# **SESSION TRANSACTION PLAN FOR TWO-DAY CAPACITY BUILDING PROGRAMME**

**FOR PWD (ELECTRICAL)**

**DAY 1: XX XX XXXX (---day)**

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| **SESSION NUMBER** | **SESSION TITLE AND DURATION** | **OBJECTIVE** | **SESSION TRANSACTION PLAN** | **EXPECTED OUTCOME AND FOLLOW-UP RESOURCES** |
| SESSON 1 | **Session Title:**  Rooftop Solar Photovoltaics - Terrestrial and Concentrator PV : Design Considerations and Type Approvals  (60 min) | **Objective:**  To provide participants with comprehensive knowledge of design, types, selection, installation, and maintenance of Solar Photovoltaic Modules | **Session Breakdown:**  **1**. **Solar Photovolatics for achieving Net Zero** (5 minutes)   * **Objective:** Introduce the session and highlight the importance of renewable energy and solar photovoltaics, Govt. schemes and pathways * **Content:** * Govt Schemes & QCOs * Efficiency of Solar Photovoltaics module * **Methodology:** Presentation with an overview of session objectives and key terms.   2. **Structure, Components and types of a Solar PV System** (5 minutes)   * **Objective:** To familiarize participants with different Solar PV technologies. * **Content:** Thin-film, monocrystalline, polycrystalline, and concentrated PV (CPV) * **Methodology:** Use visual comparisons and real-world examples.   **3. Design and installation of Ground-Mounted Photovoltaic Power Plants – Challenges and Solutions offered by Indian Standards** (10 minutes)   * **Objective:** To showcase practical applications of Solar PV systems installations * **Content:** Significance of aspects covered in the standard to address the challenges * **Methodology:** Brief presentation with examples   **4. Standards and Quality Benchmarks** (15 min)   * **Objective:** Introduce the standardization framework in the area * **Content:** * Standardization in the area of Solar Photovoltaics   IS 14286 series  IS/IEC 61730 series  IS 16228: 2024   * Significance of design qualification and associated benchmarks * **Methodology:** Link expectations w.r.t quality with solutions offered by Indian Standards   **5. Indian Standards in Action: Tackling Field Failures with Stress Tests** (15 minutes)   * **Objective:** Discuss most common field failures and how Accelerated Stress Testing in Practice helps in Mitigating Solar PV Failures: * **Content:** List most common field failures and explain how IS 14286 series helps handle the failure mode. * **Methodology:** Brainstorming session and open floor for participants to share their views on overcoming challenges.   **6. Emerging Technologies** (10 minutes)   * **Objective:** To illustrate emerging uses of Solar PV systems in various sectors * **Content:** Building-integrated PV, floating PV systems, Agrivoltaics, circular economy * **Methodology:** Use Visual Representations in the presentation with discussions | **Expected Outcomes:**  •Design qualification benchmarks  •Knowledge of best practices for designing, installing, and maintaining these systems.   * Insights from Indian Standards for Turning Challenges Into Solutions   •Awareness of sustainable practices and innovations in the field  **Follow-up Resources:**  •Access to relevant standards in Solar PV sector.  •Contact information for further queries or guidance. |
| Session 2 | **Session Title:** Cables for Electric Photovoltaic systems and Smart Energy Meter for Net Metering  Duration: 1 Hour | **Objective:**  To provide participants with insights into the role of BIS in formulating standards for Cables for Electric Photovoltaic systems and Smart Energy Meter | **Session Breakdown**  **1. Introduction (15 Minutes)**  **Objective:** Current Regulatory Framework on Cables for Electric Photovoltaic systems  **Content:** Brief on Solar DC Cable and Fire Survival Cable (Quality Control) Order, 2023  **Methodology:** Presentation with an overview on CEA Regulations and Quality Control Order and its contents.  **2. Cables for Electric Photovoltaic Systems (15 minutes)**  **Objective:** To explain the types of cables used in PV systems and their selection criteria  **Content:**   * Key requirements for PV cables (UV resistance, high temperature tolerance, flexibility). * Types of PV cables: * DC cables (module to module, module to inverter) * AC cables (inverter to distribution panel) * Earth and grounding cables * Cable sizing and its importance for system efficiency and safety   **Methodology:** Slide presentation showing cable types and specifications  **3. Smart Energy Meters for Net Metering (15 minutes)**  **Objective:** To understand the role of smart energy meters in net metering systems  **Content:**   * Functions of smart energy meters: * Bidirectional energy measurement * Real-time monitoring and data logging * Key features: * Communication interfaces (eg Wi-Fi, Zigbee) * Integration with utility networks * Importance in optimizing energy usage and billing   **Methodology:** Slide presentation with excerpts from relevant Indian Standard (IS 16444 Part 1)  **4. Conclusion and Q&A (15 minutes)**  **Objective:** Recap key points and address participant questions  **Content:**   * Summary of the role of BIS standards * Open floor for participant questions and clarifications   **Methodology:** Facilitator-led summary and interactive Q&A session. | **Expected Outcomes:**   * Understanding the key provisions of current regulatory framework on Cables for Electric Photovoltaic systems. * Understanding of BIS standard on Cables for Electric Photovoltaic systems.   **Follow-up Resources:**   * Access to relevant sections of the Solar DC Cable and Fire Survival Cable (Quality Control) Order, 2023 * Access to relevant BIS documents and standards. |
