

Author(s)	Charalambos A. Charalambous and Christos Melios
Affiliation(s)	PSM Lab EMI, Earthing and Corrosion, Department of ECE, University of Cyprus
Presenting Author	Charalambos A. Charalambous
Title of Presentation	Challenges in designing and assessing the sheath bonding configurations of complex power cable installations serving large-scale PV energy communities located in rural or open areas
Oral or Poster Presentation?	Oral

Summary:

Rural PV (Photovoltaic) energy communities, often referred to as rural solar communities or rural solar energy projects, are collaborative initiatives in which solar photovoltaic technology is harnessed to generate clean and renewable energy in rural or remote areas. These communities typically involve the installation of PV parks in rural settings to provide electricity to local residents, businesses, or agricultural operations. However, building PV energy communities comes with its own set of challenges and considerations. These challenges can vary depending on the location, scale, and specific circumstances of the project. A significant challenge associated with establishing field-based PV energy communities lies with grid connection. This is because, connecting a field-based PV energy community to the electrical grid may require substantial investments in grid infrastructure, including transformers, substations, and power lines. Moreover, ongoing maintenance and operation of a large-scale PV energy community require skilled personnel and a robust maintenance plan. Managing equipment performance, addressing faults, and ensuring long-term reliability are crucial.

This presentation will specifically elaborate challenges in installing underground power cables to connect field-based PV energy communities to the electrical grid infrastructure. This endeavour presents a unique set of challenges due to the remote and often challenging environments in which these projects are undertaken. The main emphasis of the presentation would be to highlight that deciding on the metallic sheath or shield-bonding method for underground cables in field-based PV energy communities can be a complex process. It is important to note at this point, that the sheath bonding method used in underground cables can influence their thermal rating and cable temperature; thus affecting the cable's ability to dissipate heat and manage thermal stress. More explicitly, proper sheath bonding is critical to maintaining the cable's thermal performance and preventing overheating, which can lead to insulation degradation or even cable failure. Deciding which sheath bonding method is more appropriate, involves a systematic evaluation of various factors, including cable type, installation environment and trenches' size, earthing grid designs of each individual PV park, regulatory requirements, and other project-specific considerations.

Moreover, addressing ground fault conditions in cable installations presents further challenges related to sheath bonding configurations. A ground fault occurs when one of the conductors (typically a phase conductor) becomes unintentionally grounded, potentially causing imbalances in the electrical system and posing safety risks. Proper sheath bonding is essential to mitigate these challenges, but it may also introduce complexities and conflicting requirements. This is because; sheath bonding serves different purposes under normal operating conditions and fault conditions. Under normal conditions, it ensures electrical continuity, conductor temperature control and safe sheath voltages, while during fault conditions; it provides a safe path for fault currents to dissipate. Neglecting proper sheath bonding can lead to safety hazards, equipment damage, and disruptions in the electrical system. Therefore, it's crucial to design and maintain sheath bonding systems that are suitable for both normal and fault conditions to ensure the overall reliability and safety of underground cable systems.

Finally, in the course of this presentation, we will substantiate our methods and concepts by drawing upon real-life applications. These practical examples will serve to illustrate the relevance and applicability of our step-by-step procedures to tangible scenarios (e.g. Figures 1 and 2), thereby enhancing the comprehensibility and practical value of our approach in making an informed decision on the metallic sheath bonding method for underground cables in field-based PV energy communities.

