

# EDUCATIONAL ACTIVITIES IN TECHNOLOGICAL EDUCATIONAL INSTITUTE OF CRETE RELATED TO STORAGE AND RENEWABLE ENERGY SOURCES(RES)



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### 1. Introduction

RES promotion requires educated personnel to tackle with the installation, measurements, studies and environmental assessment of RES in electricity grids. This is one of the aims of the Laboratory of Renewable Energy Engineering (LREE) of the Natural Resources & Environment Department of the Branch of Chania of the Technical Educational Institute (TEI) of Crete. LREE is responsible for providing combination of theoretic, simulation and laboratory training of young students who will act as an intermediate among senior experts and the public in the field of RES. More precisely, 3 courses training students into dimensioning, measurements and simulation of RES systems are available additionally to courses related to environmental management or energy economy also provided by RES staff. Having identified the strong relation of storage devices with RES, low cost laboratory equipment was bought or even developed by staff and former students of LREE in order to make students realize the strong relation between RES and storage.

### 2. Equipment available for educational activities

#### Simulating Electrification of small loads via PV/Battery system



**Students during the experiment with the autonomous PV**  
This experimental device consists of one portable monocrystalline 53W PV, also used for teaching students how to draw I-V curves of PVs, and a compact device consisting of I,V meters, one portable battery, also used for teaching students charge/discharge behaviour of batteries, one inverter and one transformer and some ohmic loads. The students apart from realizing what are the components for building an autonomous power system and the related sizing, take measurements in order to calculate and make reports of the energy flow in such a system depending on the weather conditions

#### Micro Scale Pump Hydro-equipment

This equipment is under construction, consisting of two water tanks of 1m<sup>3</sup> capacity each, constructed by a local factory. One is installed on the roof and the other on the basement of the Building, i.e. 20 m



The lower Tank and the infrastructures for pump storage

One 12V DC pump is placed on the base of the low storage tank and on its top a tiny hydro turbine is installed. This project is in its final completion as a Diploma thesis of one of the students supervised by members of LREE. After its completion, measurements of cycling efficiency of pumped storage can be taken as a laboratory exercise. Thus, the students can grasp the Pumped Hydro storage technology taught only in theory for the time being.

#### Fuel Cells

Since Hydrogen use starts getting more and more frequent, graduates should not only be aware but should be able to calculate some necessary parameters on how to exploit Hydrogen in combination with RES.



The Fuel-Cell electrolyser experimental device

Since Fuel Cell is one of the ways to exploit hydrogen, an experimental device, H-TEC, for combining water electrolysis and Fuel Cell is available. The students realize the fact that electrolysis can be one of the ways for exploiting excess electricity coming from RES.

They can calculate the required energy for electrolysing specific volume of water and how the Hydrogen that can be produced can be used for the Fuel Cell of 1.2.W of this device.

#### Autonomous power system

On the roof of the building one PV, 600W, and one wind turbine of 1kW have been installed.



The RES installations(PV and W/T) on the roof of the Lab



The sine-wave inverter and meters for the energy flow

Apart from the on-site installation and educational benefit, the PV production via a sine-wave inverter of 1.1kW is injected to the lab's grid. Thus, the students can be informed on the flow of current depending on weather conditions

The wind turbine is connected to batteries in order to form an autonomous power systems. There, more advanced experiments in managing autonomous power systems with RES in combination with LabView can be performed.



The autonomous microgrid of the Lab

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The EU Sustainable Energy Week 2010 is an event of the Sustainable Energy Europe Campaign.

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