as per M/s LIC of India.

b) There are unknown direct remittances of Rs.8.57 Crores which is under continuous reconciliation. We recommend the management to implement process to identify such unknown remittances in future to have better control over debtors.

Our opinion is not modified in respect of this matter.

Responsibility Management and those charged with Governance for the financial statements.

The Management of the Institute is responsible for the preparation of the financial statements in accordance with the generally accepted accounting principles in India. This responsibility includes the design, implementation and maintenance of internal controls relevant to the preparation and presentation of the financial statements that give a true and fair view and are free from material misstatements, whether due to fraud or error.

Auditor's Responsibility for the audit of Financial Statement

Our responsibility is to express an opinion on these financial statements based on our audit. We have conducted our audit in accordance with the standards on auditing issued by the Institute of Chartered Accountants of India (ICAI).

Those standards require that we comply with ethical requirements and plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessments of the risks of material misstatement of the financial statements whether due to fraud or error.

In making those risk assessments, the auditor considers internal controls relevant to the Institute's preparation and fair presentation of the financial statements that give a true and fair view in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the Institute's internal control. An audit also includes evaluating the appropriateness of the accounting policies used and the reasonableness of the accounting estimates made by the management, as well as evaluating the overall presentation of the financial statements.
We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our qualified audit opinion of the Financial Statements.

Report on other Legal and Regulatory Requirements

As required by Societies Registration Act and applicable statutes we report that:

a)) We have sought and obtained all the information and explanations which to the best of our knowledge and belief were necessary for the purposes of our audit except for the information stated in "Emphasis of matters" paragraph

b) In our opinion, proper books of account as required by law have been kept by the Institute so far as it appears from our examination of those books

c) The Balance Sheet, the Statement of Income and dealt with by this Report are in agreement with the books of account

For **V.K.Niranjan & Co.,**
Chartered Accountants
ICAI Firm Regn. No.: 002468S

(Niranjan V.K.)
Partner
Membership No: **021432**
UDIN: 23021432BGXAKG6664

Place: Bengaluru
Date: 26-07-2023

CENTRAL POWER RESEARCH INSTITUE, BANGALORE

BALANCE SHEET AS AT 31ST MARCH 2023

(Amount in Rs.)

Capital Fund and Liabilities	Schedule	Current Year	Previous Year
Capital Reserve representing Assets acquired from Grant-in-Aid from Government of India and Others	1	14,10,99,75,062	12,67,94,56,489
Reserves and Surplus	2	98,53,08,880	90,96,55,757
Earmarked and Endowment Funds	3	12,73,87,33,900	11,72,93,60,124
Grants from Government of India	4	2,16,56,88,363	2,06,15,70,625
Current Liabilities and Provisions	5	1,25,73,25,104	1,15,68,93,179
TOTAL		**31,25,70,31,309**	**28,53,69,36,174**
Assets			
Fixed Assets	6	13,81,33,87,403	12,37,54,56,487
Investments from Earmarked & Endowment Funds	7	11,82,11,26,965	10,60,98,72,346
Current Assets, Loans and Advances	8	5,62,25,16,941	5,55,16,07,341
TOTAL		**31,25,70,31,309**	**28,53,69,36,174**
Significant Accounting Policies	16		
Notes on Accounts & Contingent Liability	17		

Schedules 1 to 8 and 16 & 17 form part of Balance Sheet

As per Our Report of Even Date
for V.K.Niranjan & Co.,
Charted Accountants
FRN:002468S

Bangalore
26-07-2023

(C.S. Murali Krishna)
Chief Accounts Officer

(B.A. Sawale)
Director General

(V.K.Niranjan)
Partner
Membership No. 021432

CENTRAL POWER RESEARCH INSTITUTE, BANGALORE

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2023

(Amount in Rs.)

INCOME	Schedule	Current Year	Previous Year
Income from Test Fee & Consultancy	9	158,13,99,450	120,91,17,366
Fees	10	1,46,57,952	74,63,285
Interest Earned	11	13,62,41,699	8,23,46,654
Other Income	12	6,03,39,006	1,48,40,953
TOTAL (A)		**179,26,38,107**	**131,38,67,658**
EXPENDITURE			
Research Establishment Expenses	13	111,43,06,703	73,62,11,639
Research Administrative Expenses	14	35,53,65,211	25,59,73,265
Depreciation and Provision for doubtful debts	15	29,67,83,272	27,92,11,027
TOTAL (B)		**176,64,55,187**	**127,14,15,931**
Balance being excess of Income over Expenditure (A-B)		2,61,82,920	4,24,51,727
Add:			
Opening Balance of General Reserve Account		4,36,07,577	15,73,94,881
Assets (Non Plan) acquired transferred to Capital Reserve		98,03,255	62,38,841
Tr. To SAF from OB of GR		-	15,00,00,000
CLOSING BALANCE OF GENERAL RESERVE		**5,99,87,242**	**4,36,07,577**
Significant Accounting Policies	16		
Notes on Accounts & Contingent Liability	17		

Schedules 9 to 15 and 16 & 17 form part of Income & Expenditure Account

As per Our Report of Even Date
for V.K.Niranjan & Co.,
Chartered Accountants
FRN:003488S

Bangalore
28-07-2023

(C.S. Murali Krishna)
Chief Accounts Officer

(B.A. Sawale)
Director General

(V.K.Niranjan)
Partner
Membership No. 021431

CENTRAL POWER RESEARCH INSTITUTE, BANGALORE

Schedules forming part of Balance Sheet as at 31st March 2023

(Amount in Rs.)

	SCHEDULE - 1	Current Year		Previous Year	
	CAPITAL RESERVE REPRESENTING ASSETS ACQUIRED FROM GRANT-IN-AID FROM GOVT. OF INDIA AND INTERNAL RESOURCES				
a)	Under Non-recurring Grant-in-aid	1061,44,36,140		1065,94,51,314	
	Addition during the year	146,52,97,996		14,19,17,686	
	Transferred from CPRI Revenue	2,78,92,000		11,40,67,142	
			1240,74,26,036		1091,44,36,140
b)	Under Non-recurring Grant-in-aid (For M/s. BHPTL Equity Capital)	24,20,00,000		34,00,00,000	
	Addition during the year		24,00,00,000		24,20,00,000
c)	Under R&D Schemes	40,54,06,184		38,20,12,438	
	Less: Re-classification	1,69,07,263			
	Addition during the year	38,61,206	38,23,61,729	2,33,93,746	40,54,06,184
d)	Assets Acquired out of Staff & WF Replacement Fund	25,51,283		25,51,283	
	Addition during the year		25,51,283		25,51,283
	Sub Total (A)		1304,23,40,048		1156,23,94,407
	ASSETS ACQUIRED FROM INTERNAL RESOURCES				
a)	Under Non-recurring Grant-in-aid (CPRI's 10% Contribn.)	25,41,27,491		26,08,24,982	
	Addition during the year	54,83,867		10,13,69,651	
	Transferred To CAPITAL WIP	6,70,00,000		11,40,67,142	
			19,26,11,358		25,41,27,491
b	Under Revenue	29,02,59,096		25,53,26,154	
	Less: Re-classification	2,76,92,000			
	Addition during the year	98,03,254	27,23,71,250	3,39,32,842	29,02,59,096
c)	Under Revenue (Equity Participation)	6,40,00,000		6,40,00,000	
	Addition during the year		6,40,00,000		6,40,00,000
e)	Assets Acquired out of General Reserve	8,54,61,298		8,54,61,298	
	Addition during the year		8,54,61,298		8,54,61,298
f)	Assets Acquired out of Sponsored Schemes	36,88,07,706		35,68,18,947	
	Addition during the year	2,00,75,813	38,87,81,519	1,19,88,759	36,88,07,706
j)	Capitalisation of Assets acquired out of Loan	4,89,94,800	4,89,94,800	4,89,94,800	4,89,94,800
k)	Surplus on sale of Asset	54,12,783		54,12,783	
	Addition during the year		54,12,783		54,12,783
	Sub Total (B)		106,76,35,010		111,70,62,083
	TOTAL (A+B)		14,10,99,75,058		12,67,94,56,490

Place : Bangalore
Date: 28.07.2023

CENTRAL POWER RESEARCH INSTITUTE, BANGALORE

Schedules forming part of Balance Sheet as at 31st March 2023

(Amount in Rs.)

