

SPE NEWS LETTER

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**THE SOCIETY OF POWER ENGINEERS (INDIA)
VADODARA CHAPTER (ESTD. 1996)**

FF-48, AVISHKAR COMPLEX, OLD PADRA ROAD, VADODARA-390 007.

PHONE : (0265) 232 2355 E-mail : spevadodara01@rediffmail.com

www.spevadodara.in



2020

VISION

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Members in NEWS

The company owned by Er. SM Takalkar, Vice-Chairman, SPE(I) Vadodara Chapter named "**Takalkar Power Engineers and Consultants Pvt. Ltd. (TPEC)**" has received an assignment from **Tanzania Electric Supply Company Ltd. (TANESCO)** for training its **Senior Engineers** on the topic of **Tower & Foundation Designs and Construction of EHV/UHV Transmission Lines**. The training also included **soft skills**.

The 3-Week training is being provided by **Er. SM Takalkar and Er. KN Rathod** (Advisory Committee Member of SPE(I), Vadodara Chapter) and employees of TPEC such as **Er. KG Gaikwad** (Life Member of SPE(I) Vadodara Chapter) & Er. KN Velani, (Executive Member of SPE(I), Vadodara Chapter).

The engineers of TANESCO have appreciated the training contents and faculty members.



Er. SM Takalkar, Vice Chairman, SPE(I) Vadodara



Er. KN Rathod, Advisory Committee Member, SPE(I) Vadodara

CHAIRMAN'S DESK



I am happy to present this first Newsletter of year 2020 to the readers, and wish them all very happy, prosperous and energetic **New Year.**

United Nations' 25th session of climate change conference (COP-25) was held last month at Madrid, where India's efforts to mitigate climate change were appreciated by all nations present, according to the press briefing by Union environment minister, Mr. Prakash Javadekar.

India had committed at Paris agreement in 2015 that it will reduce emission intensity by 35% from 2005 level by 2030 and set the target of 40% electricity generation from non-fossil fuel in the energy mix. To meet this ambitious target India has set goal of installing 175GW power from renewable sources by 2022. However, it is required to set much higher target of the order of 350 to 500GW by 2030 to achieve target of 40%. The integration of massive amount of the RE is a challenging task for the system management as this type of energy is intermittent and vastly distributed. Therefore, energy storage system must be employed in large scale for proper balance and grid stability.

India Smart Grid Forum (ISGF) in partnership with India Energy Storage Alliance (IESA), has prepared the energy storage system (ESS) road map for India for the period from 2019 to 2032. The primary objective of preparing road map is to estimate the energy storage system requirements in integrating RE into the transmission grids. Large solar and wind farms will be connected to EHV grid while rooftop panels and other small RE sources will be connected to MV/LV distribution grids.

This project includes study and preparation of road map in details during three five years plans, 2019-2022, 2022-2027 & 2027-2032 and conduct cost

benefit analysis of different energy storage technologies for different applications. It also includes preparation of guidelines for assessing the hosting capacity of rooftop solar on low voltage distribution lines. The energy storage deployments on electricity grids are given utmost importance and being planned at a rapid pace.

There is huge requirement of ESS in electric mobility sector which is being deployed with priority. Government of India has approved recently the 'National Mission on Transformative Mobility and Battery Storage' with a focus on local manufacturing. This development will help reduce emissions due to transport sector and reduce oil import dependence.

Thus, India has developed significant market potential in ESS sector, mainly in battery storage system. Indian industries have already started setting up manufacturing capabilities for developing lithium-ion battery packs. Good numbers of large companies are entering cell manufacturing in 2-3 years. According to IESA's estimates, the market for energy storage would grow to over 300GWh during 2018-25. These storage additions will be used in renewable energy integration, T&D, ancillary services, railways, EVs, microgrids, telecom and many other applications. This will put India "on the global map of **Giga Factories**".

As this sector is coming up very fast in India, it will need many trained engineers in India and the sector may face the challenges for training and skill development. SPE(I) and CBIP is engaged in bringing awareness in new technologies like ESS, EVs and I am happy to inform the readers that we are organizing **2-Day Conference on ESS** within 3-4 months in Vadodara with the co-operation of CBI & P, GETCO etc.

