SOLAR PLATFORM

The Solar Platform at the West University of Timisoara (Romania) was built in the frame of the PN II Project PASOR 21039/2007. Two major objectives have been enabled during the project lifetime (Nov. 2007 – Dec. 2010):

- The Solar Radiation monitoring Station (SRMS)
- The Photovoltaic Laboratory (PV-LAB)

Location

Geographical coordinates:

- Latitude: 45°44’49.57”
- Longitude: 21°13’50.32”
- Altitude: 87 m

The platform is located on the roof of the West University of Timisoara at 18 meters elevation to the ground. Figure 1 shows a Google Earth caption from 388 meters eye altitude, in which the building of the West University of Timisoara is seen from above. Marked with “1” is the position of the SRMS platform. This location has been chosen so that the sun is not obstructed in the measurement field.

Figure 1. West University of Timisoara: 1. Solar Platform; 2. Faculty of Physics; 3. Rector’s office ; 4. Aula Magna; 5. Amphitheaters building; 6. Library; 7. Inner garden.

Solar Radiation Monitoring Station (SRMS)

DeltaOHM first class pyranometers (LP PYRA02AC, LP PYRA12AC), which fully comply with ISO 9060 standards and meet the requirements defined by the World Meteorological Organization, are employed (www.deltaohm.com). The shadow band of the LP PYRA12AC pyranometer is periodically adjusted in accordance with the manufacturer instruction. The ground reflected radiation is measured with LP PYRA05 albedometer, which consists of two first class pyranometers mounted in opposition, one measuring the global solar irradiance while the other measures the reflected solar irradiance. The main meteorological parameters, temperature, air pressure and relative humidity, are also recorded in standard conditions with the DeltaOHM HD2001.1 transmitter. Figure 2 displays photos taken of the SRMS platform.

a. **b.** **c.** **d.** **e.**

Figure 2. Solar Radiation Monitoring Station (SRMS): (a) Overview of the measurement platform; (b) Meteorological station; (c) LP_PYRA12 pyranometer equipped with the shadow band for diffuse solar irradiance measurements; (d) Anemometer; (e) Double pyranometer LP_PYRA05 measuring the global and reflected solar irradiance;

The sensors are integrated into an acquisition data system based on a National Instruments (www.ni.com) PXI Platform consisting of a PXI-8105 controller Core Duo 2GHz, Windows XP and a PXI-6259 data acquisition board optimized for high accuracy. Signal converters are installed between the sensors output (4...20 mA) and the acquisition board analog inputs (0…10V). On the same time the signal converters play the role of galvanic separators (20 kV). The system operation is relying on a LabVIEW application. Measurements of all parameters, meteorological, actinometrical and electrical, are simultaneously performed all day long at constant time intervals of 15 seconds. A picture of the data acquisition equipment is in Figure 3a.

In addition to the SRMS monitoring system, the Solar Platform is equipped with portable instruments for measuring and storing meteorological and actinometrical data (Figure 3b).

a.

b.

Figure 3. (a) Data acquisition system; (b) Portable instruments for meteorological data acquisition. The datalogger, global, UVA, UVB solar irradiance sensors (right hand) and the temperature and humidity sensors (left hand) can be seen.

For sure, SRMS is unique in Romania. The distinctive features that earn SRMS this merit are: (1) First Romanian station outfitted for systematic monitoring on tilted surface. As of November, 2007, the starting date of the PASOR project, neither Romanian meteorological station keeps long-term recordings of solar irradiance on tilted surfaces. To our knowledge, this remains the situation nowadays, in 2011, with SRMS being the only Romanian station that records systematically solar irradiance on tilted surfaces. (2) High recording rate, i.e. measurements of all parameters are performed continually every 15 seconds. It is the highest rate of actinometrical parameters monitoring in Romania. The large number of measurements, more than 1.5 million recorded points during a year for each channel, allows for the first time in Romania a thorough statistical analysis of the solar radiative regime stability.