	SCHEDULE 2	Current Year		Previous Year	
	RESERVES AND SURPLUS				
A	**GENERAL RESERVE**				
	As per last Account	4,36,07,577		15,71,94,691	
	Add: Surplus during the year	2,61,82,920		4,24,51,727	
	Less: Assets (Revenue) acquired transferred to Capital Reserve	98,03,255		62,38,841	
	Less: Transferred to SAF	-		15,00,00,000	
	Net Balance A		**5,99,87,242**		**4,36,07,577**
B	**Reserve for Capital Expenditure out of CPRI generated funds**				
	Opening Balance	83,07,72,509		83,51,75,018	
	Less: Provision reversed during the year	-		1,71,00,000	
	Add: Transferred to Capital MoF	6,15,14,133		1,26,97,491	
	Net Balance B		**89,22,86,642**		**83,07,72,509**
C	**MAINTENANCE, RENEWAL & OBSOLESCENCE RESERVE**				
	Opening Balance	3,42,77,571		4,09,57,677	
	Add: Interest earned	20,51,345		20,92,205	
	Less: Utilisation during the year	42,63,104		87,72,311	
	Sub Total	**3,20,65,812**		**342,77,571**	
	Add: Security Deposit	9,69,383		9,98,100	
	Net Balance C		**3,30,34,996**		**3,52,75,671**
	TOTAL (A+B+C)		**98,53,08,880**		**90,96,55,757**

Place : Bangalore
Date : 28-07-2023

CENTRAL POWER RESEARCH INSTITUTE, BANGALORE

Schedules forming part of Balance Sheet as at 31st March 2023

(Amount in Rs.)

	SCHEDULE 3:	Current Year		Previous Year	
	EARMARKED & ENDOWMENT FUNDS:				
A	**SUPERANNUATION FUND**				
	Opening Balance	681,18,34,115		747,79,66,977	
	Less: Re-classification of Additional Interest earned			99,40,42,862	
	Add: Contribution during the year	43,00,00,000		29,79,00,000	
	Add: Interest Transferred for Utilisation	44,70,70,711		33,84,59,634	
	Less: Utilisation for Pension payments	44,70,70,711		33,84,59,634	
	Sub Total	**726,18,34,115**		**681,18,34,115**	
	Add: Pension Money Security Deposit	15,88,010		13,28,271	
	Add: Interest Earned	51,48,93,054		46,05,81,913	
	Less: Interest Transferred for Utilisation	44,70,70,711		33,84,59,634	
	Additional Interest for the year	6,78,15,343		12,20,22,279	
	Opening Balance of Additional Interest	106,81,06,150		94,60,83,871	
		113,39,39,493		**106,81,06,150**	
	Net Balance - A		**833,73,13,630**		**787,93,54,536**
B	**PROVIDENT FUND**				
	Opening Balance	41,86,17,289		38,55,44,110	
	Add: Subscriptions & Repayments	6,31,35,885		7,03,20,444	
	Add: Interest Credited to PF subscribers	2,54,52,191		2,68,83,376	
	Less: Final Settlement/ Withdrawals	7,96,18,424		2,81,87,969	
	Less: Withdrawals	3,57,18,313		3,54,44,731	
	Sub Total	**39,20,88,573**		**41,86,17,289**	
	Add: Balances under Security Deposit etc.,	79,454		79,454	
	Opening Balance (Additional Interest)	4,85,04,373		4,54,95,057	
	Add: Additional Interest earned (Excess of Interest Paid over Interest earned Rs.3,09,17,809 Rs.2,81,07,081)	24,10,728		30,09,316	
	Total	**5,09,15,101**		**4,85,04,373**	
	Net Balance - B		**44,30,83,128**		**46,72,01,866**
C	**NEW PENSION SCHEME FUND**				
	(i) Opening Balance (Employee's Contribution)	24,320		24,320	
	Add: Interest on Employees' Contribution (cumulative)	18,878		18,878	
	(ii) Opening Balance (Employer's Contribution)	24,319		24,319	
	Add: Interest on Employer's Contribution (cumulative)	18,878		18,878	
	Sub Total	**87,595**		**87,595**	
	Add: Additional Interest earned	2,06,107		1,89,311	
	Add: Balances under Security Deposit etc.,	16,782		16,782	
	Net Balance - C		**3,10,484**		**2,93,689**
D	**DEPRECIATION FUND**				
	Opening Balance	333,20,18,193		282,33,42,842	
	Add: Depreciation during the year	27,67,83,272		26,92,11,017	
	Sub Total	349,88,01,467		309,25,53,859	
	Add: Interest earned	26,14,01,370		13,41,91,080	
	Less: Utilisation During the year	4,94,94,736		47,26,217	
	Net Balance - D		**371,07,07,101**		**322,20,18,193**
E	**OTHER FUNDS**				
	(i) Sponsored Scheme Deposits		10,31,91,141		9,86,64,014
	(ii) SHRD Scheme Deposits		7,80,58,418		6,07,28,111
	TOTAL (A+B+C+D+E)		**1273,07,33,900**		**1172,93,68,124**

Place: Bangalore
Date: 26.07.2023

CENTRAL POWER RESEARCH INSTITUTE, BANGALORE

Schedules forming part of Balance Sheet as at 31st March 2023

(Amount in Rs.)

		SCHEDULE 6	Current Year		Previous Year	
		GRANTS FROM GOVT. OF INDIA & OTHERS				
A		Under Non-recurring Grant-in aid				
		Opening Balance	202,52,15,108		110,88,91,034	
		Add: Grant received during the year	160,47,65,235		180,00,00,000	
		Less: Grant utilised during the year	146,52,97,894		28,36,76,826	
		Grant Balance		216,46,82,450		202,52,15,108
B		Under R&D Schemes Grant in Aid				
	(i)	Under DHRD Schemes				
		Opening Balance	13,60,517		12,07,77,518	
		Add: Grant received during the year	2,73,42,037		-	
		Less: Grant utilised during the year	2,87,02,554		2,25,76,000	
		Less: Trs. To NPP	-		9,68,41,001	
		Grant Balance		-		13,60,517
	(ii)	Under RSuP Scheme				
		Opening Balance	67,74,000		23,19,074	
		Add: Grant received during the year	5,53,42,720		7,46,20,000	
		Less: Grant utilised during the year	6,21,16,720		5,78,46,000	
		Add: Unspent balance received	10,04,913		14,54,124	
		Less: Grant refunded to M o P during the year	-		37,73,198	
		Grant Balance		10,04,913		67,74,000
	(iii)	Under NPP Scheme				
		Opening Balance	2,82,21,000		7,96,960	
		Add: Grant received during the year	6,21,54,243		2,53,81,000	
		Less: Grant utilised during the year	9,03,74,243		8,65,01,000	
		Less: Grant refunded to M o P during the year	-		82,96,941	
		Add: from DHRD	-		9,68,41,001	
		Grant Balance		1,000		2,82,21,000
		TOTAL		**216,56,88,363**		**206,15,70,625**

Place : Bangalore.
Date : 26-07-2023

CENTRAL POWER RESEARCH INSTITUTE, BANGALORE

Schedules forming part of Balance Sheet as at 31st March 2023

(Amount in Rs.)