Thanking you,

GVAkre

EDITORIAL



Dear Reader,

At the very outset, the Editorial team conveys its new year greetings to all members and their families.

We wish you all and your families “A Very Happy & Prosperous Year 2020”. We most sincerely wish that the vision of Dr. APJ Abdul Kalam enshrined in his book “INDIA 2020” is realised to the benefit of all the countrymen.

Indian power sector is undergoing a significant change that has redefined the industry outlook. The economic growth continues to drive electricity demand in India. The Government of India's focus on attaining 'Power for all' has accelerated capacity addition in the country. At the same time, the competitive intensity is increasing at both the market and supply sides (fuel, logistics, finances, and manpower). Total installed capacity of power stations in India stood at 356.82 Gigawatt (GW) as of October 2019.

At the beginning of FY2017-18, India saw a dramatic decline in wholesale electricity tariffs from solar and wind generation sources with capacity consistently awarded at sub Rs3/kWh through reverse bidding auctions. With zero indexation on these tariffs, renewables have broken through grid parity and have continued to capture increasing market share as the new low-cost source of capacity since 2017.

The utility scale solar segment saw an addition of 4 GW in the first three quarters of 2019-20 and is expected to add another 4.5 GW in the last quarter. This cumulative capacity of 8.5 GW amounts to nearly 28% y-o-y growth. As per research estimates, the year 2020 is expected to witness 29% growth with the addition of another 11GW of capacity.

The wind sector expects to add 4GW of capacity in 2020. This would be 50% y-o-y from 2.6 GW added in the year 2019. Of the 2.6 GW, around 1.8 was added in the first three quarters of 2019 and another 0.8 GW would be completed by the end of 2019-20. Most of the wind projects allocated in 2018 which were scheduled to commission in 2019 got delayed and are now likely to be commissioned in 2020. This delay is primarily attributed to various land related issues and lack of grid transmission availability.

Clearly, 2020 is likely to be the year of growth for RE installations. RE installations are slated to peak in 2020-21. 11 GW solar and 4 GW wind capacity is likely to be added.

The Government of India has released its roadmap to achieve 175 GW capacity in renewable energy by 2022, which includes 100 GW of solar power and 60 GW of wind power. It is preparing a 'rent a roof' policy for supporting its target of generating 40 gigawatts (GW) of power through solar rooftop projects by 2022.

Coal-based power generation capacity in India, which currently stands at 229.40 (As of October 2019) GW, is expected to reach 330-441 GW by 2040. As can be seen, we are living in interesting times.

We will be extremely happy to receive your views, opinions and suggestions. Please feel free to reach out to us.

Happy Reading!

AWADHESH KUMAR SINGH

CHAPTER'S ACTIVITIES



On **10 Nov 2019**, the **Chapter** celebrated **National Power Day**. On this day **1st Hydro Power Station of 2 x 65kW** was commissioned at Arya Tea Estate at Sidrapong near Darjeeling. This marked the

beginning of Power System in India. On this occasion, the **Chapter** organised a joint lecture programme with IE(I) Vadodara at the Vasvik Auditorium of IE(I), Vadodara Local Centre. The topic was “**Evolving Power Grid – Futuristic Aspects**”. Speaker was **Dr. Shivani Sharma, Principal Technical Consultant** of ABB, Vadodara. Important aspects covered by her in the lecture are as follows:

- (1) Pollution and increased Carbon footprints are associated with the rapid growth of grid.
- (2) While the Nation is bracing to keep pace with quality and quantity power to all by 2030, the conventional power systems through coal will have to be restricted to 50% to 55%.
- (3) Green energy corridors will need good service level, good performance and good governance.
- (4) RE penetration will be associated with the system issues. Microgrids may bring in good power usage with less burden on the grid.
- (5) E-mobility is picking up fast. The conventional diesel/petrol driven vehicles may slip into history. Lot of research work on E-vehicles and battery storage is going on world over. The aspect of EV charging will have to be addressed.
- (6) Planning of expansion of grid is a key to the desired growth of the country.
- (7) Assessment of risk, cost and performance is important for growth including development of E-mobility and charging facilities.
- (8) Asset management software can be used for optimizing inventories.
- (9) Training of experienced engineers for meeting the new challenges is vital for the nation.

The lecture generated lot of discussion, questions and answers.

