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# VIDYUT ANUSANDHAN SAMACHAR

## QUARTERLY NEWSLETTER

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# Contents



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# ABOUT CPRI

Central Power Research Institute (CPRI) was established by the Government of India in 1960. It became an Autonomous Society in 1978 under the aegis of the Ministry of Power, Government of India. For the past six decades, CPRI has rendered dedicated service to the power sector.

Over the years, CPRI has developed expertise in generation, transmission, and distribution systems. It has established world-class facilities for research and testing in the following areas:

- High Voltage, High Power, and Short Circuit Testing
- Power Capacitors and Cables
- Solar PV, Smart Metering, and AMI
- Power System and Energy Studies
- Tower Design, Vibration Studies, and Seismic Performance
- Liquid Dielectrics, Diagnostics, and Condition Monitoring
- Cybersecurity, Smart Grid Systems, and Energy Storage
- RLA studies and the Development of Newer Materials for the Power Sector


*UHV Research Lab, Hydrabad*

## Key Activities:

- Applied Research in Power Systems Engineering.
- Independent Third-Party National Laboratory for Testing & Certification.
- Consultancy & Field-Testing Services.
- Third-Party Witnessing & Specialized Training.

## Director General's Message

**Dr. J. Sreedevi**
**Director General, CPRI**

It gives me great pleasure to present the latest issue of 'Vidyut Anusandhan Samachar' for the April–June 2026. This edition showcases key achievements, developments, and events happend during this period.

CPRI fraternity celebrated the 135th birth anniversary of Bharat Ratna Dr. B.R. Ambedkar at CPRI, Bengaluru, on 29th April 2026. In another major milestone, a state-of-the-art Electromagnetic Interference and Electromagnetic Compatibility (EMI/EMC) Laboratory was inaugurated at the CPRI Regional Test Laboratory (RTL) in Nashik. This new facility is equipped to provide comprehensive EMI/EMC testing and certification services for electrical, electronic, and communication products.

Additionally, Swachhta Pakhwada–2026 was observed across CPRI and its regional units, featuring various cleanliness drives and awareness campaigns. I extend my best wishes to all CPRI employees for their dedicated efforts in advancing the mission and goals of our institution.

# IN THE NEWS

## Celebration of Dr. B. R. Ambedkar's Birthday

Central Power Research Institute (CPRI) celebrated the 135th birth anniversary of Bharat Ratna Dr. B.R. Ambedkar at its premises on 29th April 2026. Chief Guest Dr. G.B. Harisha, an eminent professor, philosopher, writer, and academician graced the occassion. The programme commenced with the traditional lighting of the lamp and the offering floral tributes to Dr. Ambedkar's portrait by chief guest and other dignitaries.

Dr. J. Sreedevi, Director General of CPRI, presided over the function. A key highlight of the celebration was the distribution of the Dr. B.R. Ambedkar Merit Awards. These awards were presented to the children of CPRI employees and contractual Staff who achieved outstanding academic success in 10th and 12th standard examinations during the academic year 2024–25.


*Dignitaries and Senior official of CPRI during the event*

## Visit of Chairperson, CEA to CPRI

Shri Ghanshyam Prasad, Chairperson of the Central Electricity Authority (CEA), visited the Central Power Research Institute on 20th April 2026 and discussed regarding establishing a new testing facility for transformers and switchgear rated up to 765 kV.

## Inauguration of EMI/EMC Laboratory at CPRI Nashik.

The Electromagnetic Interference and Electromagnetic Compatibility (EMI/EMC) Laboratory at the Central Power Research Institute (CPRI) Regional Test Laboratory (RTL), Nashik, is a state-of-the-art facility established to provide comprehensive EMI/EMC testing and certification services for electrical, electronic, and communication products.

The laboratory was inaugurated by Dr J. Sreedevi, Director General, CPRI, on 16th June 2026 in the presence of Dr M. V. Rao, Director, CPRI, and Smt. Leena H. Roy, Joint Director who served as the project leader and the Unit Head Shri Peta Sukumar.

The establishment of this laboratory strengthens CPRI's testing infrastructure. It delivers world-class testing and certification services to manufacturers, utilities, and industries, supporting product compliance with both national and international regulatory requirements.