		SCHEDULE 5	Current Year		Previous Year	
		CURRENT LIABILITIES AND PROVISIONS				
		CURRENT LIABILITIES				
	1	Sundry Creditors				
		i) For Supplies & Services	88,24,520		5,16,81,355	
		ii) For Expenses	3,17,90,479		-16,59,935	
		iii) For Salaries	4,94,50,834		4,95,86,160	
		iv) For Others	7,51,96,663		6,46,40,169	
		v) Interest received on Grant Account to be refunded to M o P	34,73,932			
				16,87,36,428		16,42,47,749
	2	Deposits Received		87,91,15,239		80,62,27,342
	3	Statutory Liabilities		2,42,41,589		8,88,74,349
	4	EMD, Security Deposits and others		16,52,31,548		9,55,43,539
	5	Reserve for Doubtful debts		2,00,00,000		1,00,00,000
		TOTAL		125,73,25,104		115,68,93,179

Place: Bangalore,

Date : 26-07-2023

CENTRAL POWER RESEARCH INSTITUTE, BANGALORE

Schedules forming part of Balance Sheet as at 31st March 2023

(Amount in Rs.)

	SCHEDULE 8	GROSS BLOCK						
	FIXED ASSETS	Cost/valuation As at beginning of the year	Additions during the year (Non-Plan)	Additions during the year (SC Project)	Transfer from WIP (CWIP)	Transfer from CCE (WIP)	Total (for Current year end)	As at the Previous year end
A	FIXED ASSETS							
1	LAND							
	Freehold	6,06,04,860		-		-	6,06,04,860	6,06,04,860
2	BUILDINGS ON FREEHOLD LAND	133,78,65,336	-	-	-	14,38,41,688	148,17,07,024	133,78,65,336
3	PLANT MACHINERY & EQUIPMENT	697,74,16,307	95,47,888	(1,30,44,253)	-	14,14,07,806	711,85,17,938	697,74,16,307
4	VEHICLES	55,81,762		-			55,81,762	55,81,762
5	FURNITURE, FIXTURES	3,72,28,715	1,55,287	-		2,10,445	3,55,85,447	3,72,28,715
6	LIBRARY BOOKS & FILM	1,55,42,327		-	-	1,64,096	1,57,10,523	1,55,42,327
7	MACHINERY & EQUIPMENTS (SPONSORED PROJECTS)	26,66,05,705		2,66,75,813		-	29,87,81,518	26,66,05,705
	TOTAL (A)	869,81,21,872	98,03,155	1,45,31,558	-	28,87,14,537	5,12,45,70,072	8,68,81,21,871
B	CAPITAL WORK-IN-PROGRESS	342,47,59,134	147,27,16,236		-	(28,87,14,587)	460,77,84,783	342,47,59,134
	CAPITAL WORK-IN-PROGRESS (CPRI GRANT PORTION)	14,25,27,881	-8,15,14,153		-	-	6,10,13,648	14,25,27,881
	TOTAL (B)	3,56,73,18,815	141,11,06,183	-	-	(28,87,14,587)	4,66,88,08,231	3,56,73,16,815
	GRAND TOTAL	1237,54,55,487	143,00,05,308	1,49,31,558	-	-	1381,35,87,485	1237,54,55,487

Note: 1. [illegible]
2. [illegible]

Place: Bangalore
Date: [illegible]

CENTRAL POWER RESEARCH INSTITUTE, BANGALORE

Schedules forming part of Balance Sheet as at 31st March 2023

(Amount in Rs.)

	SCHEDULE 7	Current Year	Previous Year
	INVESTMENTS FROM EARMARKED/ENDOWMENT FUNDS		
A	**SUPERANNUATION FUND INVESTMENT ACCOUNT**		
1	Investment in LIC of India, under Superannuation Scheme	7,92,95,13,341	755,94,89,198
2	Claims Receivable	-	8,09,000
3	Cash at Bank (S.B. Account No.10356553751)	1,68,49,855	2,11,09,162
	Total - A	**794,63,63,196**	**758,14,07,360**
B	**PROVIDENT FUND INVESTMENT ACCOUNT**		
1	In Government Securities	3,64,92,938	3,64,92,938
2	Bonds	30,95,00,000	21,50,00,000
3	Term Deposits with Banks & Financial Institutions	7,00,00,000	17,95,00,000
4	Interest Accrued on Provident Fund Investments	1,28,61,879	105,26,525
5	TDS Receivables	45,91,889	20,80,000
6	Receivable from HO & CRTL	-	93,60,000
7	Cash at Bank (S.B. Account No.10356553740)	96,16,422	134,50,509
	Total - B	**44,30,63,128**	**46,64,09,972**
C	**NEW PENSION SCHEME FUND INVESTMENT ACCOUNT**		
1	Deposit with Bank	2,81,335	2,81,335
2	Accrued Interest on NPS Deposit	29,149	12,354
	Total - C	**3,10,484**	**2,93,689**
D	**DEPRECIATION FUND INVESTMENT ACCOUNT**		
1	Term Deposits with Banks & Financial Institutions	2,41,98,77,349	1,33,91,20,479
2	Bonds	66,05,00,000	1,06,75,00,000
3	Interest Accrued on Depreciation Fund Investments	31,41,74,356	11,43,63,513
4	Margin Money Deposit	51,00,000	3,62,00,000
5	Bank Balance	2,70,84,341	45,77,333
6	TDS receivables	46,54,111	-
		3,43,13,90,157	**2,56,17,61,325**
	Total (A+B+C+D)	**11,82,11,26,965**	**10,60,98,72,346**

Place : Bangalore
Date : 26-07-2023

CENTRAL POWER RESEARCH INSTITUTE, BANGALORE

Schedules forming part of Balance Sheet as at 31st March 2023

(Amount in Rs.)

