

# SMARTGRID RENEWABLE TRAINING SYSTEM



## FEATURES

- Smartgrid Renewable Training System helps understanding the complex interactions between renewable energies, energy stores and consumers in a Smart Grid in vocational and technical education.
- With setting-up smart grids on a laboratory scale and its measurement and control, students will learn the electro-technical challenges of mains operations very demonstratively.
- Pre-set or user-created scenarios let the students gradually develop their knowledge with their own experiments.
- The influence of renewable energies on grid stability is one major advantage of this product.
- The students at first experience the problem within an experiment to develop approaches for increasing grid stability on their own. At the end they will verify them in practical experiments.
- Even complex concepts such as demand-side-management or conductor rope monitoring can be addressed in experiments.
- The basis for most of the experiments is the innovative Smartmeter allowing measurement and control of the energy fluxes in the experiments.
- The experiment components for renewable energies such as Wind and Photovoltaics as well as energy stores such as lithium-iron-phosphate batteries or fuel cells allow a large variety of fundamental experiments besides the smart grid experiments.

## EXPERIMENTS

- **Smart Grid Experiments**
  - Daily power fluctuations of a photovoltaic (PV) power plant
  - Daily power fluctuations of a wind power plant
  - Energy supply of a building by conventional power plants
  - Energy supply of a building by conventional and PV power plants
  - Energy supply of a building by conventional and PV power plants with storage
  - Voltage behavior and grid stability in a radial distribution system
  - Grid stability with PV power plants
  - Grid stability with PV power plants depending on consumer load
  - Grid stability with PV power plants depending on wire length
  - Grid stability with PV power plants and smart transformer stations
  - Grid stability with PV power plants and storages
  - Grid integration of E-Mobility
  - Conductor rope management
  
- **Fundamental Experiments**
- **Photovoltaics**
  - Characteristics of solar panels
  - Characteristics depending on illumination
  - Characteristics depending on temperature
  - MPP-Tracking
  
- **Wind energy**
  - Turbine power dependent on blade shape and pitch angle
  - Turbine power dependent on number of blades
  - Turbine power dependent on wind direction
  
- **Fuel Cell and Electrolyzer**
  - Functionality of an electrolyzer
  - Characteristics of an electrolyzer
  - Functionality of a fuel cell
  - Characteristics of a fuel cell
  
- **Storage technologies**
  - Charge and discharge characteristics of a capacitor
  - Functionality and charge procedure of a LiFePo battery
  - Operation of fuel cells and electrolyzers

## COMPONENTS

- Base Unit Professional
- SmartMeter
- Wind turbine module Pro
- Solar module 5.22 V, 380 mA
- Wind machine
- Motor module Pro
- Base for solar panel
- Power Module
- Wind rotor set
- Light bulb module Pro
- Capacitor module Pro
- AV-Module
- Battery module holder 1xAAA Pro
- LiFePo-battery AAA
- Fuel cell holder Pro
- MPP-Tracker Pro
- Grid module Pro
- Diode module Pro
- Potentiometer module 110 Ohm Pro
- Illuminant 120W, 12°
- Lamp housing
- Safety short-circuit plug with mid socket
- SmartGrid Pro
- Safety test lead, 25cm, red
- Safety test lead, 25cm, black
- Safety test lead, 50cm, red
- Safety test lead, 50cm, black
- Propeller
- Reversible Fuel cell
- Azimuth angle scale
- SmartGrid Professional