



SPE Newsletter

SPE(I), Vadodara Chapter
July 2025 Issue: 3/2025



WASTE TO ENERGY IS THE NEED OF TODAY
(TAKE PART IN CONFERENCE SCHEDULED ON 29-30 JUL 2025)

The Society of Power Engineers (India)

Vadodara Chapter (Established 1996)

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EDITORIAL



In this edition from SPE Newsletter (July-2025 issue), I have no word to ink Editorial. The reason is loss of innocent lives in Pahalgam and Ahmedabad.



Heartfelt Tribute

We pray almighty to bestow eternal peace to all victims of ill-fated plane crash in Ahmedabad and barbaric terrorist attack in Pahalgam killing innocent citizens in front of their family.

Er. Umesh Parikh
Editor
SPE Newsletter

CHAIRMAN'S DESK



Dear all,

It gives a great pleasure to welcome you all for the quarterly issue of our magazine this month.

Last month we successfully hosted a **Conference on**

Low and Medium Voltage Switchgears in Distribution Systems which saw enthusiastic participation from industry experts and professionals. The conference provided a valuable platform for knowledge sharing, networking, and exploring latest trends in switchgear technology.

Building on the success of our conference last month, we are gearing up for another impactful event **Waste to Energy, a 2-Day Conference on 29 & 30 Jul 2025** at the FGI, Vadodara.

The conference aims to bring together experts, policy makers and industry profe-

ssionals to discuss the latest developments and opportunities in waste to energy technologies. As the world grapples with the challenges of waste management and sustainable energy, this conference will provide a unique platform for knowledge sharing, collaboration, and innovation.

We are expecting GEDA and other agencies in the field to participate in the Conference. Municipalities and Municipal Corporations are also likely to participate.

I invite all members to participate in our upcoming events and contribute to the growth and development of our Engineering fraternity. I am confident that our conferences and initiatives will inspire meaningful discussions, collaborations and innovations that will drive our industry forward.

Er. MR Tilwalli



CHAPTER'S ACTIVITIES

Er. YV Joshi
Secretary

- On **19 Apr 2025**, the **Chapter**, jointly with the **IE(I)** Vadodara, organised a lecture programme on **“Application of Engineering Excellence to overcome Threats due to Technological Ill Effects and Improving Human Health”**. The speaker was **Er. PB Mehta**, Ex. EE, GETCO, CEO-Persotech Solutiuons Vadodara and **Life Member** of SPE(I) Vadodara.

He described the significance of Natural Electromagnetic Environment (NEME) and importance of human body earthing. Some of the tips on the use of mobile phones and electrical safety are given below:

- ❖ Mobile phones while talking should be kept min.6 mm away from body and while sleeping it should be kept 15 cm away from body.
- ❖ People having active medical implants should keep themselves away from cell phone.
- ❖ Keep mobile away while wearing Metal framed glass.
- ❖ Also keep the body part having medical implant away from induction cooking plate, thin metallic partitions in the Airport/metro station/ underground substations source, back side DJ sound system having strong magnets
- ❖ Use of devices like Blue-tooth headphones or other hands-free devices to safeguard from RF exposure
- ❖ Follow precautionary guidelines given by Telecom department GoI.

Tips on Electrical safety

- ❖ USE 30mA RCCB for house/office WIRING to safeguard from shock - RCCB+MCB=RCBO
 - ❖ CHECK THE RCCB OPERATION by pushing the test button (once in a month to prevent the mechanism from jamming.
 - ❖ Ensure an adequate earthing system and Lightning Protection (LP) system for all the electrical installations.
 - ❖ Down conductor of LP system should be connected to earth electrode which should be 1 M away from building.
 - ❖ Maintain adequate clearances of electrical conductors as per respective guidelines of standards.
 - ❖ Follow the guidelines of NEC 2023 for all the electrical installations.
 - ❖ When any protective device is operated it should not be switched on without identifying the fault.
 - ❖ Don't bypass the protective devices.
 - ❖ While using single pole MCB /fuse it must be on Phase and never on Neutral.
- On **30 & 31 May 2025**, the **Chapter** organised a **2-Day Conference** on **“Low & Medium Voltage Distribution Systems” Practices, Experiences and a Way Forward**. The report of the same is brought out in this issue elsewhere.

FUTURE EVENTS

1. 2-Day Conference on “Waste to Energy for better Environment” on 29 & 30 Jul 2025.
2. 29th AGM during Aug-2025.
3. 1-Day Tutorial & 2-Day Conference on “Design and Construction of Transmission Line” on 5, 6 & 7 Nov 2025.

STRESS & STRENGTH

Insulating materials used in electrical equipment have dielectric strength. It is subjected to dielectric stress during its service in electric circuit. Material is safe and perform as insulation till dielectric stress (alias electro static field or potential gradient) is lower than its strength during service. But may breakdown when service stress imposed is more than material strength. Afterwards it cannot perform as insulator and need to be discarded.