		SCHEDULE 8	Current Year		Previous Year	
		CURRENT ASSETS, INVESTMENTS, LOANS & ADVANCES				
A		**CURRENT ASSETS:**				
	1	**Inventories:**				
		a) Stores and Spares		6,22,784		6,92,198
	2	**Sundry Debtors:**				
		a) Debts Outstanding for a period exceeding six months	35,76,83,867		31,63,11,858	
		b) Debts Outstanding for a period not exceeding six months	3,81,78,620	39,58,62,487	5,41,05,730	37,04,17,588
	3	**Cash balances in hand (including cheques/drafts, imprest and Stamps)**		1,36,173		2,75,208
	4	**Deposits and Bank Balances:**				
		a) Margin Money Deposits on R&D, CPRI & Revenue	1,90,08,000		2,01,38,592	
		b) Margin Money Deposits on Grant account	1,87,27,13,154		1,70,64,61,351	
		c) Deposits earmarked for Superannuation Fund	45,00,00,000		25,79,80,000	
		d) Deposits earmarked for Depreciation Fund	27,67,81,272		20,58,42,946	
		f) Capital Bank Balance	4,58,91,077		7,88,41,358	
		g) Savings Accounts	13,78,52,233	2,80,22,51,740	20,91,41,112	2,47,81,25,901
	5	**Deposits of Maintenance, Renewal & Obsolescence Reserve**	3,40,00,000		3,40,00,000	
	Add:	Savings Bank account of Maintenance, Renewal & Obsolescence Reserve	2,55,495		26,22,000	
	Add:	Accrued interest on MRO Fund & TDS Receivable, etc.,	35,31,794	3,77,87,289	15,01,482	3,81,23,482
B	1	**Investments**				
		a) Investment in Shares of Joint Venture Company, M/s National High Power Test Laboratory Pvt Ltd., New Delhi		30,40,50,000		30,40,50,000
		b) Long Term Deposits with Banks	58,51,31,594		1,00,77,36,371	
		Margin Money with Banks against BG	1,75,31,131		1,75,31,131	
		Short Term Deposits with Banks	42,48,07,785	103,14,72,499	16,45,00,000	122,97,67,502
C		**LOANS, ADVANCES & OTHER ASSETS**				
	a)	i) Deposits with Govt.Depts & others	2,02,34,806		2,94,17,756	
		ii) Deposits with Revenue Authorities (Payment under Protest)	6,88,17,271		3,68,17,271	
	b)	Advances to Employees	20,17,343		14,00,764	
	c)	Prepaid Expenses	8,11,082		7,60,971	
	d)	Accrued Interest	20,02,52,887		9,82,24,977	
	e)	TDS Receivables	10,74,25,907		23,22,91,289	
	f)	Claims Receivables	21,77,38,297		17,26,21,391	
	g)	Capital Advances	10,05,34,159			
	h)	Other Advances	1,91,77,309		1,48,97,239	
	i)	Deposit to NHPTL	18,40,00,000	93,06,11,071	18,40,00,000	78,96,48,268
		TOTAL		**982,38,16,941**		**959,18,97,941**

Place : Bangalore,
Date : 20.07.2023

CENTRAL POWER RESEARCH INSTITUTE, BANGALORE

Schedules forming part of Income & Expenditure
for the year ended 31st March 2023

(Amount in Rs.)

	SCHEDULE 9	Current Year	Previous Year
	INCOME FROM TEST FEE & CONSULTANCY		
a)	Test Fee	144,69,81,667	107,11,15,978
b)	Consultancy Services Charges	13,44,37,783	13,80,01,388
	TOTAL	158,13,99,450	120,91,17,366

Place : Bangalore,
Date : 26-07-2023

CENTRAL POWER RESEARCH INSTITUTE, BANGALORE

Schedules forming part of Income & Expenditure
for the year ended 31st March 2023

(Amount in Rs.)

	SCHEDULE 10	Current Year	Previous Year
	FEES		
a)	**Training Fee**	1,31,52,000	63,05,500
b)	**Seminar Fee**	15,05,952	11,57,785
	TOTAL	**1,46,57,952**	**74,63,285**

Place : Bangalore,
Date : 26-07-2023

CENTRAL POWER RESEARCH INSTITUTE, BANGALORE

Schedules forming part of Income & Expenditure
for the year ended 31st March 2023

(Amount in Rs.)

	SCHEDULE 11	Current Year	Previous Year
	INTEREST EARNED		
a)	Interest on Term Deposits with Banks & Financial Institutions	10,14,42,200	7,73,87,076
b)	Interest on Deposit with Others	3,37,66,804	44,87,671
c)	Interest on Loans & Advances to Employees	10,32,695	4,71,307
	TOTAL	**13,62,41,699**	**8,23,46,054**

Place : Bangalore,
Date : 26-07-2023

CENTRAL POWER RESEARCH INSTITUTE, BANGALORE

Schedules forming part of Income & Expenditure
for the year ended 31st March 2023

(Amount in Rs.)

		SCHEDULE 12	Current Year	Previous Year
		OTHER INCOME		
1)		**Fees for Miscellaneous Services**		
	a)	Sale of Publications	6,000	4,000
	b)	Library Receipts	100	1,266
2)		**Miscellaneous Income**		
	a)	Application fee on recruitment	8,13,402	1,70,200
	b)	Sale of Tender forms	14,500	36,000
	c)	Licence fees	16,05,127	19,48,759
	d)	Rent Receipts	15,81,551	10,19,658
	e)	Sale of Scrap	46,74,163	68,43,794
	f)	Others	2,34,62,771	23,220
	g)	Interest Received on Income Tax Refunds	2,43,20,766	48,94,056
	h)	Provision for Doubtful Debts Realised	38,59,626	-
		TOTAL	**6,03,39,006**	**1,49,40,953**

Place : Bangalore,
Date : 26-07-2023

CENTRAL POWER RESEARCH INSTITUTE, BANGALORE

Schedules forming part of Income & Expenditure
for the year ended 31st March 2023

(Amount in Rs.)

	SCHEDULE 13	Current Year	Previous Year
	RESEARCH ESTABLISHMENT EXPENSES		
a)	Salaries and Wages including Bonus	63,57,29,544	56,26,94,699
b)	Staff Welfare Expenses	1,40,45,889	98,45,910
c)	Expenses on Employee's Retirement and Terminal Benefits	45,00,00,000	14,79,00,000
d)	Expenses on Medical Facilities	1,45,31,470	1,45,91,030
	TOTAL	111,43,06,703	73,62,31,639

Place: Bangalore,
Date : 26-07-2023

CENTRAL POWER RESEARCH INSTITUTE, BANGALORE

Schedules forming part of Income & Expenditure
for the year ended 31st March 2023

(Amount in Rs.)

	SCHEDULE 14	Current Year	Previous Year
	RESEARCH ADMINISTRATIVE EXPENSES		
a)	Electricity and Power	6,03,08,133	8,38,95,223
b)	Water Charges	6,37,321	7,15,963
c)	Office Expenses	5,79,31,363	4,16,76,112
d)	Repairs and Maintenance	18,22,67,243	13,41,49,731
e)	Rent, Rates and Taxes	13,98,647	12,36,467
f)	Vehicles Running and Maintenance Expenses	4,55,603	5,60,606
g)	Postage, Telephone and Communication Charges	17,51,367	20,86,393
h)	Printing and Stationery	3,22,766	7,86,861
i)	Travelling and Conveyance Expenses -Inland	73,33,712	22,35,034
	Travelling and Conveyance Expenses -Foreign	4,96,887	73,016
j)	Expenses on Seminar & Workshops	9,62,828	7,53,075
k)	Subscription Expenses	41,393	-
l)	Expenses on Fees	1,72,091	1,54,949
m)	Auditors Remuneration	1,75,000	1,87,700
n)	Professional Charges	13,50,900	2,66,260
o)	Library Expenses	9,78,708	8,42,570
p)	Training Expenses	26,52,024	25,21,079
q)	Advertisement and Publicity	11,08,812	10,62,129
r)	Transfer to 'Reserve for Capital Expenditure'	-	(1,71,00,000)
	TOTAL	39,53,65,213	25,59,73,269

Place: Bangalore
Date : 26-07-2023

CENTRAL POWER RESEARCH INSTITUTE, BANGALORE

Schedules forming part of Income & Expenditure
for the year ended 31st March 2023

(Amount in Rs.)

