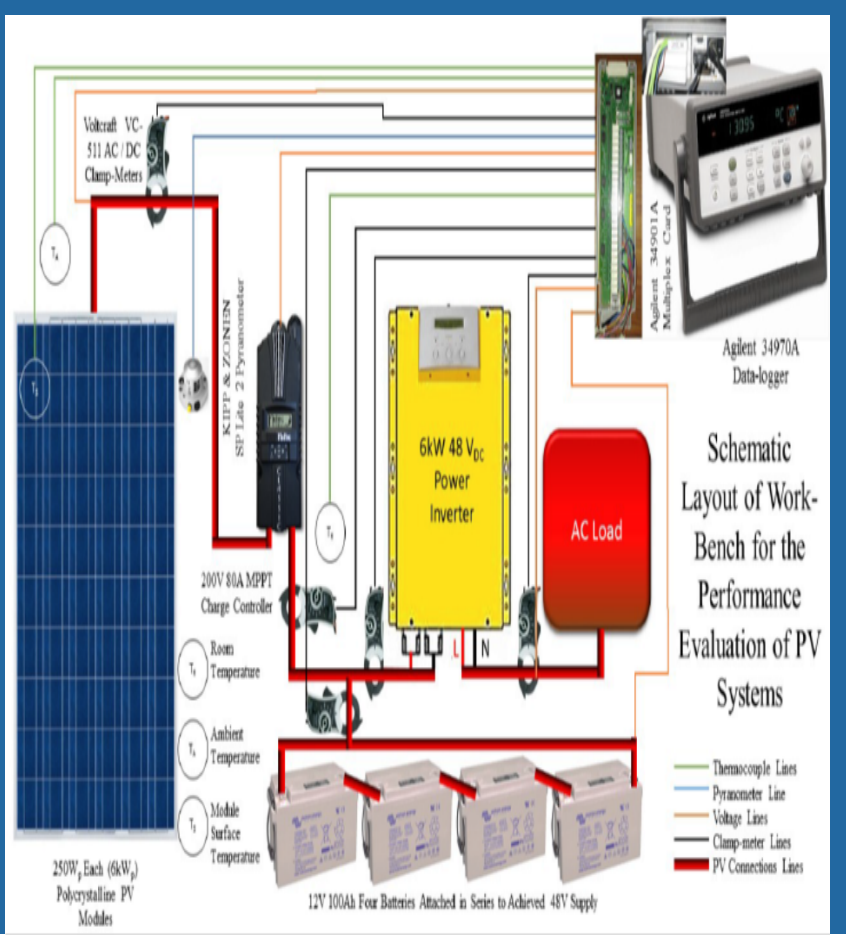
Photovoltaic Workbench for Real-Time Systems Evaluation



Anjum Munir[1], Hasnain Yousuf[2] and SaqlainYousuf[3]

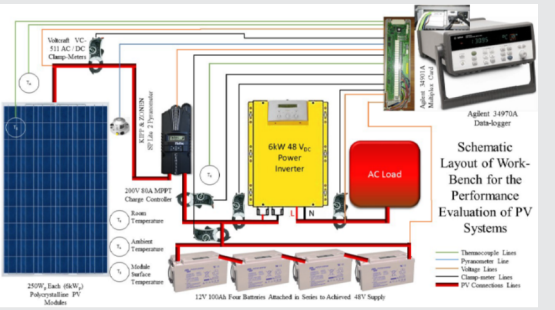
[1]Department of Energy Systems Engineering,
[2]Department of Farm Machinery and Power,
[3]Department of Physics,
University of Agriculture, Faisalabad

Electricity is a rudimentary need to perform our industrial, commercial, household and agricultural activities. In the rapidly growing economies, like Pakistan, the demand for electricity is constantly increasing. Increasing energy demand puts incredible pressure on the countries' energy infrastructur. Producing electricity from fossil fuel has, in recent years, increased its disadvantages due to cost, depletion of its resources and different types of emissions produced by the use of this source. An arousal wave has spread throughout the world to the need for a change of type of electricity production or need for rapid reduction in the use of fossil fuel. Additionally, the threat of global warming and climate change as a result of CO_2 emissions has forced scientists and technologists to become interested in the renewable energy. Within the context of renewable energies, photovoltaics (PV) is one of the technologies with the greatest future projection. Its numerous advantages, such as simple installation, high reliability, zero fuel costs, very low maintenance costs, and the lack of noise due to the absence of moving parts, have resulted in a high growth rate. Since 2010, the world has added more solar photovoltaic capacity than in the previous four decades.

Need for the workbench

At present, PV technology is growing and spreading worldwide at a reasonable pace and hence is becoming cost competitive. That is why, it is getting cheaper day by day and approaching within the purchasing range of a common user. A hindrance, in its wide spread use, is the lack of awareness about the particular technicalities of this technology to the general public. There is no facility available locally at any institution/organization in and around University of Agriculture, Faisalabad where the operational PV solar system's real-time performance can be investigated.