The facility features a 3-metre semi-anechoic chamber equipped with a dedicated amplifier room, a turntable, and a control room. This infrastructure enables accurate and reliable testing in accordance with the latest global standards.

## Visit of Additional Secretary, MNRE to CPRI

Shri Mayank Tiwari, Additional Secretary, along with Dr. Kuldeep Rana, Scientist 'E' from the Ministry of New and Renewable Energy (MNRE), visited the Battery Testing Laboratory at CPRI, Bengaluru, on 9th April 2026. During the visit, discussion were held on battery testing facilities, specific ratings, and the various types of batteries that can be tested at CPRI.

## Visit of Joint Secretary, MNRE to CPRI

Shri Rajesh Kulhari, Joint Secretary (MNRE), visited CPRI, Bengaluru, on 25 June 2026. Laboratory visits were arrenged to the Solar Inverter Lab, Battery Lab, and Cyber Security Lab to showcase its testing facilities, capacities, and equipment ratings.

## Visit of to Schneider Electric team to CPRI

Delegation of senior officials from M/s. Schneider Electric visited Short Circuit Laboratory at CPRI, Bengaluru, to evaluate its testing facilities. The Schneider team also had a meeting with the Director General and senior officials of CPRI, expressing a strong interest in collaborating to test their products at the CPRI laboratories.

# RESEARCH HIGHLIGHTS

## Research Highlights: R&D Schemes of the Ministry of Power

- DG-CPRI and HoD(R&DM) participated in a high-level meeting with the Hon'ble Minister of Power on 06th April 2026, presenting three R&D proposals on battery energy storage systems under the MoP scheme.
- The Local Inquiry Committee (LIC) visit for the renewal of affiliation of the VTU Research Centre was conducted on 14th May 2026 at CPRI, Bangalore.

## R&D Conclave on Hydro Power and Pumped Storage Technologies – HPPST 2026.

Central Power Research Institute (CPRI), in association with Central Electricity Authority (CEA), successfully organized the R&D Conclave on "Hydro Power and Pumped Storage Technologies (HPPST 2026)" on 15 June 2026 at India International Centre, New Delhi.

The conclave witnessed enthusiastic participation from more than 140 delegates representing 85 organizations, including IITs, government agencies, private utilities, research institutions, and manufacturing companies.

The event was inaugurated by Shri Ghanshyam Prasad, Chairperson, CEA, and Dr.J.Sreedevi, Director General, CPRI. During the inaugural session, the compendium titled "R&D Bird's Eye View Report on Research in the Indian Hydro Power Sector", was released.



The conclave featured four technical sessions covering:

- R&D Thrust Areas: From Concept to Commissioning of Hydropower Projects
- Innovative Outcomes through on going R&D Activities
- Industry–Academia Interaction with Manufacturers to Understand R&D Focus Areas for the Next Five Years
- Pumped Storage Opportunities and Challenges.

The event concluded with a panel discussion that deliberated on the way forward, key recommendations, and an action plan for advancing hydro power and pumped storage technologies in India.

## Project in Focus:

Composition-microstructure-property correlation studies of eco-friendly (lead free) relaxor ferroelectrics for pulse power capacitor applications

By Prof. Sanjeev Kumar, Punjab Engineering College (Deemed to be University) Chandigarh.

**Aim / Objectives**

The project was undertaken with the following objectives:

- To optimize the composition for the lead free (Na0.5Bi0.5)TiO3–BaTiO3 [NBT-BT] based solid solutions to achieve high value of breakdown strength > 200 kV/cm, recoverable energy density > 2 J/cm3 and fast discharging < 1 s.
- To study the effect of ageing on power density and energy storage efficiency.
- To design and develop a pulse power capacitor with capacity ~1000 pF, operating temperature range -30 to +100°C, Vmax (DC) ~30 kV.

## Methodology Overview

The study focuses on the synthesis of high performance lead-free Na0.5Bi0.5TiO3 (NBT)-based relaxor ferroelectric ceramics for advanced energy storage capacitor applications. The ceramic samples were synthesized via conventional solid state reaction method. High-purity raw powder were used as base materials, while both conventional sintering (CS) and microwave sintering (MS) approaches were employed to investigate the influence of processing conditions on structural, dielectric, ferroelectric and energy storage properties.