- On **01 Dec 2019**, the **Chapter** organized a **Cultural Programme (Musical Evening)** for members with spouse, at the Auditorium of Baroda High School, Alkapuri.

The **Samvadini Group** headed by **Ms. Amruta Deota** presented yester years' memorable film songs. The members and their family enjoyed each and every song.

As decided, opportunity was also given to members & their dependents to present their skill during the event. The members **Er. MG Mehta, Er. NC Solanki, Er. Bihag Majmudar** and **Er. RS Shah** presented old film songs whereas **Ms. Shreeya**, granddaughter of **Er. GV Akre** (Chairman), operated a keyboard and presented a rhythmic old song. **Mrs. Seema Agrawal** spouse of **Er. Manoj Kumar Agrawal**, Life Member, presented good old songs to the perfect rhythm of orchestra. The musical group included singers **Ms. Amruta Deota, Ms. Krutika Sangamnerkar** and **Dr. Vikas Karambelkar**. The musicians included **Shri Piyush Bhatt** (Keyboard), **Shri Nadan Bhole** (Tabla), **Shri Gajendra Devda** (Octopad) and **Shri Jay Natu** (Bongo/Congo). The programme was anchored by **Er. Dipak Gupte**, Life Member of SPE(I) Vadodara Chapter.

The cultural programme was followed by a grand dinner. During the cultural programme, the office bearers appealed to the members to donate generously towards the Silver Jubilee Celebration of SPE(I) Vadodara Chapter. There was an overwhelming response to the appeal and 42 members announced the contribution totaling to **Rs. 1,44,000/-** within 10 minutes. The list of the donor members is being published separately.

- On **14 Dec 2019**, as a part of Celebration of “**Energy Conservation Day**” the **Chapter** organized **1-Day Seminar on “Energy Conservation & Management in Industries & Utility – Case Studies**” at the Vasvik Auditorium of IE(I), Vadodara Local Centre. Report of the Seminar is brought out in this issue.

SM Godkhindi

Inauguration of Ahmedabad Chapter of SPE(I)

The Ahmedabad Chapter of SPE(I) came into existence with a Grand Inaugural Ceremony on **17 Nov 2019**, in the BhaikakaBhavan hall of the Institution of Engineers (India), Ahmedabad.

Er. Nikhil Shah, Er. Deepak Bhargava, Er. DR Shah respectively **Secretary, Chairman** and **Vice-Chairman** of Ahmedabad Chapter, were on the dais along with **Shri Saurabhbhai Dalal** (Patel), Hon'ble Power Minister, GoG., **Er. IM Bhavsar**, Chairman, GEDA and **Er. VK Kanjlia**, Secretary, CBIP.

Er. Bhargava gave welcome speech and briefed about the formation of Ahmedabad Chapter.

Er. Kanjlia, Secretary, CBIP praised the power engineers of the state. He also praised Shri Saurabhbhai for his contribution in making Gujarat as a role model for the entire power sector of the country. He also specifically mentioned the leading role of SPE(I) Vadodara in bringing engineers of state together and working for power engineering fraternity for almost two and half decade, since its inception in 1996.

Er. IM Bhavsar, Chairman of Gujarat Energy Development Association (GEDA) was next to speak.

He highlighted the role of the state and Shri Saurabhbhai in implementing "Jyotigram Yojana" which is responsible for 24 x 7 Power in every corner of the state.

He also specifically mentioned about the RE potential being explored by the state and cutting down carbon footprints. He also mentioned about the energy conservation measures taken by the state. The aim of the Discoms to provide quality power was highlighted by him.

Shri Saurabhbhai mentioned that the power sector is subjected to changes every three years. Even the coal based power plants are suffering from instability at international level. As of now, there are no

takers for coal based PPA. Gas prices are also not steady which make power business volatile. He added that Govt. of Gujarat would be using un-used land to generate about 30,000MW of RE. He further added that the Discoms in Gujarat are doing well because of strong political will. The progress of the state in power sector is due to change in attitude of the engineers and the unions. However, he lamented that these days, the quality of passing out students is not up to the mark.

Er. DR Shah, Vice-Chairman of the new Chapter presented vote of thanks. He specially mentioned about the active role played by the office bearers of Vadodara Chapter in opening new Chapter in Ahmedabad.