Photovoltaic Laboratory (PV-LAB)

Four experimental setups for characterizing PV modules and PV systems operating under outdoor condition are installed on the PV-LAB: (1) Stand-alone PV system with PV module mounted on a polar axis sun-tracker system (PV-mobile); (2) Stand-alone PV system with PV module fixed towards South and inclined to 45° (PV-fix); (3) Experimental setup for testing PV modules operating under outdoor conditions (PV-test) and (4) Wind generator. Photos of these equipments are presented in Figure 4. All four systems are fully monitored, the solar and electrical data being simultaneously recorded. The schematic of the Solar Platform monitoring network is shown in Figure 5.

Figure 4. (a) PV-mobile system; the PV module is mounted on a polar axis sun tracker support; (b) PV-fix and PV-test modules. On front of PV-test module it can be seen the pyrometer measuring the cells temperature; (c) Wind generator (d) View of the PV-LAB components inside: (a) Electric block including the instruments for monitoring PV-mobile and PV-fix systems; (b) Battery block. The loads consisting of two 20W spots (upper side of the photo) are used directly for illumination.

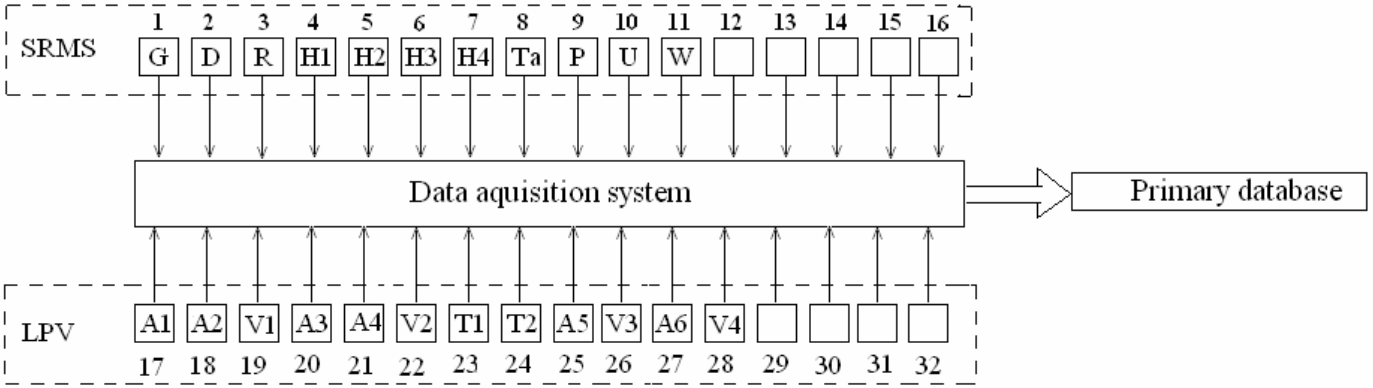

Figure 5. Schematic of the Solar Platform monitoring system: G – Global irradiance; D – Diffuse irradiance; R – Reflected irradiance; H1 – Total irradiance on South-West, vertical wall; H2 – Total irradiance on South, inclined 45°; H3 – Total irradiance on South, vertical wall; H4 – Total irradiance on South-West, inclined 45°; U – Relative humidity; Ta – Air temperature; P – Barometric pressure; W – Wind speed; A1 – Current of PV-mobile module; A2 –Current of PV-mobile load; V1 – Voltage of the PV-mobile battery; A3 – Current of PV-fix module; A4 – Current of PV-fix load; V2 – Voltage of the PV-fix battery; T1 – Temperature on the front of PV-test module; T2 – Temperature on the back of PV-test module; A5 – Current of PV-test module; V3 – Voltage of the PV-test module; A6 – Current of wind generator; V4 – Voltage of wind generator. All the quantities are recorded simultaneously with 15 seconds sampling. The idle ports 12-16 will be completed with equipment for monitoring ultraviolet (UVA, UVB) solar irradiance and the ports 29-32 will be completed with instruments for monitoring a PV system for water pumping.

http://solar.physics.uvt.ro/srms

A caption of the Solar Platform homepage is in Figure 6. The main meteorological parameters (air temperature, pressure, relative humidity and wind speed) along with solar irradiance (horizontal global and total on south direction, inclined 45° and total on South West direction, inclined 45°) are displayed in real time.