Materials used in structure have tensile, compressive and shear strength. It is subjected to one or more of stresses due to load in different working conditions. Component is safe and continue as active member of structure till stresses are lower than respective yield stress. But it may break, cripple or rupture when working stress exceeds the respective yield stress. Such failed component is no more useful in structure.

Human beings have physical strength. They are subjected to external physical stress under different situations. One can resist and live normal life till the stresses encountered are less intense than one's strength enables to

continue routine life. When stresses are more intense than one's strength, there will be temporary breakdown. However, one will regain the strength with the passage of time and continue normal life. So break down is temporary only like resistance of lightning arrester.

All humans have mental strength to handle complex situations. They are subjected to mental stress because of various problems in the life. One with strong mental strength can handle situations well but one with weak mental power may confuse, loose mental control or may end his/her life. However, appropriate treatment at right stage can reinstate normalcy to some extent avoiding mental ill-health and life ending. During normal life, we are able to withstand temporary impact without crossing our endurance limit.

In insulation it is termed as short time current rating. Thus there are many common parameters between mind & insulation.



Er. ND Makwana

Former Secretary
SPE(I) Vadodara

SOCIAL, ECONOMIC AND ENVIRONMENTAL IMPACTS OF RENEWABLE ENERGY SOURCES

Synopsis:

Establishment of Renewable Energy Power Plants (Solar & Wind) is picking up very fast in the country with very large targets fixed by GoI till 2030. The renewables have social, economic and environmental impacts which are mostly positive, They are examined one by one as follows:

- 1) On one hand conventional energy sources based on coal, gas, and oil are very much helpful for the improvement in the economy of a country, but on the other hand, some bad impacts of these sources in the environment have bound us to use these resources within some limit and turned our thinking towards the renewable energy sources.
- 2) The social, environmental and economic problems can be minimised by use of renewable energy sources, because these sources are considered as environment-friendly, having no or little emission of exhaust and poisonous gases like carbon dioxide, carbon monoxide, sulfur dioxide, etc.
- 3) Renewable energy is going to be an important source of power in near future, because we can use these resources again and again to produce useful energy. Wind power generation is considered as having lowest water consumption, lowest relative greenhouse gas emission and minimum social impact. It is considered as one of the most sustainable renewable Energy.
- 4) As these sources are considered as clean energy sources, they can be helpful in mitigation of greenhouse effect and global warming. Local employment, better health, job opportunities, consumer

choice, improvement of life standard, social bonds creation, demographic impacts, social bonds and community development can be achieved by the proper usage of renewable energy system.

- 5) Along with the outstanding advantages of these sources, some shortcomings also exist such as the variation of output due to seasonal change, which is the common thing for wind and hydroelectric power plant; hence, special design and consideration are required, which are fulfilled by the hardware and software. This is possible with the improvement in computer technology.
- 6) Hydrogen is the most abundant chemical element in nature. As noted by the IEA, the global demand for hydrogen for use as a fuel has tripled since 1975 and reached 70 million tonnes a year in 2018. In addition, green hydrogen is a clean energy source that only emits water vapour and leaves no residue in the air, unlike coal and oil. Hydrogen has a long-standing relationship with industry. This gas has been used to fuel cars, airships and spaceships since the beginning of the 19th century. The decarbonization of the world economy, a process that cannot be postponed, will give hydrogen more prominence. In addition, if its production costs fall by 50% by 2030, as predicted by the World Hydrogen Council, we will undoubtedly be looking at one of the additional source of fuels of the future.



Er. YK Sharma
Former Jt. Secretary
SPE(I) Vadodara

Brief Report of 2-DAY CONFERENCE on “LOW & MEDIUM VOLTAGE DISTRIBUTION SYSTEMS”

The Vadodara Chapter of SPE (I) organised a **2-Day Conference** on “**LV & MV DISTRIBUTION SYSTEMS**” on **30 & 31 May 2025** at FGI, Vadodara.

More than 80 delegates from all over the country participated in the Conference. The delegates hailed from GETCO, GSECL, Jyoti Ltd., Stelmec, Green Electricals, ERDA, Switchgear Manufacturers, Experts from industries, Academic Institutions, Equipment Commissioning Firms, Consultants, Individuals etc.

The inaugural function was presided over by **Er. Tejas Parmar**, IAS, MD, MGVL, **Dr. Satish Chetwani**, **Director-ERDA**, Jyoti Ltd. Others on the dais included **Er. Mohan Tilwalli**, Chairman, SPE (I) Vadodara, **Er. GR Patel**, Conference Convener and **Er. SM Takalkar**, Conference Coordinator.

Er. Mohan Tilwalli presented Welcome address and highlighted the activities of SPE (I) Vadodara. **Er. GR Patel** delivered message for the Success of the Conference. **Er. SM Takalkar** gave a brief about the Conference and basic theme.