	SCHEDULE 15	Current Year	Previous Year
	Depreciation & provision for doubtful debts		
a)	Depreciation for the year	27,67,83,272	26,92,11,027
b)	Provision for doubtful debts	2,00,00,000	1,00,00,000
	TOTAL	29,67,83,272	27,92,11,027

Place : Bangalore,
Date : 26-07-2023

CENTRAL POWER RESEARCH INSTITUTE
Schedule forming part of Income & Expenditure for the year ended 31st MARCH 2023

SCHEDULE 15.1
DEPRECIATION

YEAR	GROSS BLOCK				DEPRECIATION							NET BLOCK	
		Additions											
YEAR	OB	Additions	Transfer from WIP to Assets	TOTAL	%	OB not Charged to I&E	OB Charged to I&E	OB Accumulated Dep	For the Year	Total charged to I&E	Total	OB	CB
1	2	3	4	5		6	7		8	9	10	11	12
				(2+3-4)						(7+8)	(6+9)	(2-6-7)	(5-10)
Land	6,96,84,860	-		6,96,84,860								6,96,84,860	6,96,84,860
Buildings	1,33,35,85,369	-	14,38,41,688	1,47,74,27,057	3.17	21,46,07,660	35,74,17,900	57,20,25,561	4,43,99,200	40,18,17,100	61,64,24,751	97,61,67,469	86,10,02,293
Buildings (C Cir)	42,79,967	-	-	42,79,967	3.17	3,58,371	17,63,774	21,22,148	1,35,675	18,99,449	22,57,823	25,16,193	20,22,144
Plant & Machinery	6,93,27,01,526	-33,95,286	14,54,97,856	7,07,48,03,096	3.17	1,52,93,55,631	2,27,37,01,658	3,80,30,57,489	21,65,43,488	2,49,02,45,146	4,01,96,00,978	4,65,89,53,868	3,05,52,02,118
Plant & Machinery (ICICI)	4,47,14,841	-	-	4,47,14,841	3.17	55,59,645	1,84,15,217	2,39,74,862	14,17,460	1,98,32,676	2,53,92,322	2,62,99,624	1,93,22,519
Plant & Machinery (Sports)	36,98,05,706	2,59,75,811	-	39,57,81,517	3.17	2,73,85,799	7,55,16,290	10,29,02,090	1,27,63,260	8,82,79,551	11,56,65,350	29,32,89,415	28,31,16,167
Furniture & Fixtures	3,32,29,715	10,56,284	2,10,446	3,45,95,447	6.33	67,23,812	1,57,36,655	2,24,60,467	13,25,886	1,70,62,540	2,37,86,352	1,74,93,065	99,09,094
Vehicles	55,81,762	-	-	55,81,762	9.50	34,40,892	15,88,014	50,28,906	41,935	16,29,949	50,70,841	39,93,748	5,10,921
Library Books	1,53,20,774	-	1,64,598	1,54,85,372	95.00	-	1,45,54,735	1,45,54,735	1,56,368	1,47,11,103	1,47,11,103	7,65,039	7,74,269
Films (Documentary)	2,25,153	-	-	2,25,153	95.00	-	2,13,895	2,13,895	-	2,13,895	2,13,895	11,258	11,258
Sub Total	8,80,81,29,673	2,67,34,842	28,97,14,587	9,12,45,79,072		1,78,74,32,013	2,75,89,08,140		27,67,83,272	3,03,56,91,412	4,82,31,23,425	5,04,92,21,534	4,30,14,55,647

SCHEDULE 15.1A
Work-in-Progress

Work-in-Progress	Opening WIP	Addition	Transfer to Assets	Closing WIP
Capital Works in Progress (M o P)	3,39,71,07,134	1,50,04,02,236	28,97,14,587	4,60,77,94,783
Capital WIP (CPRI)	17,02,19,681	(8,92,06,133)	-	8,10,13,548
Total (B)	3,56,73,26,815	1,41,11,96,103	28,97,14,587	4,68,88,08,331
TOTAL	12,37,54,56,488	1,43,79,30,915	57,94,29,174	13,81,33,87,403

Place. Bangalore,
Date : 26.07.2023

Schedule – 16

Significant Accounting Policies attached to and forming part of Accounts for the year ended 31st March 2023.

Background: - The Institute, an autonomous body under Govt. of India, Ministry of Power established through a resolution vide No.33 (14)/74-Policy: dated 21/10/1974 is totally focused on Power Research. The Institute has been recognized by Ministry of Science & Technology as an S&T Institution. The Institute has been further recognized as Scientific and Industrial Research Organization by Government of India, Ministry of Science and Technology vide their letter No. 11/68/88-TU-V, dated 05/04/2017. The Institute as a legal entity is registered with the Registrar of Societies. The basic objectives of the Institute is to serve as a National Testing & Certification Authority and act as an apex body for initiating and coordinating Research and Development in the field of electric power. The Government of India is supporting the activities through grants. Additionally, the Institute is generating revenue for regular maintenance through test fees and professional services rendered to Government organizations/Electricity Boards/Commercial organizations etc.

1. **Method of Accounting:**
   The financial statements have been prepared to comply with the Generally Accepted Accounting Principles. The financial statements have been prepared under the historical cost convention on an accrual basis. The accounting policies have been consistently applied by the Institute. The Bonus paid to employees are accounted in the year of payment.

2. **Fixed Assets:**
   Fixed assets are stated at cost. Cost comprises the purchase price and any attributable cost of bringing the asset to its working condition for its intended use. Financing costs relating to acquisition of fixed assets are also included to the extent they relate to the period till such assets are ready to be put to use.

   The Grants are contribution by Govt. of India towards total capital outlay of Projects and no repayment of the same is ordinarily expected. Fixed assets acquired under Capital Projects, R & D Plan, Sponsored Schemes and loans are stated at their original cost of acquisition. The funds provided for acquisition of these Fixed Assets under Grant-in-Aid from Government of India / other Agencies are exhibited as Capital Reserve.

   Fixed Assets acquired out of Non Plan funds were being capitalized @ Rs.1-00 per asset and the balance amount charged to Income & Expenditure account from the financial year 2002-03 to 2014-15. From the financial year 2015-16, fixed assets acquired out of Non Plan funds are capitalized at full value and depreciation provided as applicable.

   The Institute is a non-profit organization and therefore depreciation on assets capitalized was not provided in the accounts up to 2006-07. However, as per the decision of the Governing Council (G.C), the Depreciation was provided on the new Schemes from 2007-08 as per the rates provided in the Income Tax Rules, 1962 on written down value basis. Further, the G.C in its meeting held on 16th Nov 2009, instructed the Institute to provide depreciation from the financial year 2009-10 on all assets and the Government of India vide No.4/11/2009-T&R dated 30-03-2010 directed to provide depreciation every year by a charge to the Income & Expenditure Account on Straight line method basis.

Accordingly, the depreciation has been provided from 2009-10 on Straight line method as per the rates determined by the Management (based on the useful life of the assets) on all the assets and the total depreciation not provided for upto 31st March 2019 is of the order of Rs.245,21,89,649/- (for assets additions from 1981) as stated in the Annual Accounts upto 31-03-2019. The useful life was taken for Buildings at 28 years and Plant & Machinery at 20 years. A review of useful life of assets was made. As per the approved project proposals for creation of Capital Assets, the project period is taken at 30 years. Therefore for depreciation, the useful life of Buildings and Plant & Machinery is taken at 30 years and hence depreciation not provided worked out to Rs.1,78,74,32,013/-. Accordingly depreciation for the year 2019-20 is also charged at the revised rates.

