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TECHNOLOGY

CUSSONS RENEWABLES SOLAR ENERGY RANGE

INTRODUCTION

Solar energy is important as it is available in locations where other types of renewable energy, such as wave and tidal energy are not practical. Solar energy is easily used in poorer countries as it needs little infrastructure or maintenance. Solar power can be used to provide clean water as well as lighting and power for computers. Students are motivated to study renewable energy, particularly with regard to the social impact of helping the poorest inhabitants of earth.

Solar energy has been used for thousands of years to naturally dry crops and fuels and provides the basis for biomass energy. The direct use of solar energy is best used in the principles of solar distillation of water, in solar heating of water, and in the direct production of electricity from photovoltaic cells.

Cussons Technology Ltd provides a range of solar energy products to permit realistic experiments in each of these three fields. Many interesting engineering challenges are presented in the understanding of solar generation. The considerations include

- Heat transfer principles, including liquid vapour transfers
- Energy available from the sun
- Composition of light
- The effects of insulation
- The greenhouse effect of glass
- Electrical properties of photovoltaic cells
- Electrical circuits associate with energy storage

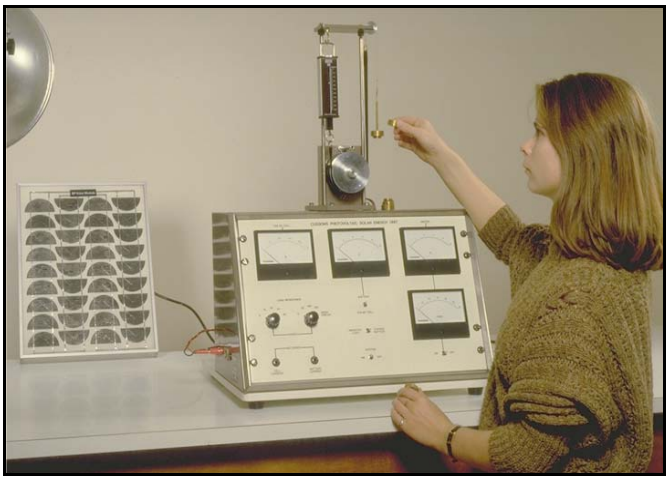
One of the attractions of solar energy is that the manufacture of solar distillation and heating are practical and immediate concepts. Students are interested in the way that solar energy is useful at a small scale and want to study the theory to understand the principles. Each manual lays out the theory behind the experiment so that the experiment can be part of a dedicated renewable energy module, or an interesting part of other modules.

Each solar apparatus can be used externally with natural sunlight, or with the Cussons light kits. This allows studies to be conducted at any time of the year. Similarly data can be recorded manually or through the use of data acquisition kits.

P9060 Photovoltaic Solar Panel

This unit provides students with the means of collecting and storing solar power, measuring the energy produced and investigating the performance of the Photovoltaic unit. The P9060 experiment enables both electrical and mechanical power to be obtained . As solar energy is intermittent almost all applications require some form of storage to permit continuous operation. In other cases the demand for energy may be much higher than the output of the cell but only for a small percentage of total time. Here again the storage system makes this possible.

The power element in the unit is a photovoltaic cell array comprising thirty-six silicon cells connected to a control unit incorporating a storage battery, and a



switched loading system consisting of an electric motor and dynamometer and a bank of resistors.

Energy of solar origin stored in the battery can be converted into kinetic energy by the use of the electric motor and measured by the dynamometer and tachometer system. The characteristics of the photovoltaic cell array can be determined by the instrumentation provided.

P7140 Solar Heating Panel

Hot water is an essential factor of modern life. The solar energy demonstration unit allows students to study the total heat capture of a solar energy unit and gain an indication of their relative efficiency.

This experiment includes a shallow heat collection tray approximately 1.2 m by 1m, the base of which is fitted with removable heat capture panel. The heat capture and transfer panel is itself covered by a sheet of flat plate glass, which captures the radiation and reflects light back to the panel.

Water is pumped through the panel and is returned to an insulated reservoir mounted on the base of the unit so that the temperature in the reservoir gradually builds up. Students can measure the effect on performance by varying the flow rate, angle of incidence, base insulation and use of glass cover. Temperatures, flows etc are measured.

P7135 Solar Distillation Still

The use of solar energy to provide clean water is under-utilised but effective.

P7135 comprises of a sloped evaporating tray over which the brine liquid flows as a thin film, heated by the solar energy. The tray is covered by a sheet of flat plate glass so that water, evaporating from the tray, condenses on the inside surface of the glass cover, runs down to the lower edge and collects in a measuring vessel The glass is set at an angle of 12½° to the horizontal, so that water condensing on it readily runs down to the lower edge.

Brine draining from the tray is collected and returned to a reservoir, whence it is pumped back to a channel from which it overflows on to the upper side of the evaporating tray. Feed water flow rate is measurable and variable. Temperature measurement by a multi-point thermocouple instrument is provided.

Cussons Load Management

The sporadic nature of most renewable energy can be seen as a drawback so Cussons offers a load management P9046, which allows load to be shared and balanced between different sources such as wind, and solar, topped up when necessary by a fuel cell.

Naturally all these products can be supplied with light meters, solar meters, artificial light and data acquisition.

If both solar distillation and solar panel studies are planned Cussons P7137 provides a combined platform.

Cussons Technology Ltd.

102 Great Clowes Street, Manchester M7 1RH, England

Tel. +(44)161 833 0036 Fax. +(44)161 834 4688

E-mail: sales@cussons.co.uk Web: www.cussons.co.uk