Shri Tejas Parmar, IAS praised SPE(I) Vadodara for organizing event on such an important topic which is a must for each Distribution Company. He shared his views and experience on the importance of such Conference in Madhya Gujarat.

All audio-visuals starting from prayer till concluding session were designed by Er. PA Shah and Er. Gargey Bhatt. The logistics and other support were provided by Er. Sanjay Shiledar Baxi and Er. VB Harani. The proceedings was compiled by Er. NV Rede, Er. PA Shah and Er. YV Joshi.

Proceedings was released by dignitaries on dais.

Er. YV Joshi, Secretary, SPE (I) Vadodara presented vote of thanks and thanked Sponsors, Donors, Advertisers, Authors, FGI authorities, Dignitaries on Dais and delegates.

After the inaugural session and a networking tea break, technical sessions for the Conference were taken up. The technical sessions were conducted by **Er. PA Shah**, **Er. Keyur Nanavati**, **Er. SM Baxi**, **Er. Shailesh Modi**, **Er. (Ms) Hetal Prajapati** and **Er. (Ms) Binal Modi** – active members of SPE (I) Vadodara Chapter.

SESSION-I

Session Chair: Er. PH Rana

Paper-1 Electronics in Distribution Systems
Author: Dr. Vijay Shah, ABB Ltd.

Paper-2 Development of MV Circuit Breakers

Author: Er. Rajveer, Jyoti Ltd.

Paper-3 LV Power Switchgear and Control Gear Assemblies as per IEC 61439 Series.

Author: Er. YI Pathan
Er. Munaf Y Patel, ERDA

SESSION-II

Session Chair: Er. SK Negi

Paper-4 Safety in LT Switchgears
Author: Er. Mrugesh Shah

Paper-5 Certification Testing of Switchgear Product during Test – ERDA’s Experience.

Author: Er. Munaf Y Patel,
Er. YI Pathan, ERDA

Paper-6 Evolving Trends in LV Technology: Terminal Blocks as Enablers of Safer Networks

Authors: Dr. Pallavi Agarwal
Er. Robin Virani, Elmex

SESSION-III

Session Chair: Dr. Satish Chetwani

Director – ERDA

Paper-7 Power Factor Improvement in Distribution System for Reactive Power Management

Author: Er. JC Marathe

Excelsource Industries

Paper-8 Presentation of products like Cable Trays, LV & MV Panels etc.

Author: Ms. Ria Shah, Green Electricals

Paper-9 Inrush Currents - Issues and Remedies

Authors: Er. GR Patel, Consultant

Er. GR Gajjar

Paper-10 DC Protections – Challenges and Opportunities

Authors: Er. Akash Kharche – ABB Ltd.

Dr. Vijay Shah – ABB Ltd.

Er. Manish Desai – FTE, MSU

SESSION-IV

Session Chair: Dr. Vijay Shah – ABB

Paper-11 Earthing System in LV Distribution System in DISCOM

Author: Er. Naitik Patel

ETP Earthing, Surat

Paper-12 Evolution of MV Switchgear and Type Test.

Author: Er. RS Selvam, Stelmec Ltd.

Paper-13 Body Earthing

Author: Er. PB Mehta, Consultant

Paper-14 An Overview of Distribution Power Systems

Authors: Er. Binal Modi

Dr. Rital Gajjar – Parul Uni.

Er. PA Shah –

Practicing Electrical Engineer,

Chartered Engineer, Safety Auditor

SESSION-V

Session Chair: Er. GR Patel, Consultant

Paper-15 LeakXpert solutions to Flashover, Corrosion, Trippings in Distribution

due to Water Ingress/Moisture/ Rodents via Cable Trenches.

Authors: Ms. Bhavika Dhabwani

Mr. Amol Sandhashiv

LeakXpert

Paper-16 LV & MV Distribution System

Author: Er. RP Varma –

Consultant Electrical & Project

Paper-17 Experience in Equipment for Intelligent Reactive Power Compensation System

Author: Er. JC Marathe

Excelsource Industries

Paper-18 O & M of MV Switchgears

Author: Er. Mrugesh Shah – Jyoti Ltd.

Paper-19 Analysis of Dielectric Failures because of Winding Resonance in Dry-Type Transformers

Authors: Er. GR Patel, Consultant

Er. GR Gajjar

The power point presentations were compiled by **Er. PA Shah**, **Er. Shailesh Modi**, **Er. Keyur Nanavati**, **Er. SM Baxi** and **Ms. Binal Modi**. Entire Technical Sessions were conducted nicely and smoothly by above engineers including Q & A sessions.

The Conference was concluded with **Vote of Thanks** by **Er. VB Harani**, Jt. Secretary and National Anthem.

