



**SYNOPSIS OF SEMINAR ON “RELIABILITY AND ENERGY EFFICIENCY IN DISTRIBUTION TRANSFORMERS AND OTHER RELATED ISSUES” HELD ON 29<sup>TH</sup> NOVEMBER, 2018, AT HOTEL MAYFAIR LAGOON, BHUBANESWAR, ODISHA.**

**INAUGURAL SESSION**

**Shri Satish Kumar, Scientist-F & Head BIS, in his Welcome Address:** Shared a brief details of various quality aspects. He explained that Quality Standard is required to reduce rejection vis-à-vis loss of wealth. He clarified that BIS does not formulate the standard on its own, instead it provides a platform for nationally acclaimed committee to decide the standards, satisfying the interest of end users as well as manufacturers. Key Performance Indicators (KPI) Liability of the utilities for the power to be supplied to the distribution network through the Distribution Transformers in an uninterrupted manner is solely dependent on the quality assurance of distribution transformers. Department of Heavy Industries therefore brought this equipment under the ambit of mandatory certification and manufacturers without proper License issued by BIS is not permitted to manufacture and sale any distribution transformer, as per the law of the land.

**Shri A. K. Tripathi, Member State Advisory Council, OERC in his Key Note Address:** Opined that the objective of today’s seminar and the topic chosen is an apt reminder of our dependence on a silent principal equipment like DT when many high tech discussion are taking place each day across the country. Smart Grid is not possible without Smart DTs. Quality starts from data. He expressed concern about the quality of available data and suggested that before using, the available data is essentially required to be ratified and there should be validation check in any data collection exercise using the power of IT. He explained the relevance of ICAI’s effort on Quality of Power front for plugging the wastage of energy. While recognizing Copper’s role in ensuring quality and efficiency he cited a global study reflecting 9 billion dollar of loss just on account of efficiency. He suggested for one seminar to deliberate on the basic details of the PQ problem. He pointed out that Transformers have gone through lots of design innovation. However DT failure rate in many States around 16% is cause of great concern though in some good utilities it is lower than 5%. The general perception is that lightning causes DT failure, but Quality of Power is also a reasonable cause to DT failure. Vagaries faced by DT are like inadequate protection, unbalanced load, unauthorized extension of load, and neglect. He stressed upon random visit of Senior Officials for improvement in operational efficiency of utilities. He concluded that DT, a static but sensitive equipment, failure rate in India is alarmingly higher in comparison to the developed countries of the world. For improvement in the situation, he suggested that failure analysis of each DT is to be made mandatory followed by processing the data and concluding by data not by hunch alone. DT data analytics is one key step to answer many challenges faced by utilities. Quality is common sense but one has to pay keen attention.

**Md. Sadique Alam, IAS, CEO, CESU, Govt. of Odisha in his Address as Chief Guest:** Stressed upon availability of Reliable and Quality Power and its availability to all at affordable cost is of paramount importance. He explained that sustenance of Distribution Utilities, often bound by Government Policies, are in usage of Non-Conventional energy towards making the electrical energy affordable to common people. While explaining the difficulties of the Distribution Utility, he shared that the number of consumers in CESU has grown to 5.5 times, around 19 lakh consumers have been added within a time of 19 years. Peak demand of CESU network was 1680 MW just ten years back, which is 4000 MW now and is expected to be 5500 MW in near future. He pointed out that changing consumers’ behavior is posing a challenge as well as opportunity to the DISCOMs. Consumers are demanding quality and uninterrupted power supply. The life style as well as working style of the rural consumers have completely changed thus affecting peak and off peak period we are usually accustomed to. While mentioning about smart people handling smart grid, he asserted that for utility the real test happens in field. As a result the distribution network of the state of Odisha has expanded at a galloping rate, such as 40,000 DTs were connected to the distribution in the year 2000, which has now crossed the mark of 2.5 Lakhs DTs in operation in the state. In CESU area alone 65 thousand DTs are added and expected to add 1100 DTs each year. He also shared some operational key figures such as 1% T&D Loss of CESU translates into

around Rs. 14 Crores; AT&C Loss of Odisha is around 28%; Failure rate of DT in CESU was around 16% (FY 09), which has been reduced to around 5.8% as of now but still high. He stressed upon Loss Computation of DTs repaired multiple times and need for Cost Benefit Analysis in Repaired DTs vis-à-vis New DTs. He wondered about the impact on EE when DTs are repaired multiple times. Mentioning that CESU area already have good number of legacy DTs in service and what should be done about them must be discussed in today's forum and recommendation drawn or trigger for action initiated.