The sintered pellets were ground into a fine powder and then fired at 600°C for I hour. The phase purity was conducted using the Advance X-ray diffractometer. The micrographs of the sintered pellets were recorded using the field-emission scanning electron microscope. High resolution transmission electron microscopy was utilized to investigate the microstructure. The average grain size was computed using Image software. Temperature-dependent dielectric studies for the prepared pellets were conducted using the Impedance Analyzer. To investigate the ferroelectric properties, the P-E loop tracer was utilized. The strain properties were evaluated using S-E loop tracer.

Dielectric investigations demonstrated pronounced relaxor ferroelectric behavior in all compositions, with the relaxor characteristics becoming increasingly enhanced as the grain size decreased. The refined microstructure generated through microwave sintering plays a decisive role in improving dielectric and ferroelectric responses by promoting grain boundary engineering and polarization disorder. As a result,

microwave-sintered ceramics exhibit enhanced breakdown strength (Eb), large polarization difference (M), and reduced remnant polarization (Pr), which collectively contribute to superior energy storage performance.

## Study and Observations

Among the investigated systems, the microwave-sintered 0.94(Na0.5Bi0.5)0.75Sr0.25TiO3-0.06BaTiO3 ceramic achieved a recoverable energy density (Wr) of ~0.76 J/cm3 with an efficiency of ~70%. Further compositional modification through Nb incorporation in 0.96(Na0.5Bi0.5)0.75Sr0.25Ti0.97Nb0.03O3-0.04BaTiO3 resulted in significantly improved energy storage characteristics, delivering a total energy density of ~1.2 J/cm3, Wr of ~0.91 J/cm3, and efficiency of ~78.44%.

Additionally, microwave - assisted [0.94(Na0.5Bi0.5)0.75Sr0.25TiO3-0.06BaTiO3]-3%Li2CO3 ceramics demonstrated not only excellent energy storage performance with Wr ~1.00 J/cm3 and efficiency ~74.46%, but also remarkable dielectric stability (~4643 ± 15%) across a broad temperature range of 95°C–332°C, indicating strong potential for high-temperature capacitor applications.

The highest energy storage performance was obtained for the 0.94[(Na0.5Bi0.5)0.98La0.02Ti0.97 Ta0.03O3]-0.06BaTiO3 ceramic system, which exhibited a high Pm (~47.05 μC/cm2), low Pr (~3.76 μC/cm2), and high breakdown strength (~137.46 kV/cm). These optimized parameters enabled the achievement of a high total energy density of ~3.09 J/cm3, Wr of ~2.49 J/cm3, and excellent efficiency of ~80.67%.

Overall, the study establishes microwave sintering and grain boundary engineering as effective strategies for tailoring relaxor behavior and maximizing energy storage performance in lead-free NBT-based ceramics. The optimized ceramics demonstrate excellent recoverable energy density, efficiency, dielectric stability, and breakdown strength, making them highly promising candidates for next-generation environmentally friendly capacitors in electric vehicles, renewable energy systems, pulsed power devices, and high-temperature power electronics.

## Benefits and Key outcomes

- Successfully synthesized high-performance lead-free NBT-based relax or ferroelectric ceramics for advanced energy storage capacitor applications.
- The microwave sintering is effective in enhancing microstructure, breakdown strength, polarization behavior and overall energy storage efficiency while reducing processing time and energy consumption.
- The synthesized ceramic samples may show strong potential in electric vehicles, renewable energy systems, pulsed power devices, smart electronics and high-temperature power electronics.

## Further Scope

- Optimization of microwave sintering parameters and exploration of advanced sintering techniques to further enhance breakdown strength, grain refinement, and energy storage performance.
- Investigation of additional dopants, high-entropy compositions, and defect engineering approaches to improve relaxor behavior, polarization dynamics, and energy storage efficiency.
- Development of multilayer ceramic capacitor (MLCC) structures and thin ceramic configurations for achieving higher operating electric fields and compact energy storage devices.
- Integration of optimized lead-free ceramics into prototype capacitor systems for applications in electric vehicles, renewable energy storage, pulsed power systems, and high-temperature electronics.