GLIMPSES OF CONFERENCE

Dignitaries on Dais



L to R: **Er. YV Joshi**, Secretary-SPE(I), **Er. GR Patel**, Consultant, **Er. SM Takalkar**, Conference Convener, **Er. Tejas Parmar**, IAS, MD-MGVCL, **Dr. Satish Chetwani**, Director-ERDA, **Er. MR Tilwalli**, Chairman-SPE(I)

INAUGURAL SESSION BEGINNING

Lighting Holy Lamp



L to R **Er. Tejas Parmar**, IAS, **Dr. Satish Chetwani**, **Er. SM Takalkar**, **Er. MR Tilwalli**, **Er. GR Patel**, **Er. YV Joshi**

Welcome Address



Er. MR Tilwalli

ADDRESS BY DIGNITARIES



Success of the Conference
Er. GR Patel



Theme of the Conference
Er. SM Takalkar



Dr. Satish Chetwani



Key Note Address
Shri Tejas Parmar, IAS

Proceedings Releasing



L to R: **Er. YV Joshi, Er. GR Patel, Er. SM Takalkar, Er. Tejas Parmar, IAS, Dr. Satish Chetwani, Er. MR Tilwalli**

Concluding Inaugural Session



Er. YV Joshi presenting
Vote of Thanks

TECHNICAL SESSIONS PAPER PRESENTATION



Dr. Vijay Shah



Er. Rajveer Rathod



Er. YI Pathan



Er. Mrugesh Shah



Er. Munaf Patel



Dr. Pallavi Agarwal



Er. Robin Virani



Er. JC Marathe



Er. Keyur Nanavati



Er. RS Selvam



Er. Akash Kharche



Er. (Ms) Rital Gajjar



Er. YV Joshi



Ms. Bhavika



Er. RP Sharma



Er. Ankur Bhuvir



Er. PB Mehta



Er. (Ms) Ria Shah

EVENT & SESSION ANCHORING

Audio Visuals



Er. Gargey Bhatt

Audio Visuals



Er. Sanjay Shiledar Baxi

Audio Visuals



Er. (Ms) Binal Modi

Session



Er. VB Harani

Session



Er. Shailesh Modi

Event



Er. PA Shah anchoring

POWER UP! CHOOSE THE RIGHT RATING FOR RIGHT PERFORMANCE FROM DISTRIBUTION TRANSFORMER

Er. YV Joshi

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Er. LN Nimawat

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Most distribution utilities in India have been traditionally selecting Distribution Transformer (DT) ratings based on aggregate contract demand, connected loads, and available standard ratings. This aligns with the concept of High Voltage Distribution Systems (HVDS) to address energy loss. However, this method often does not work well, especially in rural areas where DTs frequently run at much lower loads than their capacity. Hence, distribution systems do not achieve the expected efficiency during these low-load periods.

Over the past 20 years, the power sector has changed a lot, pushing for reliable, efficient, and cost-effective operation of all parts of the power distribution system. These changes were crucial and combining with the goal of achieving zero carbon emissions, we require a big shift towards utilising Distribution Transformers (DTs) more efficiently. This is a smart use of money for cash-strapped utilities in India. Balancing the use of High Voltage Distribution Systems (HVDS) and low-tension (LT) extensions is crucial because as load density increases, using smaller DTs can sum up to higher core losses per kVA delivered in systems and also added infrastructure costs. This is a clear warning to reassess how we choose the capacity of Distribution Transformers (DTs) based on their optimum

capacity utilisation. This approach would ensure that Distribution Companies (DISCOMs) use their key assets in efficient manner.

As we all know, hundreds of thousands of Distribution Transformers (DTs) are being acquired nationwide to meet the growing need for electricity and increased demand. Public utilities are leading this effort, followed by industrial and private customers. Utilities typically buy single-phase units ranging from 5 to 25kVA and 3-phase units from 10 to 200kVA, as per the latest IS:1180 standards. Public DISCOMs mainly purchase small transformers in large quantities, with only a few ranging from 250kVA to 1000kVA. In contrast, the private sector buys DTs based on specific needs and careful load forecasts. Many public DISCOMs in India prefer smaller transformers due to their traditional mindset about High Voltage Distribution Systems (HVDS).

However, to use DTs efficiently in the long term, we need to review how we choose them and consider using higher rated, more efficient DTs, especially in areas with rapidly growing demand. The recent increase in demand across Indian States during the summer shows what we can expect during future peak seasons.

The Bureau of Indian Standards (BIS) has set guidelines for Distribution Transformer (DT) ratings in India under latest IS: 1180. This standard specifies allowable losses at 50% and 100% loading, as well as the maximum current density for both copper and aluminium windings, and maximum flux density for CRGO and amorphous cores. It applies to both indoor and outdoor installations. However, IS:1180. Sets the same

standard losses for all types of windings and cores, preventing users from choosing materials that could reduce losses as per the loading profile of DT over its life span of 25 years. The standard requires the use of DTs with these fixed losses, stopping customers from optimising losses through material choices. Aluminium windings are commonly used because they are cheaper, usually funded by taxpayers' money.

