

Concept Paper

Capacity Building on “Advance & Innovative Transmission System Design and Optimization: Professionals from Bhutan”

1. Introduction

Advanced and Innovative Transmission System Design & Optimization, involves utilizing cutting-edge technologies and strategies to improve the efficiency, reliability, and sustainability of power transmission networks. This approach combines advanced engineering methods, digital tools, and optimization techniques to reduce energy losses, enhance grid stability, and enable seamless integration of renewable energy sources. By implementing innovative design principles and smart automation, these systems can meet the growing energy demands while minimizing environmental impact and ensuring resilient power delivery.

In this context, upon request of Member State Bhutan, SAARC Energy Center is organizing three days training workshop on Advanced and Innovative Transmission System Design & Optimization for Professionals in Bhutan. The workshop will cover cutting-edge strategies and emerging technologies for efficient transmission system design, focusing on optimization techniques that can improve network reliability, resilience, and performance. Through a combination of theoretical sessions and practical applications, participants will gain insights into modern engineering approaches that will enable the professionals effectively address the prevailing challenges and effectively manage Bhutan's electricity grids. Emphasis will be placed on innovative design solutions, digital tools, and sustainable practices that support Bhutan's commitment to reliable and sustainable energy infrastructure.

2. Objective

The objective of this workshop is to enhance the understanding of Bhutanese power sector professionals on the principles and practices of advanced transmission system planning and design, including high-voltage AC and DC transmission technologies and grid integration of variable renewable energy sources. This training will help the participants to use state-of-the-art software tools, simulation platforms, and algorithmic techniques used for transmission systems planning, network stability assessment, congestion management, and cost optimization in modern electricity transmission systems.

3. Proposed minimum content of training workshop

1. Understanding Power Transmission Systems

Gain foundational knowledge of AC/DC transmission networks, voltage levels, grid structures, load flow basics, and system reliability planning.

2. Planning and Designing Transmission Networks

Learn key approaches to planning, routing, and designing transmission lines and substations using simulation tools and security analysis methods.

- Key methodologies for short-, medium-, and long-term planning
- Technical and economic considerations in line routing and substation siting
- Introduction and computer simulation practice on power system design and modeling tools (e.g., PSS®E, PSCAD, DigSILENT PowerFactory, EMTDC, ETAP etc.)
- Assessment of grid security using N-1 contingency analysis

3. Exploring Advanced Technologies in Transmission

Understand the role of FACTS, HVDC systems, WAMS, synchrophasors, and digital substations in modern grid systems.

4. Integrating Renewable Energy into the Grid

Explore technical solutions and standards for integrating solar, wind, and hybrid systems while managing variability and curtailment.

5. Optimizing Transmission System Performance

Learn methods for economic dispatch, loss reduction, congestion management, and application of AI and digital tools for system optimization.

6. Navigating Regulatory and Market Frameworks

Understand transmission pricing, open access, investment incentives, and regulatory practices from regional and global perspectives.

4. Time and Venue

This training workshop will be conducted in Thimpu, Bhutan from 14th-16th October, 2025.