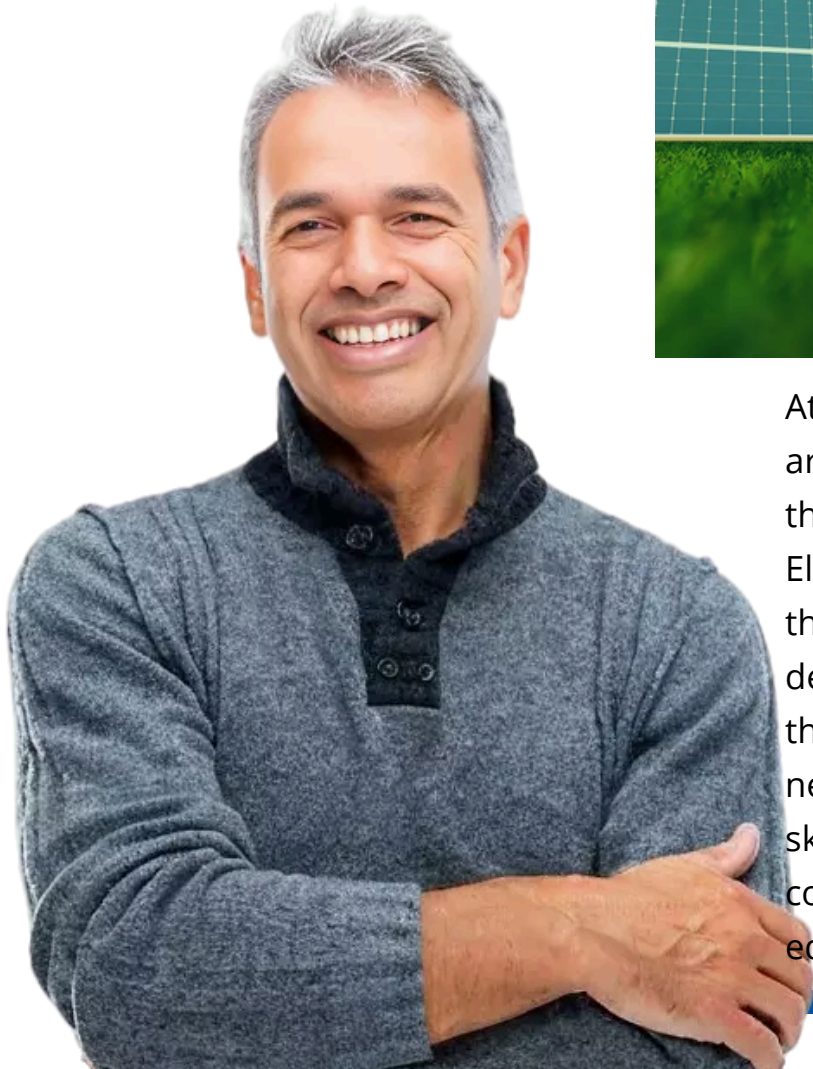




# ENGINEERS' CERTIFICATION PROGRAM

*Engineering Skills*



# BATTERY ENERGY STORAGE SYSTEM (BESS) DESIGN




At Electrical Learning Portal (ELP), we are dedicated to shaping the future of the electrical and MEP (Mechanical, Electrical, and Plumbing) industries through professional training and development. Our mission is to bridge the gap between the ever-evolving needs of employers and the dynamic skill set of engineers by providing comprehensive, industry-relevant education and training.

***Degree + Skills = Career Growth***

## CONTACT US

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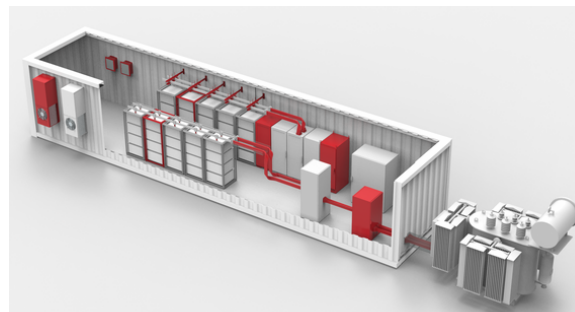
# BATTERY ENERGY STORAGE SYSTEM (BESS) | LIVE

Welcome to the Electrical Learning Portal (ELP), a premier online institute! Our course on Battery Energy Storage Systems sets itself apart from other energy technologies with its extensive market reach and diverse revenue opportunities. This training program delivers a thorough and business-focused analysis of these opportunities, empowering participants to analyze and comprehend the complexities of this dynamic field.

While the primary focus is on Battery Energy Storage, our course also delves into various competing storage technologies. It provides insights into the wide array of challenges that energy storage addresses, spanning different deployment sizes and timescales, with a special emphasis on practical project delivery considerations.

Immerse yourself in the transition to a sustainable energy system and a low-emission society with our Battery Energy Storage System course. Discover the pivotal role batteries play in this transformative journey. Participants will gain valuable insights into the implications of electrification for key sectors such as mobility, industry, and the electricity system. Explore new business models that open up exciting opportunities and develop a comprehensive understanding of the entire battery energy storage value chain.