Let's now have a closer look at some of the findings of a comprehensive study on loss optimisation in the distribution system through the proper selection of DTs that shed light on the path to enhanced efficiency and performance by using better and reliable materials.

TECHNICAL DATA:

The standard ratings are as given below as per IS: 1180

1-Phase ratings 5, 6.3, 10, 16, 25kVA ((11/√3)/0.240kV) or 11/0.240kV) & 3-phase ratings 10, 16, 25, 40, 63, 100, 160, 200, 250, 315, 500, 630 and 1000kVA

DISCOM statistics, based on annual data published by Central Electricity Authority (CEA) reveal an important gap. The cumulative capacity of Distribution Transformers (DTs) surpasses the peak load attributed to them by staggering factor of 5 to 6.

Table-1 Approximate numbers and capacity of DT, peak demand in India (1) **Table-1**

Year	No. of DTs (units in millions)	Aggregate DT cap. in GVA	Peak Demand in GW	Avg. cap. of DT in kVA
2016-17	9.6	255	159	26.56
2021-22	15.0	340	203	22.66
2029-30 Projected	25.7	642	339	24.98

Looking at the data, we see that except for crowded places like cities, urban centres and

industrial areas, most Distribution Transformers (DTs) are sub optimally used while for a high load density area the loading should be around 70% plus as we see in urban areas like Delhi, Kolkata, Mumbai etc.

This situation allows us to reconsider the traditional approach and critically assess how we choose Distribution Transformers (DTs) to ensure efficient use, especially from a national policy perspective. Currently, due to the focus on High Voltage Distribution Systems (HVDS) by DISCOMs, when a consumer demands, for example, 15HP, DISCOMs often respond by installing a 16 or 25kVA DT with an 11kV extension. Then, a month or two later, if another nearby consumer demands a similar load, DISCOMs tend to install another DT of the same capacity rather than increasing the existing capacity.

This situation also involves considering the reliability of DTs, which have high failure rates, and their serviceability. It impacts the overall optimisation of capital (Capex) and operational (Opex) expenses incurred by DISCOMs in providing reliable electricity to rural consumers who deserve quality service.

It's important to recognise that by implementing the High Voltage Distribution System (HVDS) principle without proper application engineering based on simply aiming to reduce ATC (Aggregate Technical and Commercial) losses is leading to increased fixed losses in the system. This approach also results in additional capital costs for distribution points (DP), fuses, grounding equipment (GO) and earthing.

A major concern is the frequent failure of smaller-rated Distribution Transformers (DTs), which significantly affects Discoms' key performance indicators (KPIs) in delivering reliable power, despite substantial capital expenditure on underutilised DTs.

To address these issues, DISCOMs should

consider rationalising and choosing appropriate DT ratings. Transitioning to higher-capacity DTs in peri-urban and potentially rural areas promptly, will prepare the DISCOM to accommodate short-term load growth. It would further enhance utility companies' ability to provide reliable electricity over the long term.

Disturbing reality - Failure rate

While selecting the right capacity, it is also important to acknowledge the reality of Distribution Transformer (DT). A study by the Central Electricity Authority suggests the overall failure rate of DTs exceeds 14% nationally, with lower capacity DTs and those situated in rural areas experiencing a disproportionately higher number of failures.

From the field experience, we observed that disproportionate failure in lower rating DTs (6/10/16/25/63/100kVA) are taking place across the country. This is a serious concern for all at policy making level and a challenge for DISCOM decision makers to solve when we can hardly avoid cold pick up or seasonal overloading issues at rural areas.

A study by IIT Roorkee [4] on DT failure clearly brings out HT winding failure as major reason and creep behaviour of windings and winding joints significantly impacts DT life. With rising ambient and adverse field operating conditions at hand.

As we know that equipment maintenance cost is directly proportional to numbers, so with high number of small capacity DT deployed in system, it is always higher. Over and above high failure rate increases the extra capital cost due to short life.

DISCOMs may look into this aspect of metal creep behaviour and improve their technical specification for ensuring better reliability and higher life of critical assets while reviewing their network engineering aspects discussed in detail in this paper [5]. In addition, regular maintenance and

monitoring plan of DT is more of an imperative rather than a choice for DISCOM.

WHY LOWER RATING DTs?

HVDS is being adopted to reduce electricity theft. This involves using smaller and lower capacity DTs, which are considered sufficient for local needs and help in detecting unauthorised usage. For cost cutting, manufacturers and utilities prefer using aluminium instead of copper for the windings of these DTs because it is less expensive. This decision reflects a culture focused on initial procurement costs, rather than considering the total cost of ownership over the transformer's lifespan. Normally, for larger power transformers, the approach is to consider the life cycle costs, which encompass not just the purchase price but also maintenance, energy losses, and reliability factors over the years of operation.