#### **TECHNICAL SESSION**

The pre-lunch technical session (Session – I) dealt with six technical presentations on different subjects and seven technical presentations were deliberated in the post lunch session (Session – II). Presentations can be downloaded from following link:

[https://www.dropbox.com/sh/e820bjirsdrq1dz/AADFcdrr\\_fwQdaFhlqSuPxEEa?dl=0](https://www.dropbox.com/sh/e820bjirsdrq1dz/AADFcdrr_fwQdaFhlqSuPxEEa?dl=0)

#### **SESSION – I (PRE-LUNCH):**

1. **KEY UPDATE ON INDIAN STANDARD IS 1180(PART – 1)2014 FOR DTs AND QUALITY CONTROL ORDER** by Shri Praveen Kumar Scientist-E, BIS, Bhubaneswar: It has been shared that twenty four Product Certification Licenses have been issued based on the Quality Control Order. He confirmed that BIS certification is mandatory for manufacturing Distribution Transformers. The Distribution Transformers certification is divided in two groups, one group is upto 200 KVA and the other group is above 200 KVA. In any group if a rating say 200 KVA pass all test, to be carried out in BIS approved test laboratories for certification, then the manufacturer is allowed to manufacture any transformer with rating lower than the tested rating without any further product certification. However, before supply of the transformer, the manufacturer is required to submit type test reports of the new rating to BIS for their records.
2. **ASSEST MANAGEMENT PRACTICES – NEW TRAND BY DISCOMS** by Dr. Aradhana Ray, MD, Laxmi Associates (Engineering Consultancy & Service Provider), Vadodara: She explained the concept of Fleet Screening Study of DTs through physical inspection and various condition monitoring tests followed by individual recommendation of each unit regarding (a) Health Index Score, with suggested action; (b) Failure Trend Analysis of DT; (c) Gap Analysis of Asset Register; (d) Dielectric Frequency Response to predict Insulation behavior, (e) Interpretation of Different Moisture Content; (f) Ageing Stages to assess residual life of DT; (g) Overall Risk Assessment of DT. Based on the above data and assessments STRUCTURED ASSET MANAGEMENT PROGRAM is recommended to mitigate the unpredictable failure of DTs. This concept has been put to operation in other Asian countries, but yet to be implemented in India.
3. **SAFE, RELIABLE & EFFICIENT DTR – THE QUALITY JOURNEY OF CESC LTD.** by Mr. Rajarshi Ghosh, DGM (Substations), CESC Ltd. KOLKATA: Mr. Ghosh represented a private utility having DT failure rate of less than 0.3% and explained the steps implemented for this achievement and their future programs for further improvement. He brought in other dimension of Safety in addition to Reliability and Efficiency. For ensuring safety steps taken – (a) Fully covered design with no exposed part; (b) Coordinated fuse protection between HT & LT; (c) Dry type DT and retro-filling with Ester oil; (d) Strengthening of Tank by enhanced sheet thickness, less welded joints, stiffener for higher radiation surface; (e) Introduction of PRV, Vent Pipe, Splash Guard, Air Vents. For enhancing Reliability steps taken – (a) Proper specification for new and repaired transformers with Standardisation of drawings; (b) Vendor evaluation before placing orders; (c) Stage inspection & testing (routine & type) with warranty for five years; (d) Audit after installation; (e) Condition monitoring & timely rectification; (f) Root Cause Analysis of each failure followed by corrective action plan. For Improving Efficiency steps taken – (a) Standardised Copper winding, checking of copper quality certificates from suppliers; (b) Loss Capitalisation; (c) Regular loss measurement on random basis; (d) Reduction of losses for repaired transformers; (d) Reducing overloading and unbalance loading through monitoring; (e) Introduction of APFC in low pf (<0.85) areas; (f) Procurement based on total owning cost; (g) Regular random loss measurement at the utility's workshop; (h) Temp. Rise test at utility's workshop to verify capacity.
4. **IMPROVING ENERGY EFFICIENCY AND RELIABILITY OF LEGACY DISTRIBUTION TRANSFORMERS** by Mr. Manas Kundu, Director ICAI: The presentation primarily addresses the issue of Transforming Transformers through Active Repair for improving EE, & Reliability of Legacy DTs with the benefits of (a) Technical Loss Reduction (Total loss reduced by 28%); (b) Reliability Improvement by reducing DT failure rates; (c) Improvement in rated capacity allowing higher loading. The Methodology, Solution & Results and Cost Benefit Analysis for ACTIVE REPAIR OF DTs (payback period is 2 – 5 years) have been dealt in minute details during the presentation. The exercise is expected to arrest High DT failures, High R & M Costs and High DT Technical Losses. Two case studies related to one 100 KVA & another 200 KVA DTs were shared along with design,

test result and capex requirements. Potential Business Model was also shared during the presentation. Active Repaired DT performance was monitored by using TRANSFORMER MONITORING UNIT (TMU).