Tailored for grid-connected photovoltaic system designers aspiring to enhance their skills, the "Battery Storage Systems for Grid-Connected PV Systems" course focuses on the integration of battery storage systems. Join us and stay ahead in the dynamic field of energy storage technology!



# TOPICS

## 1. Intro and Electrical System Analysis

- Engineering Planning of storage system
- Identification of type of load pattern (Continuous, intermittent, or backup)
- Identifications of existing electrical network and system information
- Understanding of on-grid and Off-grid sol. based on different applications
- Calculation of on-grid / off-grid load.
- Use of on-grid and Off-grid sol. based on different applications
- Power System studies related to BESS.
- Electrical load and energy consumption calculation

## 2. Scheme Of Battery Energy Storage System

- Solar-plus- battery storage system architectures
- AC & DC Coupled BESS
- Selection of AC coupled BESS system
- Selection of DC coupled BESS system
- AC Coupled V/S DC Coupled BESS
- Summary of AC coupled and DC coupled system

## 3. Battery Sizing And Selection

- Type of batteries and their selection (Li-ion, Ni-cd, lead acid, etc.)
- Selection of battery cell and types
- Standardized sizes and shapes of both primary and secondary batteries
- Key technical parameters in selection of Battery (Voltage, DOD, C-Rate, SOC, SOH, Energy density, BOL, EOL, Lifecyle etc)
- Key Technical parameters in selection of BESS applications (Grid ancillary services & other application
- Battery series-parallel connection (For capacity estimation).
- Selection of AC coupled BESS system
- Battery backup hours and rating selection
- Battery Mounting arrangement and installation methodology in the containerized solution

- Technical offer review & comparison for BESS solution
- Pre-order finalization review points and post order Vendor Drawing review details for BESS

## 4. Selection & Sizing Of Grid Tied Solar Inverter or Hybrid PCS (Inverter)

- Selection & sizing of Grid-Tie or Hybrid PCS (Inverter)
- Working principle of Bi-directional Inverter
- Selection & sizing of AC rating of PCS (Inverter)
- Key Technical parameters in selection of PCS (Inverter) – (Inverter efficiency, DC nominal voltage, DC operating voltage, DC protection, AC protection, grid support & ancillary services, general information etc.)
- BMS (Battery Management System)
- EMS (Energy Management System) or PPC (Power Plant Controller) system
- Technical offer review & comparison for BESS-PCS solution
- Pre-order finalization review points and post-order Vendor Drawing review details for BESS-PCS

## 5. Selection & Sizing Of Balance System For BESS

- Understanding of BESS Containerized solution
- Understanding of BESS Container Cooling and Ventilation arrangement
- Understanding of BESS Fire detection & prevention arrangement
- Selection & Sizing of DC cables between ESS & PCS (Inverter)
- Selection & Sizing of AC cables between PCS (Inverter) & IDT (OR LV-ACDB Panel)
- Selection & Sizing of IDT (Inverter Duty Transformer)
- Understanding of ACDB, DCDB & MV-Switchgear
- Understanding of EHV substation in Utility scale BESS project
- Understanding of Earthing Design & Basic Details
- Understanding of AC (MV or EHV) protection details



## 6. Case Study – ENGINEERING DRAWINGS & LAYOUTS

- *Single Line Diagram for BESS AC & DC*
- *Preparation of site layout with BESS containerized solution and MV skid solution*
- *Typical Cable routing layout for utility scale BESS*
- *Typical Earthing layout for utility scale BESS*

## 7. Energy Storage System (ESS) & BESS Capabilities

- *Need to Energy Storage System and its various types*
- *Renewable Energy & Grid Integration Issues*
- *Basic understanding of Grid, Utility, End-user (customer) & Smart Grids*
- *Electrical Energy time-shifting and load followings*
- *Renewable Energy time-shifting & capacity firming*
- *Grid Ancillary Services (Frequency Response, Reactive Power Control, Voltage Management, Inertia, Power Reserves, Black Start services etc)*
- *RTE - Round Trip Efficiency*
- *Lifetime and Cycling*
- *Response Time of BESS*

## 8. BESS & Other Energy Storage Technologies

- *Various types of Energy Storage System (Battery, Thermal, Flywheel, Pumped-Hydro, Green Hydrogen etc)*
- *Advantage of BESS over other storage technologies*
- *BESS overall footprints and any restriction with geographical locations*
- *Evaluating the Investment cost in building the Utility scale BESS plant*
- *Calculating the revenue generated by the Utility scale BESS plant*

## 9. System Modeling using ETAP

## 10. ETAP Studies

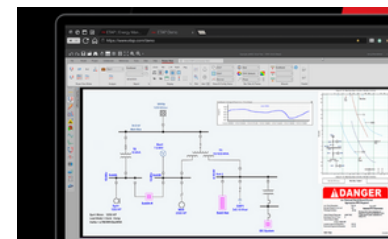
- *Load Flow Analysis*
- *Short Circuit Analysis*
- *Relay Coordination*
- *Harmonics*
- *Earthing report for the BESS plot area*

## 9. Q&A session

## 10. Final Assignment

### Benefits of the program

1. *Join the professional training*
2. *Understand the real world*
3. *Be a part of the Professional Engineers' Community*
4. **Program Completion Certificates**
5. **Join our engineers' WhatsApp Groups**



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