This approach has led to unintended problems. Here is what's happening:

Earlier, we've shown an example of 15HP connection catered by a 16kVA DT. Using smaller transformers with low overload margins (only 10-20% of their rated capacity) means they quickly get overloaded with even a slight increase in demand. This frequent overloading causes these transformers to fail more often. In today's era of Power Reforms, high failure rates are unacceptable because they lead to long power outages. During these outages, no electricity usage is billed, resulting in lost revenue for utilities.

When a DT fails, it has several consequences for the utility:

1. Fails to meet key performance indicators (KPIs).
2. Loss of revenue due to downtime.
3. Increased expenses for repairs and maintenance.
4. Damage to the utility's reputation.

For example, when DTs rated at 10, 16 and 25 kVA are mostly installed for individual

agricultural and industrial consumers, their ability to manage short-term overloads is limited to just 20% above their capacity. This becomes problematic in regions where agricultural activities require submersible pumps with higher capacities. These pumps, with frequent failures and local rewinding, have high starting torque drawing more current and often have additional unauthorized connections, leading to frequent overloading and subsequent DT failures.

Furthermore, the use of non-standard motors with capacities like 10/15/25HP contributes further to the failure of DTs with aluminium windings, which have weaker durability under stress compared to copper.

In contrast, opting for higher capacity DTs for a group of consumers allows for better handling of short-term overloads. This is because the margin above capacity remains higher in absolute terms.

It's well-known that aluminium has lower mechanical strength than copper, especially at higher temperatures. This is crucial given today's ambient temperatures exceeding 50°C. Aluminium's ductility is 18%, lower than copper's 30-40%, making it more susceptible to fatigue under temperature variations. Overall, copper is preferred for its reliable performance.

The challenge of low utilization of DT capacity

Every choice has its challenges, and the underutilization of Distribution Transformer (DT) capacity is no exception. In rural areas and agricultural regions, DTs are used little due to intermittent power supply and the variety of different power needs. When we compare the total capacity of DTs to the highest demand the utility handles, the usage rate drops drastically to just 10 to 30%.

Table-2: Below shows the Pan India % utilization of Distribution Transformers

Table:2

Year	Aggregate DT capacity, GVA	All India Peak observed, GW	50% load supposed to be attributed to DT	% Utilization of DT
16-17	255	159	79.5	31.37
21-22	340	203	101.5	29.85
29-30 (projected)	642	330	165	25.7

As per annual progress report of one of the DISCOMs, till Dec-2022.

Table:3

Aggregate DT capacity, GVA	All India Peak observed, GW	50% load supposed to be attributed to DT	% Utilization of DT
56.8	16	8	14.08

The data above is clear: Although most Distribution Transformers (DTs) handle relatively high loads for a few hours, these loads do not occur simultaneously. Therefore, it's crucial for buyers to prioritise DT efficiency properly as per the load profile of the area being catered to. By emphasising this, we can achieve optimal efficiency and utilisation, creating a more effective and sustainable power distribution system.

Similarly, in urban settings, efficiency should be targeted around 75% to ensure capital is used effectively and to maximize efficiency. National standards should not be limited to only considering 50% and 100% loading when defining DT loss levels.

Higher-rated DTs have lower core losses per unit of capacity. For example, a CRGO core can have core losses as high as 1 to 1.1 Watts per kVA for lower-rated DTs, but this reduces to 0.8 watts per kVA for higher-rated DTs. Amorphous cores can significantly reduce these losses even further. Newer generations of CRGO cores can also offer improved

performance, though they are constrained by overall ISI marking regulations.

Core losses considerations.

In the case of DTs, it is important to note that the core loss per kVA significantly increases for smaller capacities compared to their higher capacity counterparts. This means the total core losses of 10 transformers with a rating of 25kVA would surpass the core loss of a single 250kVA transformer.

Additionally, a 250kVA DT has the capability to handle a greater distributed and diversified load when compared to 10 individual 25kVA distributed transformers.

Energy losses of higher rating DT against multiple low rating DT are calculated and it is observed that higher rating DTs are more beneficial. (Table- 4)

Table:4

Year	Aggregate DT capacity, GVA	All India Peak observed, GW	50% load supposed to Be attributed to DT	% Utilization of DT
16-17	255	159	79.5	31.37
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The data above is clear: Although most Distribution Transformers (DTs) handle relatively high loads for a few hours, these loads do not occur simultaneously.

Therefore, it's crucial for buyers to prioritise DT efficiency properly as per the load profile of the area being catered to. By emphasising this, we can achieve optimal efficiency and utilisation, creating a more effective and sustainable power distribution system.

Similarly, in urban settings, efficiency should be targeted around 75% to ensure capital is used effectively and to maximize efficiency. National standards should not be limited to only considering 50% and 100% loading when defining DT loss levels.