The inaugural function was followed by five technical and informative presentations.

The first presentation was by **Er. Nikhil Shah**, Secretary, Ahmedabad Chapter. He lauded the role of SPE(I) in bringing the engineering fraternity together. He recalled his close association with the office bearers of SPE(I) Vadodara Chapter for founding the Ahmedabad Chapter and also welcomed the members of SPE(I) Vadodara who went all the way to attend the inaugural function, to Ahmedabad.

Er. DR Shah from Gujarat Power Research & Development, Gandhinagar (working under GUVNL) made a presentation on R&D activities of the centre he is working for. He mentioned about the monitoring of the Discoms through various modern techniques including watch dog transformers. Good earthing practices being followed by Discoms has provided good safety to equipment and the human being, he stated.

Er. Dilip Brahmhatt from Torrent Power made a presentation on Dholera Smart City coming up in Gujarat. He stated that the State of Art Smart City with the size of

Memorable Events

Musical Evening on 1st December 2019



Founder Chairman Er. N Dinker
at Registration Counter



Appeal for donation by Er. SM Takalkar &
Er. NG Yadav



Appeal for donation by Er. SM Godkhindi

+



Appeal for donation by Er. GV Akre



Er. Dipak Gupte anchoring Musical Evening



August audience enjoying melodies

Memorable Events

Musical Evening on 1st Dec 2019



Ms. Amruta Deota
of Samvadini group presenting a song



Shri Shirang Karkar of group
presenting a song



Shri Rathod of group presenting a song



Shri Nandan Bhole performing on Tabla



Er. Seema Agrawal guest artist
presenting old melody



Er. Bihag Majmudar presenting a song

Memorable Events

Musical Evening on 1st Dec 2019



Ms. Krutika Sangamnerkar
presenting a song



Ms. Shreeya Akre being felicitated by Er. SM Takalkar
on her Key Board performance as Guest Artist



Er. NC Solanki
Presenting a Song



Er. RS Shah
Presenting a Song



Er. Mrugen Mehta
Presenting a Song

Members in NEWS



Er. KG Gaiwad
Life Member SPE(I) Vadodara



Er. Keval Velani Life Member &
Executive Member SPE(I) Vadodara

Memorable Events

Inauguration of Ahmedabad Chapter on 17 Nov 2019



Er. GV Akre, Chairman briefing activities of SPE(I) Vadodra Chapter



Shri Saurabhbhai Patel delivering his address



August Audience during Inauguration



L to R Er. AK Shah, Er. BB Shah, Er. VK Kanjlia, Er. SM Takalkar, Shri Deepak Shah



Dignitaries on Dais L to R Er. Nikhil Shah, Er. GV Akre, Er. IM Byhavsar, Shri Saurabhbhai Patel, Shri Deepak Bhargava, Shri Deepak Shah

35kM x 37kM is going to be a reality soon. It will include international airport, 5,000MW Solar Power Plant, world class infrastructure, e-mobility etc.

The next presentation was from **Ms. Manaz Dixit**. She highlighted the use of energy efficient equipment and e-mobility to reduce green house gases. She stressed the need for orientation of the society towards saving energy through good building construction and proper light fixtures.

The fifth and last presentation was from **Ravin Cables** who were one of the sponsors for the event.

The presenter highlighted the role of cables in solar power development. The fire

survival cables manufactured by Ravin Cables are unique, he added. These cables are tested for 950°C. This is possible due to molecular moisture management system during the manufacturing process.

The last leg of the function was film songs sung by Engineers on karaoke. They included **Er. Rathod, Er. Rajendra Joshi, Er. PJ shah** and **Er. Chinmay Pandya**.

Er. Raju Shah presented vote of thanks.

The programme came to an end with good lunch.