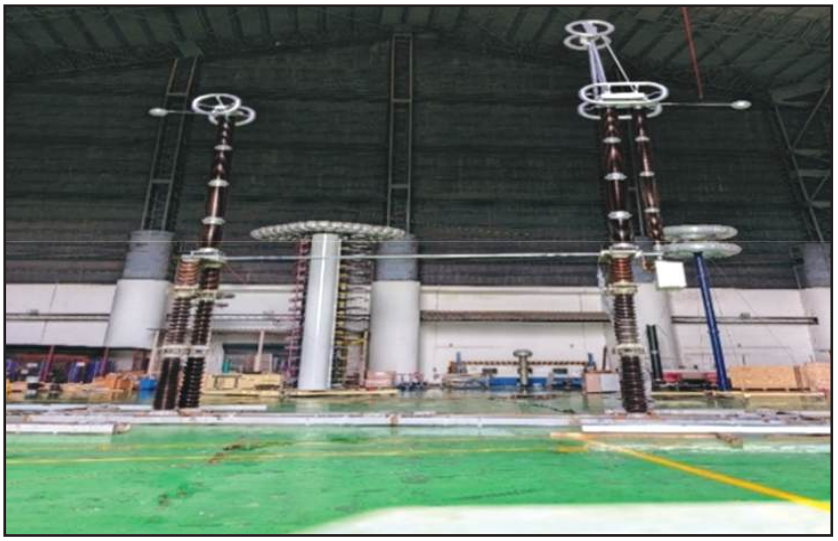
# TCHNICAL SPOTLIGHTS

- As a nominated expert, Mr. Ved Prakash Yadav, EO II visited M/s. JSW Energy Limited in Toranagallu, Bellary on 12 June 2026. The delegation led by Mr. Asit Singh, Member Secretary, SRPC, included experts from POWERGRID, TGTRANSCO, SRPC, SRLDC, and JSW. The team analyzed the spurious tripping of the 400 kV Jindal TPS-BPS lines.


## Special Test:

- Switchgear Testing & Development Station (STDS), CPRI Bhopal carried out 165kA for 1 second short time current test conducted on 24kV, 25000A, HT busduct was as per IS 8084. The special test was conducted for M/s. BHEL, Uttarakhand.

## First Time Test



- High Voltage Laboratory, CPRI, Benglauru successfully carried out Switching Impulse test under wet conditions on 765 kV, 3150 A Knee type Disconnector of M/s. Switchgear Manufacturing Company, Chittor as per IEC 62271-102 standard for the first time.

- Short Circuit Laboratory, CPRI, Bengaluru carried out comparison of voltage measurement of HV live wire testing kit using standard reference PT of M/s. Signals and Systems Pvt. Ltd., Chennai for the first time.

- Short Circuit Laboratory, CPRI, Bengaluru carried out comparison of current measurement of HV Live wire testing kit using standard reference CT of M/s. Signals and Systems Pvt. Ltd., Chennai for the first time.

# INDUSTRY TRENDS

## 10/350 µs Impulse Current Test Facility at CPRI

The increasing use of lightning protection systems in power transmission, substations, renewable energy plants, industries and critical infrastructure has created a growing demand for testing components under realistic direct lightning conditions. The main elements of lighting protection system are Air-termination rods, down conductor, Earth-termination system, Clamps, Connectors, Terminal components, bridging components, Expansion pieces, Measuring points, lightning counters, SPDs etc., These components are required to safely conduct high-energy lightning currents without suffering unacceptable thermal or mechanical damage. To support indigenous manufacturers and utilities, the High Voltage Division of Central Power Research Institute (CPRI) has established an advanced 10/350 µs Impulse Current Test Facility for evaluating lightning protection components and SPDs in accordance with National and International standards.

## Why 10/350 µs Wave Shape Necessary?

Unlike the conventional 8/20 µs impulse current, which represents induced lightning surges, the 10/350 µs impulse current simulates the first return stroke of a direct lightning strike. Due to its longer duration, the waveform transfers substantially higher electrical charge and specific energy, producing severe thermal and electrodynamic stresses comparable to those experienced during an actual lightning event. Consequently, the 10/350 µs waveform has been internationally standardized for qualifying components intended to safely conduct direct lightning currents.