Higher-rated DTs have lower core losses per unit of capacity. For example, a CRGO core can have core losses as high as 1 to 1.1 Watts per kVA for lower-rated DTs, but this reduces to 0.8 watts per kVA for higher-rated DTs. Amorphous cores can significantly reduce these losses even further. Newer generations of CRGO cores can also offer improved performance, though they are constrained by overall ISI marking regulations.

Core losses considerations.

In the case of DTs, it is important to note that the core loss per kVA significantly increases for smaller capacities compared to their higher capacity counterparts. This means the total core losses of 10 transformers with a rating of 25kVA would surpass the core loss of a single 250kVA transformer.

Additionally, a 250kVA DT has the capability to handle a greater distributed and diversified load when compared to 10 individual 25kVA distributed transformers.

Energy losses of higher rating DT against multiple low rating DT are calculated and it is observed that higher rating DTs are more beneficial. (Table- 4)

Table:4

Formula of energy loss in a transformer in a year

$$= \text{core loss in Watts} \times 8760 / 1000 + [(0.3LF + 0.7LF \times LF) \times \text{Load loss at 100\%}] \times 8760 / 1000$$

Below are some cases of energy saving in case the multiple transformers are replaced by single higher rating transformer. Let us consider a case when 6 numbers 100kVA (level-2(2018)) are replaced with (1*500kVA) DT Level-3(2021) in an urban area

Sr. No.	Case study of different ratings	Total units saved in a year
1	A set of (6*100kVA (Total: 600kVA) are replaced with 500kVA transformer	15195.7
2	A set of (3*250kVA + 5*100 kVA) (Total: 1250kVA) are replaced with 1000kVA transformer	27388.2
3	A set of (3*16+3*10) (Total: 78kVA) are replaced with 63kVA transformer	2411.3
4	A set of (1*40+2*25+2*16 kVA) (Total: 122kVA) are replaced with 100 kVA	4077.7

Consequently, the use of lower rating DTs leads to adverse effects on losses, both in terms of higher core losses and limitations in load handling capacity of the distribution system.

Recognising the significance of this issue highlights the need for considering higher capacity DTs to mitigate losses and improve overall reliability and efficiency in power distribution systems.

Benefits of higher rating DTs

If DISCOMS look forward to optimal utilisation of DT capacities, it is important to select higher rating DTs, especially in urban and semi-urban areas. These areas are much lesser theft prone, where LT extension can be achieved through underground cables or aerial bunched XLPE cables (ABC).

This strategic approach brings forth a multitude of benefits, including.

- A significant reduction in aggregate core losses,
- Lower HT extension costs,
- Improved overload capacity,
- Reduced maintenance requirements due to fewer units, and
- Decreased labour expenses.

Moreover, it also translates into substantial savings in terms of land costs, as a single 1000 kVA DT occupies less space compared to the requirement for 10 units of 100kVA DTs.

The deployment of a single 500kVA DT has the potential to replace as 5-8 units of 63kVA DTs, resulting in enhanced reliability, efficiency, streamlined operations, and optimised utilisation of resources.

CONCLUSION:

For DISCOMs to claim truly optimised operation of DTs, a change in current approach is necessary. Maximising efficiency, while meeting the demands of reliability and durability must be at the core of selecting DTs. The current approach must be re-evaluated with on-the-ground data, and a collective effort from DISCOMs must be made to do a reality-check on the present philosophy and changing the status-quo.

Based on the analysis and arguments above; to maximise efficiency and benefits, it is advisable to prioritise higher capacity DTs instead of multiple low rating DTs at any location, especially in semi-urban and urban areas. As discussed above, this approach offers numerous advantages, including:

- (i) Significantly lower per kVA core loss compared to the use of multiple low rating DTs.
- (ii) Reduced HT extension costs.
- (iii) Improved overload capacity to handle varying load demands.
- (iv) Decreased maintenance requirements and associated costs.

- (v) Lower workforce expenses for operation and maintenance.
- (vi) Reduced land usage due to fewer transformer centres, particularly in urban areas, which can also minimise the need for extensive HT lines.
- (vii) Enhanced safety by minimizing the chances of accidents.

Addressing the concern of copper theft from DTs can be achieved through effective measures such as proper anchoring of naked wires, implementation of pressure sensors, chip-based remote monitoring of DTs, regular monitoring based on smart metering technology and energy audits of feeders.

Additionally, the long-term benefits, based on life cycle cost approach, using copper for HT and LV winding can prove advantageous, bringing commercial dividend, in the long run over its lifetime.

When selecting the appropriate rating of a DTs, the above recommendations will allow for the optimal utilisation of the transformer and its associated benefits.

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Er. LN Nimawat is Retired Chief Engineer from Rajasthan Rajya Vidyut Prasaran Nigam. He has an experience of more than 40 years at different levels in

Power System Planning, Designing, Operation and Maintenance and Purchase of transmission line and substation equipment along with Implementation and Monitoring of Projects. He has also worked for loss reduction in distribution sector and designed and implemented evacuation system for super thermal projects and large size renewable projects of Wind and Solar Power. Resolved the issues related with Grid Integration in consultation with SLDC. Represented/ Acted Nodal Officer in Central Electricity Regulatory Commission, State Electricity Regulation Commission.