Congratulations to the office bearers of SPE(I) Ahmedabad

Report on 1-Day Seminar on Energy Conservation & Management in Industries & Utilities–Case Studies

The Society of Power Engineers (India) Vadodara Chapter organized 1-Day Seminar on "Energy Conservation & Management in Industries and Utilities – Case Studies" on 14th December 2019, jointly with Institution of Engineers (India), Vadodara Local Centre. The Seminar was organized as a part of celebration of the Energy Conservation Day. In inaugural session, the Chairman & Vice-Chairman of SPE (I) **Er. GV Akre & Er. SM Takalkar** respectively, the Chairman of IE (I) Vadodara Centre **Er. NP Singh Brar** and **Ms. Amitaben Pandya**, Director of Gujarat Energy Development Agency (GEDA) – a nodal agency of Energy Conservation and Renewable Energy for Gujarat State, were on the Dais. The dignitaries on dais were felicitated by Er. GV Akre.

Er. Akre spoke about the activities of Vadodara Chapter such as Monthly lectures, Seminar and Workshop conducted during last year. **Er. Takalkar** discussed about the topics to be covered in this Seminar. He briefed about the speakers of the Seminar. **Er. Brar** appreciated the SPE (I), Vadodara Chapter for conducting the Monthly Lectures and Seminar.

He requested for the support of SPE (I) Vadodara Chapter to extend their co-operation in future programmes of IE(I) Vadodara. He briefed about the activities conducted by the Institutions of Engineers (India), Vadodara Local Centre. He also requested SPE (I) Vadodara Chapter to organize similar events in future. He wished all success to the Seminar.

Er. Amita Pandya made a presentation on GEDA's activities which included Roof Top Solar Power Plant, RE Sources etc. She discussed about the ways and means of Energy Conservation, Energy Management and Energy Audit.

Dr. BG Desai, an exponent in the field of Energy Conservation and Management, also spoke on the occasion and praised SPE(I) Vadodara Chapter for the activity being conducted regularly. Dr. BG Desai has Authored Book on "ENERGY CONSERVATION IN INDUSTRIES", which is published by SOHAM TECHNOLOGIES, Vadodara. The book was formally released during this Seminar by the dignitaries on the dais.

Er. VB Harani, Advisory Committee Member of SPE(I) Vadodara Chapter presented vote of thanks at the end of the inaugural session. The Experts and Exponents in the field of Energy Conservation, Management and Audit in & around Vadodara were the faculty members. They included as under:

- 1) **Dr. BG Desai**, EC Expert – He spoke on **“Energy Scenario and Approaches for Energy Audit”**. He spoke about, Energy Conservation in various industries. He stressed upon saving in all types of Energy i.e. Electrical, Mechanical, Chemical, Gas, Water, etc. There were good question answers amongst participants and speaker. He also shared his experience in conducting Energy Audit in various Industries and utilities
- 2) **Er. Bharat Shah**, Consultant – He made a presentation on **“Highly Efficient Electric Motors”**. He described the development in the Electric Motors. The usage of Electric Motors in the various fields like Manufacturing Industries, Government sectors – Military, Navy, Air Force, Power Plants, Transmission Substations etc. He also displayed highly efficient and high speed (12,000rpm) motors at the venue, which was well appreciated by participants.
- 3) **Er. Yatin Joshi**, Schneider – His presentation was on **“Variable Frequency Drive & Energy Management System in Industry”**. He explained the fundamentals of Energy Management System in the Industries. He explained why and up to what extent Energy Management will be useful in conducting Energy Audit and Energy Conservation activities. He also discussed the method to implement the Energy Conservation on the basis of Energy Audit report. He also expressed that the area where energy saving is more, is to be taken on had first and to be followed by other areas.
- 4) **Er. Bhaskar Raval**, Accredited Energy Auditor – He spoke on **“Electric Billing System, Electric Tariff and Energy Conservation ways and means”**. He shared his experience of 40 years in

conducting the Energy Audit in Industries, Houses, Plants, Substations, Colleges, Offices, Government Buildings etc. He informed the various ways and means of saving Electrical Energy while using Washing Machine, Water Geyser, Oven, Refrigerator, Water Pump etc. He told empathetically that even simple look at the energy bill can also save money as there are different heads & tariffs which can be studied for optimizing the power bill.