There is a difference between the Capital Reserve and Fixed Asset Gross block to the tune of Rs.5.51 Crores. **1.** During the financial year 2010-11 an amount of Rs.482.34 lakhs being the proceeds of sale of assets at TRC, Koradi was received and fixed assets to the tune of Rs.482.34 lakhs was reduced in Fixed Asset schedule but not in Capital Reserve same rectified by reducing in capitalization and added to Grant Receipt during the year FY 2017-18. **2.** During the financial year 2009-10 an amount of Rs.9.81 lakhs being the proceeds of sale of assets was received and fixed assets to the tune of Rs.9.81 lakhs was reduced in Fixed Asset schedule but not in Capital Reserve same rectified by reducing in capitalization and added to Grant Receipt during the year FY 2017-18. **3.** Similarly an amount of Rs.495.00 lakhs was capitalized, but actual assets capitalized was Rs.489.95 lakhs, thus difference of Rs.5.05 lakhs was rectified by reducing in capitalization and added to General Reserve. **4.** Similarly the surplus on sale of Fixed Asset of Rs.54.13 lakhs as on 31-03-2017 has been added to the Capital reserve same was rectified by reducing in capitalization and added to Grant Receipt during the FY 2017-18.

Depreciation on Library Books & Films (Documentary) charged at 95% of Book Value.

Capital work-in-progress includes expenditure on Civil Works of projects, which have not been completed as at the end of the year.

3. **Depreciation Fund**

As per direction from Governing Council, Depreciation fund is created as on 01-04-2019. The interest earned/accrued is added to the fund. Current year depreciation also was provided and added to fund.

4. **Investments:** Investments are shown at cost.

5. **Inventories:**
Inventories of stores and spares are shown at cost and cost includes expenses incurred for procuring the same wherever directly attributable. All consumables purchases are charged off at the time of procurement.

6. **Research and Development:**
Research expenditure on Research and Development is charged against the receipt of research grants. Capital expenditure on Research & Development is treated in the same manner as expenditure on other fixed assets.

7. **Foreign Currency Transaction:**
Transactions in Foreign Currency are recorded at a notional rate of exchange.

Realized gains and losses on Foreign Currency transactions are effected in the Income and Expenditure Account. The balances are recast at the end of the year based on the rate prevailing as On 31st March.

8. **Revenue Recognition:**

The Revenue in respect of Test Fees and Consultancy charges are accounted on completion of work /report. The policy of the Institute is to account the 'TDS Receivables 'on receipt of Form 16 from the client.

Interest Income on deposits relating to CPRI with banks is recognized on time proportionate basis.

9. **Retirement Benefits:**

(i) **Post – employment benefit plans:**

(a) Defined Contribution Plan –

Contribution to New Pension Scheme are accrued in accordance with applicable statute and managed as per Government rules and regulations.

(b) Defined Benefit Plan

The liability towards retirement benefits like Pension, Gratuity and Leave Encashment are ascertained on the basis of Projected Unit Credit Method with actuarial valuation and provided in the books of accounts.

(ii) **Short term employment benefits:**

The undiscounted amount of short term employee benefits expected to be paid in exchange for Services rendered by employees is recognized during the period when the employee renders services. These benefits include compensated absence and other incentives.

(iii) **Pension payments:**

Pension payments are accounted for April to March every year.

As per our report of even date
for **V.K.NIRANJAN & CO.,**
Chartered Accountants,
FRN :0024685

(C.S.MURALI KRISHNA)
Chief Accounts Officer

(B.A.Sawale)
Director General

(V.K.Niranjan)
Partner
Membership No. 021432

Place: Bangalore.
Date: 26-07-2023

Schedule – 17

Notes on Accounts & Contingent Liability attached to and forming part of Accounts for the year ended 31st March 2023.

1. Fixed Assets and Depreciation: -Upto 2002-03, the Institute capitalized all costs relating to the acquisition and installation of all fixed assets. From the year 2002-03 onwards, the Institute has changed its policy for accounting capital assets as under

   - All assets acquired under Capital Projects, R&D Plan, Sponsored Schemes, RSOP Schemes are capitalized with all costs relating to their acquisition.

   - All assets acquired-out of Non-Plan (Revenue) expenditure of the Institute were charged off to the Income & Expenditure account from the financial year 2002-03 to 2014-15. Total value of assets charged off from 2002-03 to 2014-15 is Rs.1691.00 lakhs. In the financial year 2015-16, the Institute started to capitalize 'at cost' all assets acquired out of Non-Plan (Revenue) expenditure and depreciation provided as applicable.

   - The Institute is maintaining a fund "Maintenance, Repairs and Obsolescence – Fund" by charging certain amount to the Income & Expenditure Account. The Institute is utilizing this fund towards revenue and certain capital expenses. As the charge is already provided to the Income & Expenditure account, depreciation is not provided on such assets acquired out of this fund. The value of such assets is Rs.42.63 lakhs for 2022-23 (Rs.87.72 lakhs for the previous year) and Rs.1699.76 lakhs up to 2022-23.

2. Government Grant: - Grant received from the Government of India and other organizations towards specific projects are shown as capital/sponsored grants. The Institute confirms compliance of all the conditions of the grant. The Institute consistently has followed the procedure of showing the assets procured from such grants under the Fixed Assets.

3. Reserve for Capital Expenditure out of CPRI generated funds: -
   (a) Ministry of Power, Government of India, vide letter No. 5/4/2013-T&R dated 25-02-2014 while conveying approval for the project 'Augmentation of New Facilities Projects' for Rs.105.90 Crores has directed C.P.R.I. to (i) bear 10% of the total outlay of the projects i.e., Rs.10.59 Crores and (ii) also bear additional funds, if any required over and above the approved outlay including any escalation of FE component of the project, from its internal resources. In the same way Ministry of Power, Government of India, vide letter No. 5/5/2014-T&R dated 05-01-2015 conveyed approval for the project 'Augmentation of High Power Short Circuit Test facilities and establishment New Facilities Projects' for Rs.996.10 Crores. The same was revised to Rs.979.00 crores vide Ministry of Power letter No.4/1/2020-T&R dt.14-01-2022 has directed C.P.R.I. to (i) bear 10% of the total outlay of the projects i.e., Rs.97.90 Crores and (ii) also bear additional funds, if any required over and above the approved outlay including any escalation of FE component of the project, from its internal resources.

The total amount to be contributed by C.P.R.I. on account of above mentioned projects is Rs.108.49 Crores.(10.59+97.90) To meet the above expenditures, C.P.R.I. has created a reserve by name "Reserve for Capital Expenditure out of CPRI generated funds" and the credit balance under this reserve as on 31-03-2023 is Rs.89.54 crores.

(b) National High Power Test Laboratory Pvt. Ltd. is a Joint Venture of NTPC, NHPC, Power Grid, DVC and CPRI. The total equity of NHPTL is Rs.152.00 Crores, contributed equally by JV Partners of Rs.30.40 Crores each.

CPRI had contributed the amount by obtaining Plan Grant of Rs. 24.00 Crores from MoP and the balance of Rs. 6.40 Crores was contributed from Internal Resources. M/s. N.H.P.T.L. requested to provide temporary loan of Rs.6.00 Crores from each JV Partner vide letter no.NHPTL/JVs/1643 dated 21.03.2018 towards repayment of loans to M/s. Power Finance Corporation. The same was paid on 28.03.2018 from CPRI General Reserve with the approval of Ministry of Power vide letter no.31-4/1/2018-T&R dated 27.03.2018 for a period of 3 months. Later on as NHPTL had requested for extension of the temporary loan for another 3 months as they were in the process of negotiating larger loan from Banks and Financial Institutions vide their letter No. NHPTL_F&A/019 dated 14.06.2018. The extension of period for temporary loan was obtained from MoP vide letter no. 31-4/1/2018- T&R dated 26.06.2018. The temporary loan is still not settled by M/s NHPTL since NHPTL has requested to provide additional loan of Rs. 12.40 Crores from each JV Partner. CPRI is receiving simple interest @ 10% p.a. on the temporary loan amount.