| Session 3 | **Session Title:**  “Electric Vehicle Charging Infrastructure”  **Duration:**  1.5 hrs | **Objective:**  To provide participants comprehensive understanding of the current landscape, technologies, challenges, and future trends related to electric vehicle (EV) charging infrastructure in India. | **Session Breakdown:**  **1. Role of Charging Infrastructure in India's EV Transition (**10 minutes)   * **Objective**: Importance of EV charging infrastructure and its importance in India's EV adoption. * **Content**: Overview of EV penetration targets by 2030, charging infrastructure development, and challenges (e.g., grid capacity, consumer awareness, charging network gaps). * **Methodology**: Short presentation highlighting EV growth targets and challenges.   **2. Government Initiatives (**15 minutes)   * **Objective:** Keygovernment initiatives supporting EV adoption in India. * **Content**: FAME scheme, state-level EV policies, guidelines for the installation of charging infrastructure, and subsidies for EV manufacturing and infrastructure development. * **Methodology**: Presentation of successful EV policy implementations (e.g., Delhi, Tamil Nadu) and interactive Q&A.   **3. EV Charging Technologies** (15 minutes)   * **Objective**: Familiarize with various EV charging technologies. * **Content**: Conductive charging, inductive charging, and battery swapping. * **Methodology**: Technical discussion with examples of different charging technologies (conductive, inductive, etc).   **4. Indian Standards for EV Conductive Charging (IS 17017) (**10 minutes)   * **Objective**: Understand the Indian standards for EV conductive charging systems. * **Content**: Detailed discussion on IS 17017 covering requirements * **Methodology**: Guided walkthrough of standard IS 17017 to explain technical details.   **5. Indian Standards for Battery Swapping (IS 17896)** (10 minutes)   * **Objective**: Understand the Indian standard for Battery Swap System. * **Content**: Discussion on IS 17896 covering System Overview * **Methodology**: Guided walkthrough of standard IS 17896.   **6. Challenges in Battery Swapping (**15 minutes)   * **Objective**: Identify key challenges to establishing Battery Swapping infrastructure and potential solutions. * **Content**: Issues related to non-uniform battery designs, homologation, etc. * **Methodology**: Group activity—Participants brainstorm possible solutions to challenges and present findings.   **7. Relevant Indian Standards** (15 minutes)   * **Objective**: To create awareness about various Indian Standards related to EV Charging Infrastructure. * **Content**: List of Indian Standards category wise. * **Methodology**: Open forum for questions, followed by a summary of the session’s key points and closing remarks. | **Expected Outcomes:**   * Importance of EV charging infrastructure in India's EV adoption. * Keygovernment initiatives supporting EV adoption in India. * Familiarity with various EV charging technologies. * Familiarity with Indian Standards related to EV Charging   **Follow-up Resources:**   * Access to relevant BIS documents and standards.   Contact information for further queries or guidance. |
| Session 4 | **Session Title:**  “Electric Vehicle Charging Protocols”  **Duration:**  1.5 hrs | **OBJECTIVE:**  To provide participants with a comprehensive understanding of EV charging protocols, communication standards, and emerging technologies, enabling them to effectively implement and manage EV charging infrastructure. | **Session Breakdown:**  **1. Importance of EV Charging Protocols** (10 minutes)   * **Objective:** To provide an overview of why EV charging protocols are essential. * **Content:** Importance of interoperability in EV infrastructure. Ensuring compatibility between various EVs and charging stations. Overview of charging process: Plug & Charge, monitoring, and safety features. * **Methodology:** Short presentation with key points from the presentation slides. Q&A to address basic queries from participants.  **2. Communication Protocols in EV Charging (20 minutes)**  * **Objective**: To understand how EVs communicate with charging equipment. * **Content:** Low-level and high-level communication protocols. Indian Standards governing the protocols. * **Methodology**: Detailed explanation of communication processes.  **3. Smart Charging and Vehicle-to-Grid (V2G) (10 minutes)**  * **Objective**: Explore advanced features like smart charging and bidirectional energy transfer. * **Content**: Smart charging: Optimizing energy use based on grid conditions. Vehicle-to-Grid (V2G) technology and its benefits. Managing energy demand using EV batteries. * **Methodology**: Explain concepts using examples and figures from the presentation. Discussion: How V2G can help balance energy demand.  **4. Boost Charging and High Power EVSE (10 minutes)**  * **Objective**: Introduce high-power and boost charging technologies for faster EV charging. * **Content**: Thermal management in EVSE to reduce charging time. Practical considerations for high-power EVSE setups. * **Methodology**: Explain thermal exchange systems through Demonstration: Compare charging times of standard vs. boost charging.   **5. Open Charge Point Protocol (OCPP)** (10 minutes)   * **Objective**: Discuss the Open Charge Point Protocol for ensuring charging infrastructure compatibility. * **Content**: Importance of OCPP for communication between different EVSE manufacturers. Features: Remote monitoring, diagnostics, firmware updates. * **Methodology**: Explain how OCPP ensures interoperability through presentation. Participants share experiences or questions on charger compatibility issues.   **6. Indian Standards for Communication Protocols and relevant section of NEC** (15 minutes)   * **Objective**: Familiarize participants with relevant Indian Standards * **Content**: Key features of IS/ISO 15118, and National Electrical Code (NEC). * **Methodology**: Explain key features of IS 15118 standards and brief about the requirements covered in NEC for supplies of Electric Vehicles.   **7. Future Trends: Pantograph Charging & Megawatt Charging System** (15 minutes)   * **Objective**: Highlight future developments in EV charging technologies. * **Content**: Pantograph charging for buses and high-power vehicles. Key features of Megawatt Charging System   **Methodology**: Interactive discussion on future applications. | **Expected Outcomes:**   * Importance of EV charging protocols for efficient communication. * Understand how EVs communicate and level of communications involved. * Familiarity with Indian Standards related to EV Communication. * Highlight future developments in EV charging technologies   **Follow-up Resources:**   * Access to relevant BIS documents and standards.   Contact information for further queries or guidance. |

**DAY 2: XX XX XXXX (---day)**

| **SESSION NUMBER** | **SESSION TITLE WITH DURATION** | **OBJECTIVE** | **SESSION TRANSACTION PLAN** | **EXPECTED OUTCOME**  **AND FOLLOW-UP**  **RESOURCES** |
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| Session 1 | **Session Title:** Cables for Low Voltage Application and their types, PVC insulated cables for House Wiring  Duration: 1 Hour | **Objective:**  To provide participants with insights into the role of BIS in formulating standards for Cables for Low Voltage Application and their types, PVC insulated cables for House Wiring | **Session Breakdown**  **1. Introduction (10 Minutes)**  **Objective:** Current Regulatory Framework on Low Voltage Cables  **Content:** Brief on Electrical Wires, Cables, Appliances and Protection Devices and Accessories (Quality Control) Order, 2003 and CEA Regulations, 2023  **Methodology:** Presentation with an overview on CEA Regulations and Quality Control Order and its contents.  **2. Brief on Low Voltage Cables (15 minutes)**  **Objective:** To introduce low voltage (LV) cables and their significance in electrical systems  **Content:**   * Definition of low voltage cables (up to 1000V) * Importance of LV cables in residential, commercial, and industrial applications * Basic structure of LV cables (conductor, insulation, sheath)   **Methodology:** Slide Presentation with diagrams and images of LV cables  **3. Types of Low Voltage Cables (15 minutes)**  **Objective:** To classify and understand different types of low voltage cables based on construction and application  **Content:**   * Common types of LV cables: * Single-core and multi-core cables * Armored and unarmored cables * Flexible cables for specific applications * Materials used: * Conductors: Copper vs. Aluminum * Insulation: PVC, XLPE * Applications of each type in residential and industrial settings   **Methodology:** Slide Presentation with a focus on comparison tables for cable types and features  **4. PVC Insulated Cables for House Wiring (10 minutes)**  **Objective:** To explore the characteristics and applications of PVC insulated cables in residential wiring  **Content:**   * Features of PVC insulated cables: * Electrical insulation properties * Durability and resistance to heat, moisture, and chemicals * Applications in house wiring: * Lighting circuits * Power circuits * Earthing systems * Standards and safety requirements for house wiring   **Methodology:** Slide Presentation supported by images of PVC cables in use  **5. Conclusion and Q&A (10 minutes)**  **Objective:** Recap key points and address participant questions  **Content:**   * Summary of the role of BIS standards * Open floor for participant questions and clarifications   **Methodology:** Facilitator-led summary and interactive Q&A session. | **Expected Outcomes:**   * Understanding the key provisions of current regulatory framework on Low Voltage Cables. * Understanding of BIS standard on Low Voltage Cables.   **Follow-up Resources:**   * Access to relevant sections of the CEA Regulations and Cables Quality Control Order, 2003 * Access to relevant BIS documents and standards. |
