Wind Turbine Technology
Not long ago, wind power generation seemed an economically unattainable utopian goal. Today, much of the world is embracing this technology, with wind farms becoming more and more prevalent. As a result, there is a high demand for Wind Turbine Technicians, and while new programs about wind power technology are flourishing in colleges and universities worldwide, the need for hands-on training systems in this technology is acute.

To answer this need, Lab-Volt Systems, Inc. is proud to lead the way in offering hands-on training programs in Wind Power Technology. With over 50 years of dedicated Electrical and Mechanical training systems development, Lab-Volt continues to be at the forefront of safe, highly-regarded learning environments and the first choice for teachers and departments who want the best programs for their students.

**REAL-WORLD COMPREHENSIVE TRAINING FOR WIND TURBINE TECHNICIANS**

The growing demand for wind energy has resulted in the rapid growth of hiring in this industry and the need for Wind Turbine Technicians is acute. Wind Turbine Technicians handle the maintenance and repair of wind turbines. Wind turbine technicians must be agile and safety-conscious. The work is demanding and requires a thorough knowledge of hydraulics, mechanical devices, electric power generation, worksite safety, electricity, and electronics, with many of the job responsibilities taking place 300 feet (91.44 meters) above the ground.

Lab-Volt’s Wind Turbine Technology program offers comprehensive coverage in all of these areas, as well as cross-technology troubleshooting and problem-solving, preparing students for jobs in the wind power energy industry. Lab-Volt’s program also incorporates hands-on training using real-world equipment and comprehensive simulation software covering wind farms and grid-tied systems.
WIND TURBINE TECHNICIAN SKILLS COVERAGE

- Energy Fundamentals
- Mechanical Systems
- Hydraulics
- Electrical Fundamentals
- Programmable Logic Controllers (PLC)
- AC/DC Motors and Drives
- DC Power Electronics

- DC Power Circuits
- Electric Power Transmission, Generation, and Distribution
- Computer-Assisted Wind Power Technology
- Power Electronics
- Rigging Systems
- Safety
For over 50 years, Lab-Volt has been the consistent leader in hands-on technical training and technical skill development. Relying on decades of satisfied users, as well as feedback from the power utility industry, wind power companies, and professional educators, Lab-Volt has developed hands-on training that fits the needs of the emerging wind power energy and turbine technology programs and is designed to meet a variety of training objectives.

Lab-Volt’s unparalleled computer-based fault insertion capabilities allow instructors to set faults, requiring students to locate, isolate, and troubleshoot malfunctions through a series of troubleshooting steps, enabling students to understand and safely operate industrial-type equipment, while developing troubleshooting and problem-solving skills that will help prepare them for on-the-job challenges.

Student tracking and management is key to providing an effective and successful learning environment. Lab-Volt’s Mind-Sight program is a seamless integration of course delivery and classroom management. Designed around the most up-to-date programming standards, Mind-Sight facilitates Lab-Volt’s Wind Turbine Technology curriculum. Instructors can use Mind-Sight to manage student enrollment, schedule learning activities, customize courseware and track student achievement as they work through the modules. Currently, Mind-Sight is a LAN-based solution to deliver curriculum locally, however, it will ultimately be a web-based solution so that students can log on and study from anywhere at any time!

- SCORM-Compliant Courseware
- Flexible Scheduling Options
- Easy Grade Viewing
- Real-Time Data Collection
- Simple Report Generation
- Competency Testing
- Manual Skill Assessment
WIND TURBINE SYSTEMS

Wind Turbine Hub Training Systems
Lab-Volt offers two Wind Turbine Hub Training Systems: an Electrical Pitch Control Trainer and a Hydraulic Pitch Control Trainer.
Each Hub Trainer addresses blade pitch control and emergency back-up systems using the appropriate technologies typical to their respective electrical or hydraulic pitch control systems. The systems include PLC controls and control software coupled to a single turbine blade system, modestly scaled down from an industry standard mechanical system.

Topic Coverage
• Introduction to the Trainer
• Hub Mechanical
• Electrical
• Electrical Control (Electrical Pitch Control System Only)

Wind Turbine Nacelle Training System

The Nacelle trainer covers the major systems found in a modern wind turbine. The drive train is featured along with nacelle lighting, a yaw system, braking systems, hub electrical feed, system cooling, and automated control.
The trainer features modestly scaled down working versions of standard wind industry components allowing for true-to-life analysis, replacement, and repair training.