## CPRI's High-Current Test Facility

The High Voltage Division of CPRI is equipped with a state-of-the-art 150 kJ, 100 kV Lightning Impulse Current Generator capable of generating standardized 10/350 µs lightning current impulses with a lighting impulse current of upto 100kA-200kA. The generator operates on the capacitor discharge principle, wherein stored electrical energy is discharged through a carefully designed wave-shaping network comprising resistive and inductive elements. High-accuracy impulse current shunts, digital recorders and calibrated measuring systems are employed to measure the peak current, front time, time to half-value, charge transfer and specific energy of the generated waveform. The facility is suitable for testing Type 1 SPDs, lightning protection system components, bonding conductors, connectors, earthing components and other equipment designed to withstand direct lightning currents.

## Test Procedure

During testing, the specimen is connected directly into the discharge circuit of the impulse current generator. After charging the generator to the specified voltage, the stored energy is discharged through the test object to produce the standardized 10/350 µs current impulse. Depending on the applicable product standard, the required number of impulses with specified current magnitude and polarity are applied. The specimen is subsequently examined for mechanical integrity, thermal damage, electrical continuity and functional performance, where applicable. The recorded waveforms are verified to ensure compliance with the specified waveform tolerances before acceptance of the test results.

## Applicable Standards

Testing at the facility is carried out in accordance with National and Internationally recognized standards, including IS 18925/IEC 62561 (Lightning Protection System Components), IS/IEC 62305 (Protection against Lightning), IS16463/IEC 61643-11 (Low-Voltage Surge Protective Devices), and the relevant requirements of IEC 60060-1 and IEC 60060-2 for high-voltage testing techniques and measuring

systems. The test current magnitude, transferred charge, specific energy and acceptance criteria are selected in accordance with the applicable product standard and intended service conditions.

## Contribution to the Indian Power Sector

The establishment of 10/350 µs Lightning Impulse Current Test Facility represents a significant milestone in India's high-current testing capability. The facility enables indigenous manufacturers to qualify lightning protection components against international standards within the country, reducing dependence on overseas laboratories. It supports the development of reliable lightning protection systems for power transmission and distribution networks, renewable energy installations, railways, industries and critical infrastructure. By providing independent testing and certification under realistic direct lightning conditions, the facility contributes to improved equipment reliability, enhanced public safety and greater resilience of India's electrical power system.

The establishment of the 10/350 µs Lightning Impulse Current Test Facility represents a significant milestone in India's high-current testing capability. It enables manufacturers to qualify lightning protection components against international standards within the country, reducing dependence on overseas laboratories. The facility supports the development of reliable lightning protection systems for power utilities, renewable energy installations, industrial facilities and critical infrastructure, thereby contributing to improved equipment reliability, enhanced public safety and a more resilient electrical network.

**Auothers:**

Shri Nagachandra, Engg. Officer
Shri C. Prabhakar, Joint Director

High Voltage Laboratory,
CPRI, Bengaluru

# EXHIBITION PARTICIPATION

## • ELAsia-2026

Central Power Research Institute (CPRI) participated in ELAsia 2026 Exhibition organised by M/s. Triune Exhibitors, Bengaluru during 14 – 17 May 2026 at BIEC, Bengaluru. Dr. J. Sreedevi, Director General, CPRI was the Chief Guest for the function and inaugurated the Exhibition along with dignitaries on 14th May, 2026.


CPRI has showcased its test facilities and credentials during the exhibition. Visitors from industries, manufacturers, utilities, educational institutions etc., visited CPRI stall and discussed about ranges of test facilities and services. CPRI officers from BD&CBSD, HVD, CDD, HPL, SC Lab & QAD, Bangalore were deputed for the exhibition.

# EVENTS

## • Swachhta Pakhwada–2026

Swachhta Pakhwada–2026 was observed at CPRI & its units from 18th May to 31st May 2026. As part of the observance, various cleanliness and awareness activities were undertaken across CPRI campuses. These included cleaning of the CPRI campus, staff colony, laboratories, and office buildings, as well as disposal of scrap materials. Awareness mural paintings were created on the roadside compound wall of the CPRI Staff Colony, Bengaluru, to promote the message of cleanliness and environmental responsibility.