- 5) **Er. Bhavesh Vasiyani**, ERDA –He made presentation on **“Case Studies of Energy Audit in Power Generation Companies and Industries”**. He presented the case studies of Energy Audit conducted in the industries and gain on implementation of the suggestion made by them. He covered Thermal Power Plant, Steel Industry, Nuclear Power Plant, Chemical Industry etc. He explained the ways and means to conduct the Energy Audit and difficulties faced while doing the energy audit and way out.
- 6) **Er. PA Shah**, Associate, TPEC – He spoke on **“Perform, Achieve & Trade Scheme (PAT) of Central Government of India for Industries & DISCOMs”**. He explained about PAT. He also informed PAT schemes applicability in the field of Industries, DISCOMs etc. He also briefed about role of BEE, Accredited Energy Auditor and Central Government. He also informed about various terms used in PAT scheme like Designated Consumer, DISCOM, State Designated Agency, Bureau of Energy Efficiency, Specific Energy Consumption, MYOE, Types of Energy (Gas, Diesel, Petrol, Electricity, Kerosene etc.) He described benefits of the PAT Schemes in terms of Energy Saving Certificates and its Trading.
- 7) **Er. SM Takalkar**, Managing Director, TPEC – He made presentation on **“Energy Management Opportunities in Industries”**. He spoke on Energy Management opportunities in various industries. He explained various forms of energy like static, rotating, illuminating,

heating, dynamics etc. He also informed about the Energy Management Standards ISO 50001. He explained with examples how an industry can optimize its energy cost by opting for various sources. He stressed the need of using minimum natural resources in design, engineering construction and manufacture, as each natural resource is an attached cost of energy.

- 8) **Dr. BG Desai**, EC Expert –He was the last speaker for the day. His topic was “**BEE Standards, Star Labeling and Rating of Energy Efficient Equipment**”. He briefed about the standards published by BEE. He informed about the star labels and its usages. He explained the rating of equipment and energy consumption based on rating and procedure for obtaining the labels. He stated that at-least 3 star rated appliances should be used by everyone.

The concluding session was conducted by Er. SM Takalkar. Dr. BG Desai, Er. BN Raval and Er. Bharat Shah were also on dais. Er. Raval and Er. PA Shah summed up the event and invited views of the participants regarding the arrangements and technical presentations. Some participants came forward and gave good opinion.

The seminar was attended by about **125** delegates from Industries, Power Utilities like State's Power Distribution Company, Transmission Company & Generation Company, Academic Students & Teachers and Power Sector Industries & Organizations. Delegates

also came from various industries around Vadodara. The Seminar was also attended by the members of the Institution of Engineers (I), Vadodara Local Centre and the Society of Power Engineers(I) Vadodara Chapter. The following organizations provided financial support for the event.

(1) Sponsors:

- a. GEDA, Gandhinagar
- b. ERDA, Vadodara
- c. Ami Life Science Pvt. Ltd., Vadodara

(2) Co-sponsors:

- a. Alembic Pharma, Vadodara

(3) Supporters:

- a. Shivam Engineering, Waghodia, Vadodara
- b. Power Craft, Waghodia, Vadodara
- c. Elmex, Vadodara
- d. VilashTranscore
- e. Pratik Electricals, Manjusar, Vadodara
- f. Shiva Pharmachem
- g. RE 360, Vadodara
- h. Lon Sen Kiri

Er. BN Raval, Soham Technologies, had anchored the whole event. The concluding session was anchored by **Er. PA Shah** and **Er. BN Raval**. The vote of thanks was delivered by **Er. SM Takalkar**, Vice-chairman of SPE (I) Vadodara Chapter.

The Seminar was a Great Success from all aspects.

Earthing

ND Makwana

Earthing stands for electrical connection to earth. All the electrical equipment have terminals for connecting it in the circuit. But creator of EARTH has not provided terminal for connection. Hence, wherever required artificial terminal is created on earth for connection to it. This is known as Earthing Pit. This is created at site wherever

required. Solidity of this terminal with earth has to be perfect for efficient performance. This is measured as Earthing Resistance. Very low resistance is better for Earth Terminal.

Feature/Characteristic of Earthing Resistance.

Let us refresh concept for resistance of

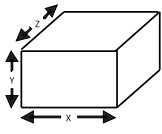
conductor.

A piece of conducting material has specific resistance ρ and dimensions as in the sketch hereunder.

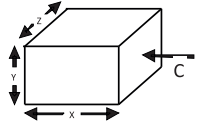
$$\text{Resistance of the piece} = \rho \frac{\text{length}}{\text{area}}$$

Question arises about consideration of length and area.