| Session 2 | **Session Title:**  Conduits for Electrical Cables, and Switch Boards  **Duration:**  1.5 hrs | **Objective: “**To provide participants comprehensive understanding of the present regulatory framework, key challenges, Indian standards, solutions provided by standards and technology upgrades on Conduits for Electrical Installations and Distribution Boards  ” | **Session Breakdown**  **1. The Present Regulatory Framework On Conduits(**10 minutes)   * **Objective**: To introduce the current regulatory framework governing Conduits for electrical Installation. * **Content**: National Electric Code of India and the expected Quality Control Order by the government. * **Methodology**: Short presentation giving details.   **2. Key challenges and Associated safety concerns related to conduits (**15 minutes)   * **Objective:** To identify key challenges and safety concerns associated with conduits and its installation in household and commercial applications. * **Content**: Common challenges:Proper sizing and selection, Installation, selection of conduit material, weather and environmental factor etc. * **Methodology**: Short presentation on key challenges and the associated safety concerns.   **3: Indian Standards on Conduits for Electrical Installations and addressing the challenges** (25 minutes)   * **Objective**: Familiarize with Indian standards on conduits for electrical Installations, key specified benchmarks ensuring safety and performance and how standards address the key challenges. * **Content**: Key benchmarks specified by Indian Standards for ensuring proper selection, safety, quality, and performance of Conduits. Standardized dimensions, electrical safety, mechanical strength and performance benchmarks and how they address the key challenges. Impacts of using Non standardized products. * **Methodology**: Technical discussion listing out various quality benchmarks specified in the standards and their significance to address various concerns   **4: Technology upgrades in the conduit sector** (10 minutes)   * **Objective**: Brief overview of the new technological advancements * **Content**: Listing new innovations/technological upgrades in the conduit sector viz-a-viz conventional products * **Methodology**: Brief presentation.   **5. Indian Standards on Distribution Boards** intended to be operated by ordinary persons ( dbo )(15 Minutes)   * **Objective:** Brief overview of the Indian Standard on Distribution Boards * **Content**: Applicability and scope of the standard, important characteristics specified in Indian standard. * **Methodology**: Presentation on the important technical details   6. **Key Challenges associated with distribution Boards and role of standards**(15 Minutes)   * **Objective:** Listing ofKey Challenges associated with distribution Boards and role of standards in overcoming the challenges. * **Content**: Key challenges: electrical safety, load balancing, compatibility issues and role of standards in overcoming key challenges by ensuring electrical protection, short-circuit withstand, electromagnetic compatibility, durability etc. * **Methodology**: Technical discussion listing out various quality benchmarks specified in the standards and their significance to address various concerns | **Expected Outcomes:**   * Comprehensive understanding of the Indian Standards on Conduits for electrical installation and distribution boards and the government regulations in the field. * Knowledge of Key Benchmarks specified by Indian standards and how they address the challenges. * Awareness on technological advancement in the sector   **Follow-up Resources:**   * Access to relevant BIS documents and standards.   Contact information for further queries or guidance. |
| Session 3 | **Session Title:**  Plugs and Socket outlets for Household and Similar Purposes  **Duration:**  1.5 hrs | **Objective: “**To provide participants comprehensive understanding of the present regulatory framework, key challenges, Indian standards, Solutions provided by standards and technology upgrades on plugs and socket outlets” | **Session Breakdown**  **1. The Present Regulatory Framework (**15 minutes)   * **Objective**: To introduce the current regulatory framework governing plugs and socket outlets, focusing on BIS standards and quality control mandates. * **Content**: Key gazette notifications by the government: Plugs and Socket-Outlets (Quality Control) Order, 2019, Electrical Accessories (Quality Control) Order 2023 * **Methodology**: Short presentation giving details.   **2. Key challenges and Associated safety concerns (**15 minutes)   * **Objective:** To identify common challenges associated with plugs and socket outlets and the safety risks. * **Content**: Common challenges:Improper Installations practices, Limited awareness, overuse of Adapters and Extension Cords, ageing infrastructure etc. * **Methodology**: Presentation on key Challenges and overall impacts if the challenges remain unaddressed.   **3: Indian Standards on Plugs and Socket Outlets, specified Benchmarks and** **addressing the challenges** (30 minutes)   * **Objective**: Familiarize with Indian standards on Plugs and socket Outlets and key specified benchmarks ensuring Safety and performance. * **Content**: Key benchmarks specified by Indian Standards for ensuring proper selection, safety, quality, and performance of Plugs and Socket outlets. Standardized dimensions, electrical and mechanical safety, construction, and performance benchmarks and how they address the key challenges. * **Methodology**: Technical discussion listing out various quality benchmarks specified in the standards and their significance to address various concerns   **4: Impacts of using non standardized accessories** (15 minutes)   * **Objective**: Understanding the overall impacts of using non-standardized plugs and socket outlets. * **Content**: Detailed discussion on the short term and long term impacts of using non-standardized products with respect to associated electrical risk and overall safety in long run * **Methodology**: Brief presentation and technical discussion.   **5: Technology upgrades in the sector** (15 minutes)   * **Objective**: Brief overview of the new technological advancements * **Content**: Listing new innovations/technological upgrades viz-a-viz conventional plugs and socket outlets.   **Methodology**: Brief presentation. | **Expected Outcomes:**   * Comprehensive understanding of the Indian Standards on plugs and socket outlets and the government regulations in the field. * Knowledge of Key Benchmarks specified by Indian standards and how they address the challenges. * Awareness on technological advancement in the sector   **Follow-up Resources:**   * Access to relevant BIS documents and standards.   Contact information for further queries or guidance. |
| **SESSION 4** | **Session Title**  Protective Devices for Low Voltage - Fuses, MCBs and RCCBs  **Duration:**  1.5 Hours | **Objective**  The session aims to enhance understanding of electrical safety standards, focusing on key protective devices like MCBs, RCCBs, RCBOs, and fuses. It will cover their functionality, classifications, and compliance with standards such as IS 12640 (Part 1), IS 12640 (Part 2) and IS/IEC 60269-1, using interactive presentations and discussions to promote knowledge of safety measures, regulations, and advancements in protective technologies. | **Session Breakdown**  **1. Introduction to Electrical Safety Standards (15 minutes)**   * **Objective**: Critical importance of electrical safety and the transformative role of standards in safeguarding lives and property. * **Content**:   + Key Issues with Household Safety   + Common electrical hazards in households   + Benefits of adhering to safety standards.   + Regulatory framework for RCDs, MCBs, and fuses. * **Methodology**: * Interactive presentation with explanation of household electrical hazards, safety standards, and regulations for RCDs, MCBs, and fuses.   **2 Miniature Circuit Breakers (MCBs) (20 minutes)**   * **Objective**: Understand the functionality, classification, and practical applications of MCBs. **Content**:   + Primary functions.   + Key characteristics (overload and short circuit protection).   + Main Classification   + Time-current characteristic   + Selection criteria and typical use cases. * **Methodology**:   + Interactive presentation highlighting classification, functions, characteristics and selection criteria of MCB.   **3.**  **Exploring Residual Current Devices (RCCBs and RCBOs) (30 minutes)**   * **Objective: F**unctionality, applications and advancement in RCCBs and RCBOs technology. * **Content:**   + Indian Standards   IS 12640 (Part 1)  IS 12640 (Part 2)   * + Major Classifications of RCCB   + Differences between RCCB and RCBO.   + Important Tests to ensure proper functionality   + Present Scenarios and Key Advancements in RCCB and RCBO Technology * **Methodology:**   + Provide a brief overview of RCCBs and RCBOs importance in preventing electric shocks and fire hazards.   + Interactive presentation highlighting primary role of RCCBs and RCBOs in electrical safety and importance in preventing electric shocks and fire hazards   **4. Fuse Technology (25 minutes)**   * **Objective:** Understand the principles, advantages, and limitations of fuses. * **Content:**   + Advantages and limitations of Fuses   + Overview of IS/IEC 60269-1   + Utilization Categories of Fuses   + Other important standards related to Fuses   + Coordination with other protective devices. * **Methodology:** * Interactive presentation highlighting advantages and limitations of fuses, key aspects of Indian standards and their various categories | **Expected Outcomes:**   * Understanding of importance of electrical safety and the role of standards in preventing hazards. * knowledge of the functionality, classifications, and applications of MCBs, RCCBs, RCBOs, and fuses. * Awareness of the regulatory framework and advancements in protective device technologies.   **Follow-up Resources:**   * Access to relevant standards. * Contact information for further queries or guidance. |