Topic Coverage
• Introduction to the Trainer
• Mechanical Systems
• Computer Control
• Power Generation
• Reading Electrical Schematics
• Equipment Inspection
• System Troubleshooting

Products shown are subject to change.
The Solar/Wind Energy Trainer forms a complete hybrid energy training system. This program demonstrates how wind turbines and solar cells are being used in the consumer and industrial markets to supplement the world’s power needs.

The program explores solar and wind as energy sources that can be used to help reduce dependence on non-renewable fuel sources. Students gain a global perspective when they understand the economics, efficiency, and low environmental impact of producing energy from non-polluting, renewable sources.

**Topic Coverage**
- Energy Fundamentals
- Trainer Familiarization and Safety
- Solar Module
- Wind Turbine
- Solar/Wind Systems
- Going Green

**Grid-Tied Systems Simulation Software, Model 46120-A0**
Lab-Volt’s Grid-Tied Systems, an add-on to the Solar/Wind Energy Training System, Model 46120, uses computer software to simulate the installation and operation of a utility-interactive photovoltaic (PV) solar energy system in a residential home. The software is comprised of an Electrical Wiring Simulator and a Home Energy Simulator and includes Student and Instructor Manuals.

**Topic Coverage**
- Grid Connected Equipment
- Utility-Interactive Software
- The NEC
The Lab-Volt Mechanical Training System, Model 46101, covers the installation, use, maintenance, and troubleshooting of mechanical drive components.

The list of industrial components includes pulleys, sprockets, gears, various types of belts, single- and multi-strand chains, several types of couplings, shafts, bearings, ball screws, clutches and brakes, and all the components required to assemble the proposed set-ups.

**Topic Coverage**
- Belt Drives
- Chain Drives
- Gear Drives
- Lubrication
- Couplings
- Shaft Alignment
- Bearings

The Lab-Volt Industrial Controls Training System has unique controls training capabilities, which are enhanced by its modularity and its instructor-inserted faults.

The system allows students to select and mount control devices to form typical control circuits, and to troubleshoot them once a fault is inserted.

**Topic Coverage**
- Electric Motor Control
- Circuit Layout and Specifications
- Basic Control Circuit
- Jogging Control Circuits
- Reduced AC Voltage Starters

- Controls with Electronic Devices
- AC & DC Drive Controls
- PLCs
- Troubleshooting

- Linear Bearings
- Ball Screws
- Gaskets and Seals
- Clutches and Brakes
- Laser Alignment
- Vibration Analysis
WIND TURBINE TRAINING SYSTEMS

Rigging Training System, Model 46109

The Lab-Volt Rigging System was created to cover the fundamentals of rigging practices, including techniques to help students move and install machines safely.

The mobile beam-style gantry is designed to conform to OSHA and CMAA standards. This heavy-duty, steel crane has polyurethane swivel casters with roller bearings, and pivoting support legs for easy maneuvering in tight places.

**Topic Coverage**
- Ropes and Slings
- Wedge Sockets
- Dollies and Roller Pipes
- Cranes and Hoists
- Machine Installation
- Machine Movement
- Lifting Objects and Unbalanced Loads

Industrial Wiring Training System, Model 46102

The Lab-Volt Industrial Wiring Training System, Model 46102 faithfully reproduces an industrial environment where students can develop their skills in the installation and wiring of industrial electrical equipment, in compliance with the National Electrical Code® (NEC®).

The system can also be used to teach trainees how to adjust and maintain industrial electrical equipment as well as enforce the safety rules to be followed when working at industrial sites.

**Topic Coverage**
- Enclosures and Conduits
- Electrical Power Distribution
- Electrical Wiring
- Three-Phase Motor Starters
- AC Motor Drive
- DC Motor Drive
Lab-Volt offers the most comprehensive and flexible Hydraulics course available. Using the Hydraulics Training Systems, students gain a solid foundation in, and hands-on experience with, hydraulic components and circuits, the principles and concepts underlying hydraulic systems and applications, and methods of troubleshooting and testing hydraulic systems.

Each lesson builds upon previous lessons, making this an ideal job-training program.