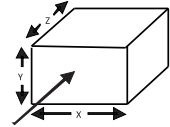
Resistance of the piece depends upon the direction of the current as under.



$$\text{Actual Resistance } R = \rho \frac{y}{xz}$$



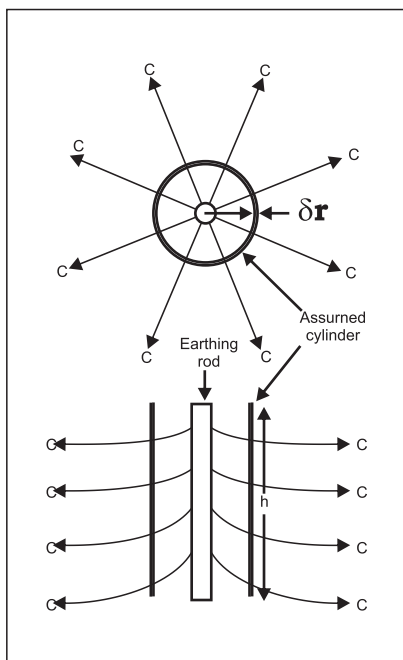
$$\text{Actual Resistance } R = \rho \frac{x}{yz}$$



$$\text{Actual Resistance } R = \rho \frac{z}{xy}$$

The dimension along the direction of current is length and transverse to it is the area. Ground current from earthing rod will flow radially in all direction and downward as shown.

Let us assume numbers of concentric cylinders of soil one over the other having thickness δr .



Take one such cylinder having radius r . Length for the ground current in this earthen cylinder is δr (in direction of current)

Area available for ground current to flow in this earthen cylinder is $2\pi r h$ (cross section to current Path)

Hence, resistance experienced by ground current in this cylinder of soil is

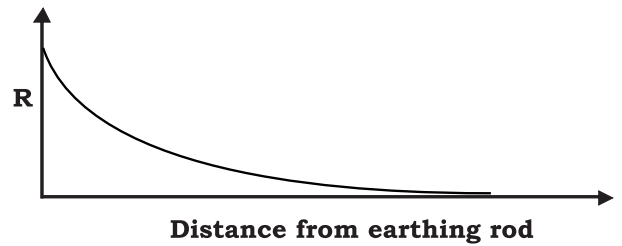
$$= \rho \frac{\delta r}{2\pi r h}$$

As it moves away from the rod, the radius r and active height h will increase.

So cross section area $2\pi r h$ increases as it moves away from the earth rod.

Length δr for current to flow is same for all cylinders.

Hence, earthen cylinder resistance is maximum near the rod and goes on reducing as it moves away from the rod, till it is practically zero after about 15 meters.



All these cylinder resistances are in series along path of current.

Hence total resistance is sum of all these resistances.

This total resistance is known as Earthing Resistance of the pit.

This Earthing Resistance primarily dependent on soil resistivity related to type of the soil.

Earthing Resistance has to be minimum for efficient performance.

Major part of the earthing resistance is due to soil surrounding the rod. Hence, efforts are made to make surrounding more conductive by back filling with charcoal, salt, water, bentonite, etc.

Powdered clay has more contact area with rod compared to ordinary coarse soil. Charcoal is conductive and porous that holds brine. Salt is hydroscopic that captures moisture and as electrolyte makes water conductive. Bentonite has better conductivity and moisture holding capacity compared to ordinary soil and with water it expands and sticks firmly to earthing rod. Earthing resistance increases in dry condition so occasional watering is required.

Memorable Events

Energy Conservation Seminar on 14th Dec 2019 at Vadodra



Releasing the book
authored by Dr. BG Desai



Er. Bharat Shah speaking on
High Efficiency Motors



Er. BN Raval Speaking on
Energy Conservation



Dr. BG Desai speaking on
Energy Scenario



Er. PA Shah speaking on PAT



August audience during Seminar

Memorable Events

Energy Conservation Seminar on 14th Dec 2019 at Vadodara



Er. GV Akre, Chairman
giving Welcome Speech



Er. SM Takalkar, Vice Chairman,
giving brief of Seminar



Er. NP Singh Brar, President,
IE(I) Vadodara speaking on the occasion



Ms. Amita Pandya, Director, GEDA
giving Inaugural Speech

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