Section *online_data* contains graphs showing solar irradiation and weather parameters at hourly sampling for the last two days. The section *download* links to monthly files including hourly data, mean values of meteorological parameters and hourly sums of actinometrical data.

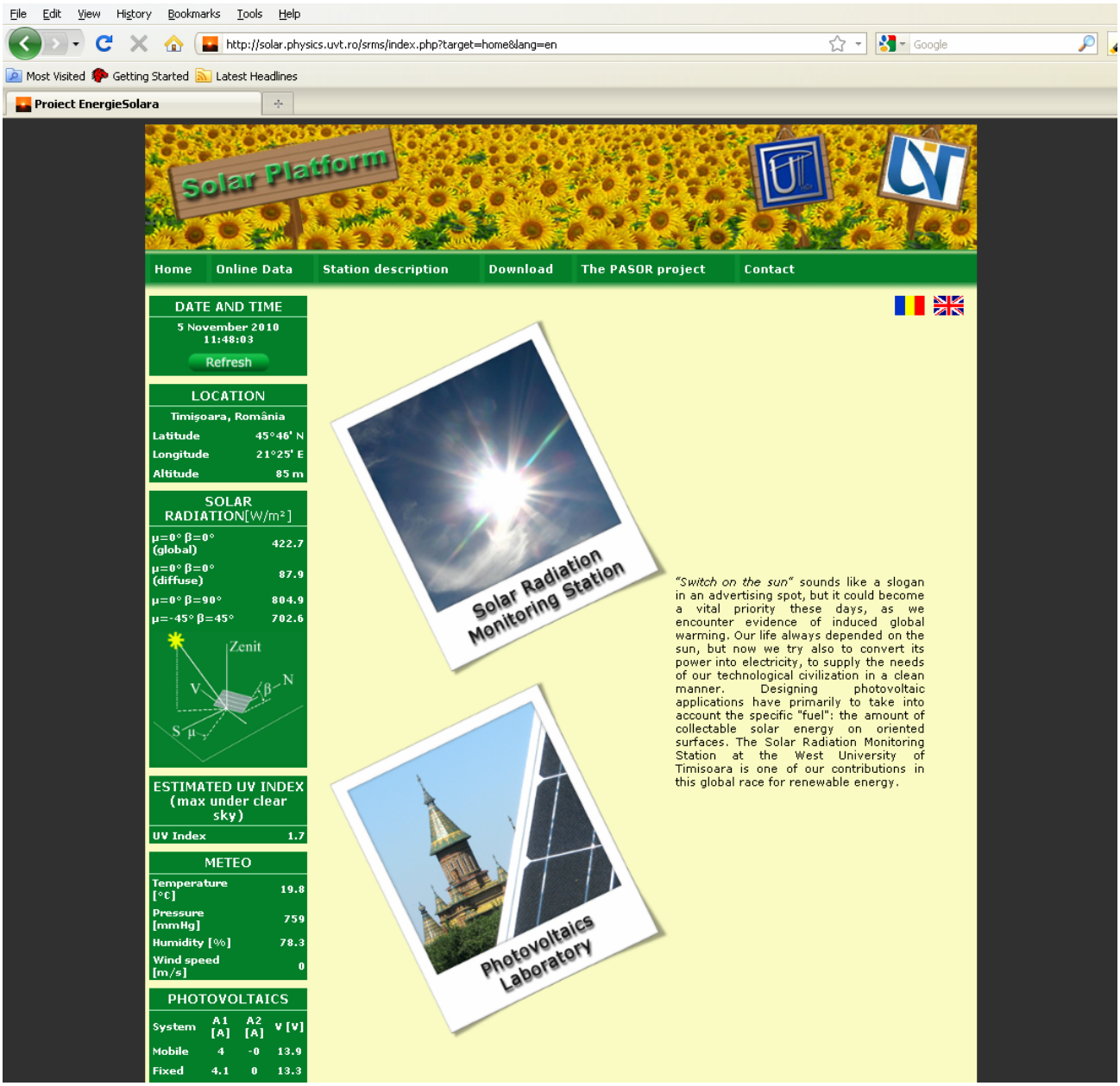

Figure 6. Homepage of the Solar Platform site, http://solar.physics.uvt.ro/srms