**Topic Coverage**
- Pressure and Force
- Flow Rate and Velocity
- Work and Power
- Cylinders
- Circuits and Valves
- Troubleshooting

Lab-Volt’s Programmable Logic Controller (PLC) trainers enable students to develop competence in operating, programming, and troubleshooting modern PLC-controlled circuits found in wind turbine and other industrial applications.

**PROGRAMMABLE LOGIC CONTROLLERS**

*Model 3240-30*
- Familiarization with the PLC Trainer and with the RSLogix 500 PLC Programming Software
- Programming Basics
- Online Operations
- Latching Instructions
- Timer Instructions

*Model 3240-B0*
- Counter Instructions
- Sequencer Instructions
- Comparison Instructions
- Shift Register Instructions/The Force Function

Other PLCs and PLC applications are also available. Please see our PLC Guide for more information.
WIND TURBINE ELECTROMECHANICAL SYSTEMS

Renewable Energy Basic Training System

This foundational training system introduces students to both wind power and solar power, two popular sources of renewable energy with zero greenhouse gas (GHG) emissions, and requires only a basic knowledge of electricity principles. This course also introduces lead-acid batteries which are used to store electrical energy produced from wind power or solar power. The Wind Turbine Generator/Controller (Model 8216-0), allows students to study Wind Turbine operation and small scale production of electrical energy.

0.2-kW Electromechanical Training System, Model 8001/8006/LVSIM/DACI/LVDAC-EMS

The Lab-Volt 0.2-kW Electromechanical Training System, deals with the different techniques associated with the generation and use of electrical energy. All machines have cutaway bell housings to permit visual inspection of the internal construction and observation of the machine during operation. LVSIM®-EMS is a virtual classroom laboratory in which students can install an EMS training system, set up equipment, and perform exercises, just as if actual EMS equipment were being used. Data Acquisition and Control interface (DACI) is a versatile USB peripheral used for measuring, observing, analyzing, and controlling electrical and mechanical parameters in electric power systems and power electronics circuits. These instruments and control functions are accessed through the Lab-Volt Data Acquisition and Control for Electromechanical Systems (LVDAC-EMS) software.

Program Coverage

- DC Power Circuits
- Lead-Acid Batteries
- Solar Power
- Wind Power
- Ni-MH Batteries
- DC Power Electronics: Diodes, IGBTs, and Choppers
- Battery Chargers and Small Electric Vehicles

Topic Coverage

- Investigations in Electric Power Technology
- Power Circuits
- DC Machines
- Single-Phase Transformers and AC Machines
- Three-Phase Transformers and AC Machines
WIND TURBINE ELECTROMECHANICAL SYSTEMS

Computer-Assisted 0.2-kW Wind Power Technology Training System, Model 8052

The Lab-Volt Computer-Assisted 0.2-kW Wind Power Technology Training System covers electrical basics, from Ohm’s law and complex impedance through single- and three-phase transformers, typical wind power asynchronous generator principles, and synchronization, as well as doubly-fed induction generators and the associated power electronic converters.

**Topic Coverage: 8052-00**

- Fundamentals for Electrical Power Technology
- Alternating Current
- Capacitors in AC Circuits
- Inductors in AC Circuits
- Power, Phasors, and Impedance in AC Circuits
- Three-Phase Circuits
- Single-Phase Transformers
- Special Transformer Connections
- Three-Phase Transformer

SIMULATION SOFTWARE AND ONLINE PROGRAMS

Wind Farm Simulation Software

The Wind Farm Simulation Software is a software-only solution: no special hardware is required, only a PC with adequate performance capabilities. The HMI is designed to be user-friendly and intuitive, presenting every parameter as well as the values of the signals, both internal to the wind turbine and published to the SCADA system.

**Topic Coverage**

- Wind Turbine Block Diagram
- Structure of the Simulator
- Initial Start-Up
- Simulators used in the Program

ITZ Renewable Energy Online Training Program, Model 47919

The course begins with electrical systems and AC/DC Motors and Drives. Students then advance to the functions and interactions of mechanical and fluid power systems, and end the course with a comprehensive understanding of the methodology of renewable energy systems.

**Topic Coverage**

- Safety
- Mobile Hydraulics
- Mobile Electrical
- PLC Fundamentals
- AC/DC Motors and Drives
- Mechanical