Developing the technology of the workbench



A portable workbench has been developed which can be used for the performance evaluation of any photovoltaic system. A standalone complete PV system consisted of the solar cells, inverter, charge controller, backup dry batteries, and rectifiers, was investigated real-time with the help of the developed workbench. There were numerous parameters which were explored by the workbench to check the performance and reliability of the under investigation PV system. This PV system was in operation in the Faculty of Agricultural Engineering, Department of Energy Systems Engineering. The developed work-bench was equipped with the current-state-of-the-art instruments like as Agilent Data logger/Data Acquisition Unit (34970A), Kipp & Zonen Pyranometer (SP lite 2), Thermocouple (K-type), Voltcraft current adopter (VC-511) and Voltcraft Clamp-meter (VC-732) as shown in the Figure

Figure 1: Schematic diagram of workbench for the evaluation of PV systems

Usefulness of the workbench

This work-bench unit is an innovative unit which is smart in size and easily installable on the site where it is needed to evaluate the real-time performance of any sort of the PV System (commercial or domestic). Commonly, in the locality around the University of Agriculture, Faisalabad, the PV system users are non-technical/general public lacking much awareness about the performance, compatibility and integration of the PV system components. They mostly rely on the information supplied by the PV system providers so they can easily be cheated by the solar energy units/parts suppliers or vendors who want to make money and do not follow clean business ethics. This workbench will certainly enable the PV system users (domestic or commercial) to verify the capacity claimed by the solar system supplier and will reveal the true real-time picture, onsite actual working performance and quality of the PV system components. It will enable the PV system user to explore the difference (if any) in the stated and actual performance ability of the supplied/installed PV unit.

This workbench is a new and innovative technology developed for the first time at the department of Energy Systems Engineering, Faculty of Agricultural Engineering and Technology, University of Agriculture, Faisalabad. It is the most appropriate investigative tool to investiagte real-time performance of the operational PV system for the local users. The main components of the workbench are shown in the Figure 4.

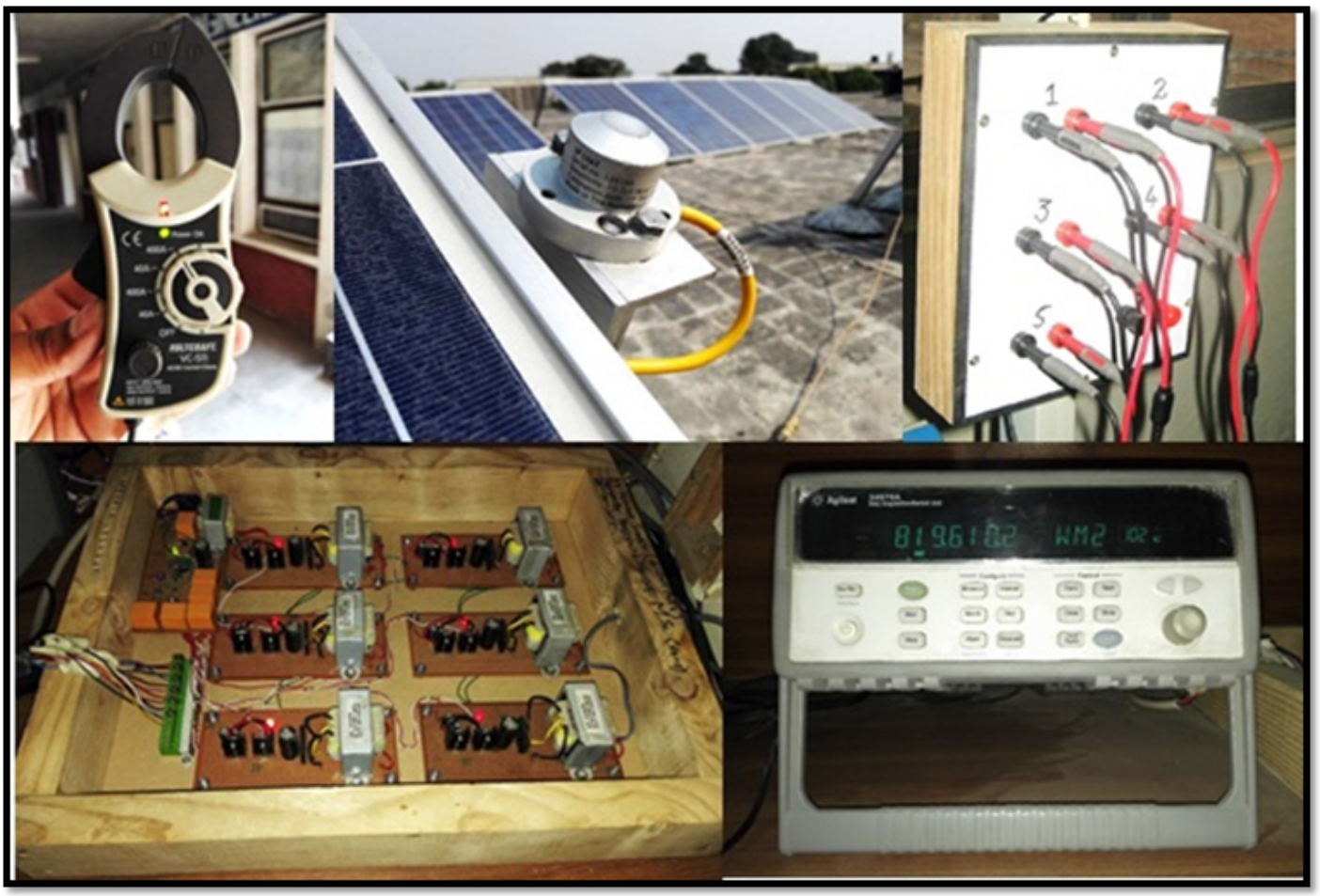


Figure 4: Main components of the workbench