5. **DATA ANALYTICS AND CONDITION MONITORING** by Mr. Ayush Kumar, SAI ELECTRICALS & SAI COMPUTERS: The presentation dealt with Condition Monitoring of DTs, Network Efficiency and Theft & other Exceptions.
6. **IMPROVED TRANSFORMER SAFETY AND RELIABILITY** by Mr. Rajib Nayan Chaudhary, Director, Powergen, Cargil India Pvt. Ltd. Gurgaon: Dealt with the advantages of using FR3 FLUID for improvement of Grid reliability and optimization of Transformer performance. The fluid has the advantages of (a) Extension of Insulation System Life; (b) Enhanced Loading of Transformer; (c) Increased Fire Safety; (d) Improved Environmental Foot Print with best-in-class environmental properties. The comparative Fire Point (being the most important factor for fire safety of Transformers) figures are Mineral Oil - 160°C; Synthetic Ester Oil - 310°C & Natural Ester Oil - 360°C, thus zero fire history in FR3 fluid filled transformers.

#### **SESSION – II (POST-LUNCH):**

1. **QUALITY & RELIABILITY OF POWER SUPPLY – NEED OF SMART CITY** by Mr. P. K. Pattnaik, DGM, OPTCL, Bhubaneswar: Shared in great details the intricacy of operational principle of the proposed SMART CITY project of Bhubaneswar.
2. **AMORPHOUS METAL DISTRIBUTION TRANSFORMERS – MANUFACTURING, REPARABILITY AND OTHER CONSIDERATIONS** by Mr. Ishan Pathak, Sales & Marketing, Hitachi Metals India Pvt. Ltd. Gurgaon: It was shared that Amorphous core DTs are in use in Eleven states of our country with a total estimated population of 15 Lakhs. The author carried a complete core and winding assembly at the venue for demonstrating un-lacing and lacing of the Amorphous metal core for changing burnt out coil for changing the prevailing myth that it is difficult or impossible by general repair houses to handle Amorphous metal core during repair of burnt DTs.
3. **ENHANCING DT RELIABILITY THROUGH MONITORING** by Mr. Suraj Vernekar, Director, Aegeus Technologies Pvt. Ltd. Bangalore: They develop Asset Monitoring and Protection System for Electrical Utilities through various embedded sensors for measuring Phase Voltage / Current; Neutral Voltage / Current; Oil level; Oil Temperature; Winding Temperature etc.
4. **FIRE SAFE AND ENVIRONMENT FRIENDLY DIELECTRIC FLUID FOR TRANSFORMERS – ESTER FLUIDS** by Mr. Saikat Koley, Eastern Regional Head, Savita Polymers Limited, Mumbai: Various properties of Mineral Oil was explained along with a comparative study of PCB, Synthetic Ester & Natural Ester.
5. **CASE STUDY ON IMPROVING TRANSFORMER RELIABILITY, LIFE SPAN, OVERLOAD CAPABILITY OF DISTRIBUTION TRANSFORMERS** by Mr. Chittaranjan Debta, CE (Technical Works) CESU, Bhubaneswar: Shared various details of the distribution network of CESU including the Transformers and CKT KMs of lines of various voltage class. As example of rapid growth it was shared that 42,675 consumers with a connected load of 79.02 MVA have been added to the system during the first quarter of FY 2018-19. They were procuring DTs as per IS: 2026, subsequently implemented BEE star level DTs now switched to IS: 1180 compliance DTs resulting into reduction DT failure from 15.39% to 5.78%. The failure rate of BEE Star level DTs is 4.5%. The speaker also shared the failure of some BEE/BIS compliant DTs and its subsequent investigation reports with the audience.
6. **TESTING FACILITY OF DISTRIBUTION TRANSFORMERS** by Mr. Yogesh Singh, Scientist – B, NTH, Ghaziabad: Details of various test facilities were shared with the audience. It has been noted that they are going to do the test of DT at site or at the Utility's premises. Short Circuit Test and Impulse Test Facilities are coming up in their Kolkata Laboratory is a welcome news for the manufacturer, repairer as well as the utilities around the city of Kolkata.
7. **CASE STUDY ON APPLICATION AND MAINTENANCE OF NATURAL AND SYNTHETIC ESTER LIQUIDS** by Mr. Nitin Satija, Director & Country Head, M&I Materials India Pvt. Ltd.: The speaker described the superiority of Ester Fluid for DT & Power Transformer application in comparison to Mineral oil. Superiority of Synthetic Ester over Natural Ester was explained. The audience was also enlightened on various IS and IEC standards controlling the Ester Fluid. It was opined that the Synthetic Ester is with highest Fire resistant property of K4 class vis-à-vis the Natural Ester is of K2 class. It was also explained that the Ester Fluid is fully and readily Bio-degradable, which is not the case with Mineral Oil.