Energy Auditor, Bureau of Energy Efficiency,
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NEW LIFE MEMBERS

GR No.	Name	Grade
2466	Er. Naimish S Raval	LM
2467	Er. Ajay D Takalkar	LM
2468	Er. Nayanbhai C Vaidya	LM
2469	Er. Bhargav N Mehta	LM
2470	Er. Mrunal A Mehta	LM Institutional

TRANSMISSION AND DISTRIBUTION TARIFF FOR CONSUMERS OF STATE OWNED DISCOMS EFFECTIVE FROM 01 APR 2025

Transmission Tariff:

1. Transmission charge is reduced to Rs. 3918.01/MW/Day from Rs. 4130.32/MW/Day.
2. Transmission Tariff for STOA is reduced to 37.75 Ps/unit* from 39.09 Ps/unit.
3. No change in Reactive drawl Charges.

Distribution Tariff:

1. No change in Retail Supply Tariff.
2. Green Energy premium is reduced to Rs. 0.90/unit from Rs 1.0/unit.
3. Cross Subsidy surcharge is reduced to Rs. 1.29/unit from Rs. 1.52/unit.
4. Wheeling Loss is reduced to 7.25 % from 8.5%.
5. Wheeling charge is marginally increased to 20.53 Ps/unit from 14.73 Ps/unit.

New Rebates:

1. 2% rebate on energy charge for consumer having installed pre-paid Smart Meter.
2. Consumption during 11:00Hrs to 15:00 Hrs. attracts TOU discount of Rs. 0.60/unit for RGP- NRGP-GLP-LTMD, EVCS having installed pre-paid smart meter.
3. Time of Use (TOU) discount of Rs. 0.60/unit to HTP-I, HTP-II and HT-EVCS for consumption between 11:00

Hrs to 15:00 Hrs.

4. 1% rebate on energy charges to all HT consumers
5. Rebate energy charge for 33kV/66kV consumer is increased to 1.5% and Rebate for 132kV & above consumer is increased to 2%.

Time of Use charge for Tariff Category NRGP, LT-EVCS and HT-EVCS:

1. NRGP & LT-EVCS consumers having CD >10kW and having installed pre-paid smart meter as well as HT-EVCS are under ambit of TOU charge @ Rs. 0.45/unit for consumption during morning peak Hrs. and evening peak Hrs.

Other Provision:

1. In a separate order, Regulator has reduced Additional surcharge to Rs. 0.82/unit for allowed Access Transactions for H-1 of FY 26.
2. Regulators have approved aggregate of Rs. 1091Cr. for four DISCOMs for smart meter maintenance cost to be paid to Advance Metering Infrastructure service provider. This cost is socialized.
3. FPPPA Charge is replaced by FPPAS which will be computed on monthly basis and billing on monthly basis.

Er. Umesh Parikh

MEMBERS IN NEWS

Recently our **Life Members Er. (Dr.) AJ Chavda** and **Er. RM Athawale** were invited to provide a week long training to the Electrical Engineers of Eritrea in the capital city of Asmara. Eritrea is a country in the North-East of African Sub-Continent (Horn of Africa). Power Minister of the country was also present in the concluding session.

Congratulations to **Er. (Dr.) Chavda** and **Er. Athawale!**



OBITUARY



Er. Mukundbhai P Trivedi, Retd. Executive Engineer, MGVCCL and **Life Member** of **SPE(I)** Vadodara left for his heavenly abode on **17 Apr 2025**.

A soft spoken and mixing nature person, he was friendly to all.

May God give peace to the departed soul and strength to his family members to bear the impact.



Er. Vallabhbbhai N Agheda, Retd. SE (Civil), GSECL and **Life Member** of **SPE(I)** Vadodara left for his heavenly abode on **12 Jun 2025** in

Ahmedabad Plane crash. Unfortunately, his better half Mrs. Veenaben was also travelling with him to UK.

He was omnipresent in the evening lecture sessions of SPE. Gentle by nature, he was hard working person.

REMEMBERING Er. VN AGHEDA



Late Er. VN Agheda

Er. VN Agheda and his better half Smt. Veena lost their lives in plane crash in Ahmedabad on 12 Jun 2025. They were travelling to UK to stay with their daughter. I had close association with him. In 1988, I was responsible for R&D work on tower foundation. In the photograph Er. Agheda is seen in excavated foundation of 400kV S/C Asoj-Jetpur line.

He was a noble person and with helping mindset.

May God give peace to his departed soul along with his better half.

Er. SM Takalkar

Disclaimer

The views expressed in this newsletter are solely of the author and do not necessarily reflect the views of the editorial committee and Society of Power Engineers (I), Vadodara