In accordance with the approval of Government of India, Ministry of Power vide letter No. 5/18/2007- T&R dated 16-01-2012, an amount of Rs.2,390.00 lakhs has been paid towards initial equity contribution in M/s National High Power Test Laboratory Pvt Ltd., New Delhi, (M/s NHPTL) a Joint Venture Company of 5 equity partners viz., NTPC, NHPC, POWERGRID , DVC & C.P.R.I. The total equity share of C.P.R.I. would be Rs.2,400.00 lakhs being 1/5th equal share of the total equity capital of Rs.12,000.00 lakhs, equally shared by all the 5 equity partners.

2,39,00,000 shares of Rs.10.00 each for total amount of Rs.2,390.00 lakhs was allotted and Share Certificates have been issued to C.P.R.I. M/s N.H.P.T.L, called for allotment of 1,00,000 shares of Rs.10.00 each during February 2017 and the same was paid to M/s N.H.P.T.L.

M/s N.H.P.T.L has decided to increase its Equity capital. Hence it has asked C.P.R.I. to pay an amount of Rs.640.00 lakhs, towards allotment of 64,00,000 shares of Rs.10.00 each. Ministry of Power, Government of India, has asked C.P.R.I. to make this investment of Rs.640.00 lakhs out of its own Funds / Reserve and accordingly the amount of Rs.640.00 lakhs was paid to M/s N.H.P.T.L. during February 2017. The shares were allotted to us and the share certificate for Rs.650.00 lakhs has been received.

M/s. N.H.P.T.L. requested to provide temporary loan of Rs.600.00 lakhs from each JV Partner vide letter No. NHPTL/JVs/1643 dated 21.03.2018 towards repayment of loans to M/s. Power Finance Corporation. The same was paid on 28.03.2018 from CPRI General Reserve with the approval of Ministry of Power vide letter no.31-4/1/2018-T&R dated 27.03.2018 for a period of 3 months.

4. **Retirement Benefits:** - The Governing Council at its meeting held on 17.10.2007, directed CPRI to provide for the liability from internal resources/charging to Income & Expenditure Account. Monthly pension and retirement benefits are to be met out of interest received on the invested fund. In case of shortage same have to be charged to Income & Expenditure A/c.

The liability on account of Pension, Gratuity etc., was evaluated as on 31.03.2023 through M/s LIC of India and the liability has been estimated at Rs.70,322.00 lakhs. (Estimation received from M/s Transvalue is Rs.97,676.00 lakhs). The opening fund balance was Rs.68,118.00 lakhs. During the year Rs.4500.00 lakhs was allocated out of the surplus of the Institute.

Interest earned on Superannuation Fund Investment over and above utilization was added to fund since beginning. The same is re stated as Additional Interest on Superannuation Fund and disclosed separately from FY 2022-23 and stands at Rs.11,341.36 lakhs. The calculation sheet is attached in Annexure I.

5. **Income Tax Cases :--**

The CBDT vide Notification No.27/2016 (F.No. 203/32/2015/ITA-II) dated 07-04-2016 has notified C.P.R.I. in the category of 'Scientific Research Association' under Section 35 and sub section (i) and (ii) of Income tax Act 1961 from Assessment Year 2003-2004 onwards and consequently C.P.R.I. has become eligible for exemption from Income Tax under section 10 (21) of the Income Tax Act 1961.

C.P.R.I. has applied for refund of TDS of Rs.25.43 lakhs for AY 2006-07 and for AY 2014-15 there is an outstanding TDS to the tune of Rs.901.07 lakhs.

Sl. No.	A.Y.	Issue and status of the of the cases as on 31.03.2021
1	2011-12 2012-13 2013-14 2014-15	Appeal was filed with ITAT, "C" Bench regarding taxability of Quarters occupation under perquisites and the appeal was party allowed vide order dated 13.10.2017. The case is pending with Income Tax Department.
2	2014-15	Appeal was filed with CIT (A)-14 and a personal hearing was attended on 31.01.2019. On follow up it is understood that the file has been moved for "National Faceless Appeal Centre". We received communication stating that, appeal has been accepted and income assessed as NIL. Refund awaited.

6. **Service Tax Cases:-**

A) As per order no. 35/Commr/ST/ADJ/BPL-I/2014 dated 31.01.14, the Commissioner, Central Excise & Service Tax, Bhopal has raised a demand of Rs. 8,09,51,984/- (Service Tax, Interest and Penalty) alleging non-payment of Service Tax on Advance Payment received during the period July 2005 to June 2011. An appeal is filed against the said order with the CESTAT, New Delhi on 24.4.2014 which is pending for adjudication. The Hon'ble Tribunal Bench of CESTAT vide its Order dated 07-10-2015 has ordered for a deposit of Rs.5,67,91,862/- . The Institute complied with the Order and deposited Rs.5,67,91,862/- being the demand of Service Tax along with interest. An appeal has been filed on 22.11.2017 in the Hon'ble High Court of M.P Jabalpur and the case is pending.

B) The Asst. Commissioner of Service Tax Service Tax Division II, Bangalore vide Order No.28/2013, dated 24.06.2013 has raised a demand of Rs.52,952/- as interest on belated payment of Service Tax on Advance Deposits. The Institute has filed an appeal before the commissioner of central excise against the Adj. Order on 14-09-2013.

C) A Show Cause Notice No.C.No.IV/01/51/2013 ST Divn.II/1973/13, Dt 09/05.2013 issued, demanding Rs.2,06,712/- being ineligible cenvat credit claimed on "Hiring of Vehicles" and "Catering Services" during the year 2011-12. A reply was given to this Show Cause Notice vide letter dated 30.08.2013. On receipt of reply from CPRI, a demand for Rs.1,13,410/- towards CENVAT on catering services was allowed vide Order No. 32/2015 dated 27-11-2015. The authorities disallowed CENVAT credit of Rs 93,302/- on 'rent-a-cab' for which CPRI has filed an appeal for availing CENVAT credit.

D) The audit team of Service Tax department audited the accounts for the period from October 2013 to March 2015. In the Audit Report, they demanded to pay a sum of Rs.25,46,328/- , out of which an amount of Rs.2,79,494/- was remitted. CPRI filed an appeal for remaining amount of Rs.22,66,834/- and the case is pending.

7. **Other Cases :-**

a) CPRI had received a request for refund of unutilized test charges of Rs.4,10,900/- from M/s. Jabshetty Transformers, Gulburga during the month of May 2016 through their representative, Shri B Puttaraju who was a regular visitor to the Institute on behalf of M/s. Jabshetty Transformers. For transferring the amount, CPRI had requested M/s. Jabshetty Transformers for RTGS details which they provided through an email. Based on the RTGS details given by them, CPRI transferred Rs.4,10,900/- to the account as provided ie. M/s. M&CDCC Bank Ltd., Mysore

On informing M/s. Jabshetty Transformers through email about the transfer of the above amount, they informed back that they did not ask for refund/transfer and also no money had reached to their account. On enquiry it was found that Shri B Puttaraju, the representative of the M/s.Jabshetty had fictitiously created another account in the name of M/s.Jabashetty Transformers in M&CDCC Bank Ltd., Mysore.