In addition, tree plantation drives, awareness lectures, display of cleanliness awareness posters, drawing competitions, installation of colour-coded dustbins, and fogging operations were carried out during the Pakhwada. These initiatives were aimed at promoting hygiene, environmental sustainability, and active participation among employees and residents.

- As part of the Swachhta Pakhwada–2026 observance, employees of CPRI participated in the Swachhta Pledge ceremony and reaffirmed their commitment to the principles of cleanliness, hygiene, and environmental sustainability.


- **Green Initiative - Mass Tree plantation** was organized on various dates during the Swachhta Pakhwada 2026 period throughout the headquarters at Bengaluru and out station units. Officials and contract staff participated and planted tree saplings at the green area identified under the Swachhta Pakhwada 2026, on 28th May 2026.

Tree plantation was also organized at RTL, CPRI, Noida wherein officials participated and planted tree saplings, on 22nd May 2026. Indoor Tree plantation drives were organized in the RTL, Kolkata, and RTL, Guwahati, RTL Nashik, STDS, Bhopal, and other out station units wherein several officials and contract staff participated and planted saplings of indoor plants in earthen pots.


*CPRI Noida*

*CPRI Nashik*

- **Inspection of CPRI by Regional Implementation Office, Bangalore**

An inspection of the CPRI was carried out on 10th June 2026 by the Deputy Director and the Research Officer from the Regional Implementation Office (RIO) to review the implementation of the Official Language Policy and its related compliance. During the visit, the Deputy Director and the Research Officer addressed the Chairman and members of the Official Language Implementation Committee (OLIC) on the effective execution of the policy. Emphasis was laid on compliance with the Government of India guidelines, the progressive use of Hindi in official work, regular monitoring, proper maintenance of records, achievement of prescribed targets, and active participation of all divisions in promoting Hindi.

Additionally, in continuation of World Environment Day celebrations, a sapling plantation drive was carried out jointly by the visiting RIO officials in the presence of the Chief Administrative Officer and the staff of the Official Language Section, CPRI.

- **Inspection of CPRI, Regional Testing Laboratory (RTL), Noida by the Ministry of Power**

  During 23rd June 2026, Shri Shamsher Singh, Deputy Director, Ministry of Power conducted the Official Language Inspection of CPRI, Regional Testing Laboratory (RTL), Noida. During the inspection, he reviewed the use and implementation of Official Language Hindi in the office and examined various records, registers, and official correspondence. He emphasized the need to further strengthen the use of Official Language Hindi and to continuously promote its use in official work.

  Following the inspection, a workshop was organized during which he delivered a detailed address on the effective and extensive use of Hindi in official work. He provided valuable insights into the Official Language Policy, constitutional provisions, and various aspects relating to the progressive use of Hindi. In his address, he stated that Hindi is a dynamic and rich language that continues to evolve with time. The workshop was informative and inspiring for the participants and further enhanced awareness regarding the promotion, progressive use, and effective implementation of Official Language Hindi.

- **Hindi Workshop:**

A Hindi workshop titled "Fake News and Social Awareness in the Digital Age" was held in the STDS, Bhopal, CPRI on 10th June 2026, the session was conducted by Shri Anil Tripathi, Deputy Director (Official Language) and Member Secretary, TOLIC (No. 3), Office of the Principal Chief PCCIT, Bhopal.

## ACCOLADES

### Awards and Achievements

- Dr Tulika Bhattacharjee (EO4) served as a panelist in a discussion titled "EV Infrastructure – Charging and Load Impact on Distribution System" at the Bengaluru International Exhibition Centre (BIEC) on May 16, 2026, during Elasia–2026.

Power Research – A Journal of CPRI is a biannual publication by the Central Power Research Institute, Bangalore, India. The journal focuses on research and innovative applications in the generation, transmission, distribution, utilization, and conservation of electric power within the power and energy sectors. It serves as a platform for technical and managerial professionals across utilities, R&D institutions, planners, industries, and academia.

The journal invites authors to contribute original, high-quality research papers addressing current or futuristic topics of relevance to the power and energy sector, spanning concepts to practical field applications.

All submissions undergo a rigorous peer review process by subject experts. Detailed instructions for authors are available on the journal's official website.

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