M/s.Jabshetty Transformers has sent legal notice for refunding the amount which was transferred to M/s. Jabashetty Transformers Account. This is being defended by our Legal Advisers, Ravi, Suri & Sunitha, Malleswaram, Bangalore. A case was also filed in this regard, in the Sadashivanagar Police Station on 20th Oct. 2016. The matter is still pending.

b) There is an arbitration case going on between CPRI and Purushottama Raju in Hon'ble High Court of Karnataka for Civil Works of EMI/EMC building construction vide case No.COMAP No.224/2022. The party has claimed Rs.4,84,08,273/- along with interest till the case is settled. The matter is still pending. Rs.1,00,00,000/- paid as Arbitration Deposit to City Civil Court, Karnataka.

8. **Contingent Liabilities**: -

a) On account of Letter of Credit opened and remaining to be honored – NIL (excepting Letter of Credits with 100% margin) (NIL for 2022-23).

b) Estimated amount of liability on account of capital contracts - Rs.11,744.49 lakhs. (Rs.23,739.83 lakhs for 2021-22).

c) Claims not acknowledged as debts by the Institute – NIL.

d) Bank Guarantees furnished to various clients by the Institute is of the value of Rs.275.33 lakhs as on 31.03.2023 backed by deposits to the full extent.

e) The total amount of Demand received from Service Tax Department (as provided in para b above) is Rs.836.44 Lakhs.

9. **Sponsored Projects :-**
The Institute is engaged in core research activity funded by Government Grants. Apart from this, research activity for Government, Semi-Government and private agencies are also carried out on Sponsored basis. The cost of such research is fully funded by such agencies. The element of service if any in such activity is separately identified and charged.

10. The Institute has a system of Internal Audit conducted by a firm of Chartered Accountants.

11. The grant balances shown at Schedule-4 are exclusive of margin money deposits for LC establishment towards the import of equipments. The margin money deposits as on 31.03.2023 are Rs.197,27.13 lakhs (Rs.17864.61 lakhs as on 31.03.2022).

12. Accrued Interest on Investments made in Public Sector Undertakings is calculated based on simple interest method.

13. Figures for the previous year have been regrouped wherever necessary to conform to the presentation of the current year.

As per our report of even date

For V.K.NIRANJAN & CO
Chartered Accountants,
FRN :002466S

(C.S.MURALI KRISHNA)
Chief Accounts Officer

(B.A.Sawale)
Director General

(V.K.Niranjan)
Partner
Membership No.021432

Place: Bangalore,
Date: 26-07-2023

Annexure-I

Details of SAF Fund additional interest from 1993 to 2023

YEAR	Interest Received & Accrued	Utilisation	Additional Interest
1993-94	4,71,161		4,71,161
1994-95	14,58,913		14,58,913
1995-96	18,70,187		18,70,187
1996-97	23,72,914		23,72,914
1997-98	43,67,495		43,67,495
1998-99	21,00,505		21,00,505
1999-2000	55,00,425		55,00,425
2000-01	57,32,117		57,32,117
2001-02	60,07,547		60,07,547
2002-03	94,60,574	16,51,278	78,09,296
2003-04	1,60,40,538	1,67,75,493	
2004-05	2,77,15,336	1,69,89,821	1,07,25,515
2005-06	2,96,55,720	2,63,97,924	32,57,796
2006-07	3,67,18,576	2,52,67,701	1,14,50,875
2007-08	4,27,50,121	3,65,96,262	61,53,859
2008-09	5,60,26,521	7,80,14,624	
2009-10	7,77,42,724	7,88,64,750	
2010-11	8,53,09,090	7,92,10,383	60,98,707
2011-12	11,69,01,308	10,18,06,492	1,50,94,816
2012-13	20,26,55,420	13,52,89,238	6,73,66,182
2013-14	25,56,96,511	13,51,68,776	12,05,27,735
2014-15	32,46,22,612	16,07,71,381	16,38,51,231
2015-16	35,54,30,019	18,22,60,283	17,31,69,736
2016-17	37,41,54,945	24,00,14,035	13,41,40,910
2017-18	37,68,52,808	37,28,85,623	39,67,185
2018-19	39,62,35,069	32,65,73,790	6,96,61,279
2019-20	44,26,21,889	36,43,95,135	7,82,26,754
2020-21	43,50,22,214	37,23,62,492	6,26,59,722
2021-22	46,05,61,922	35,84,99,634	10,20,62,288
2022-23	51,48,95,054	44,70,79,711	6,78,15,343
TOTAL	**4,66,69,50,235**	**3,55,68,74,826**	**1,13,39,20,493**

Note:1. During the year 1993-94 to 2001-02, Pension Payments have been charged to Income & Expenditure A/c and not utilised from Interest.

2. For the year 2003-04, 2008-09 & 2009-10 excess of expenditure on account of Pension Payments had been charged to Income & Expenditure A/c.

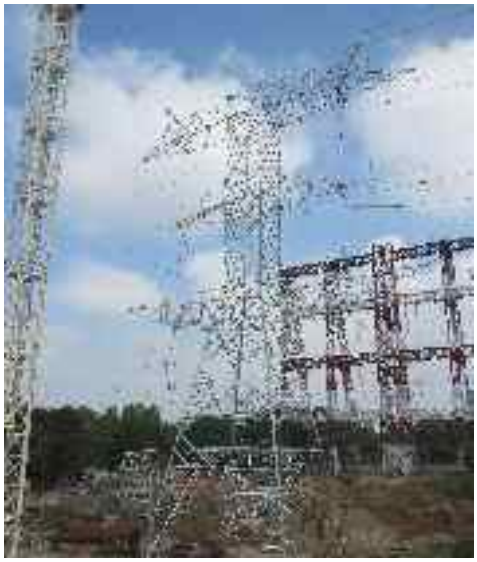
Reply to the Independent Auditor's Report

Observation	Reply
CPRI has invested Superannuation fund with M/s LIC of India to the extent of Rs.839.59 Crores for the year ended 31.03.2023 with current year provision of Rs.45 crores. CPRI has received two Actuarial valuation reports as follows a. Estimation received from M/s Transvalue Consultants is Rs.976.76 Crores. b. Estimation received from M/s LIC of India is Rs.703.22 Crores. Hence the surplus for the year has been overstated Rs.137.17 Crores (as per M/s Transvalue Consultants valuation) and excess provision made as per M/s LIC of India.	Every, year the surplus earned is allocated to Superannuation Fund as contribution to the extent possible. However CPRI is having continuous excess interest over its utilization from the year 2010-11 onwards. The additional interest earned stood at Rs.113.39 crores as on 31.03.2023.
There are unknown direct remittances of Rs.8.57 crores which is under continuous reconciliation. We recommend the management to implement process to identify such unknown remittances in future to have better control over debtors.	To avoid the Unknown Direct Remittances, CPRI has introduced Online Payment portal for customers during January, 2023. The present balance of Unknown direct Remittances is at Rs.7.03 crores as on 26.07.2023. Efforts are being made to clear the remaining balances.

Chief Accounts Officer
(C S MuraliKrishna)

Place: Bengaluru
Date: 26.07.2023

GLOBAL PRESENCE OF CPRI



CENTRAL POWER RESEARCH INSTITUTE

Prof. Sir. C. V. Raman Road, Sadashivanagar P.O.,
P. B. No. 8066, Bengaluru – 560 080, Karnataka, India.
Tel: +91 80 22072201/22072207/22072215
Fax: +91 80 23601213
Website: www.cpri.res.in