Charge Controllers

It is essential to have some sort of charge control on any renewable power system. Not only to protect the generation equipment but more importantly to prevent the batteries overcharging. In some systems the load can come from the charge controller in order to limit draw and prevent draining the battery.

Hydroelectric and **Wind Turbines** require a diversion charge controller to regulate the battery voltage. If a turbine is disconnected from the battery while still spinning it will continue to generate power, but with no where to go, the voltage will rise dramatically and may become a fire risk!

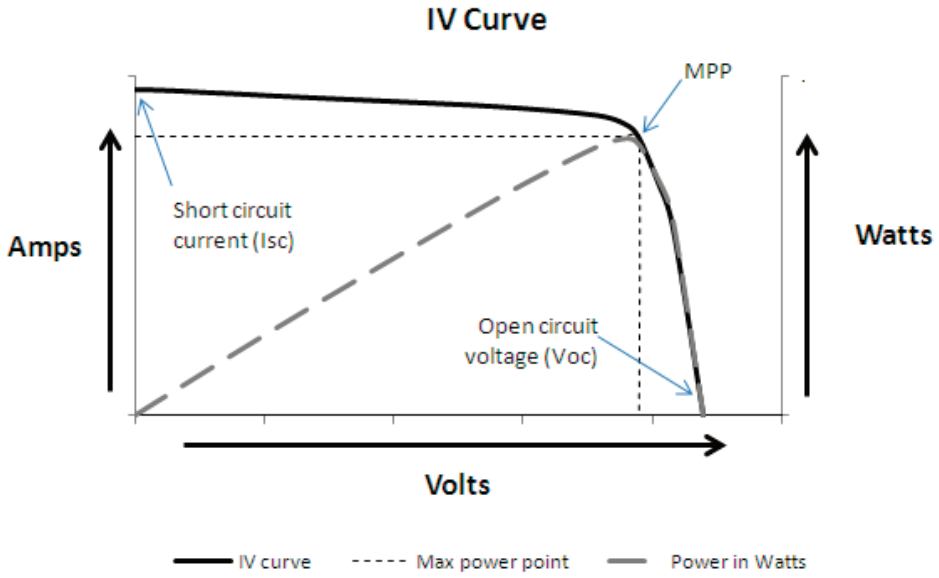
For that reason a diverting charge controller is used with turbines, which divert power when the batteries are full. The power is diverted to a 'dump load', usually a heater element for space or water heating.

Diversion controllers can be used for PV as well but are usually used only in hydro, wind or hybrid systems due to the higher cost and higher internal power consumption.

A **Solar Photovoltaic (PV)** controller can simply open the circuit to stop the charging and no harm will come to the batteries or panels. At open circuit voltage (Voc) there is no current. On all PV panels spec sheet there will be an IV curve which has been produced under standard test conditions (STC) and show the panels characteristic (see figure overleaf). They show the measurements of voltage and current and illustrate the maximum power point (MPP). It is advisable to get a charge controller with MPP tracking (**MPPT**) which put simply down converts the excess voltage into amps. This can provide up to 30% more output, the same as physically tracking the sun!

We affectionately call MPPT charge controllers **Muppets**! It's easier to remember. However they are more expensive and you should consider spending £300+ on a good make.

A **PV Direct System** connects the PV panels directly to the appliance to be run, most commonly DC water pumps and ventilation fans. By having no battery the system costs are lower, control is simpler and maintenance is virtually eliminated. There is no need to prevent overcharging but a device is required to boost the output in low light levels, commonly called a linear current booster....



....LCB's are solid state devices that help motors start and keep running in low light. They do this by taking advantage of the PV panels characteristics (IV Curve). When a PV panels is exposed to even very low light levels the voltage jumps up immediately, although the Amps produced at low light are very low. A DC motor requires lots of Amps but doesn't mind low voltages. The LCB down converts some of the high voltage into Amps, much like the MPPT explained before. Once the motor starts, the LCB will automatically raise the voltage to as much as generation conditions allow without stalling the motor. Meanwhile, on the PV side of the LCB, the panel is allowed to operate at it's MPP, which is usually a higher voltage than the motor operates at. An LCB can boost pump output by as much as 40% by starting earlier and finishing later; and can mean the difference of between running or not in cloudy conditions. They do, however, suffer about 10-20% conversion loss, for this reason, if the LCB has been sized correctly, when the PV panel gets closer to full output the LCB should bypass itself.

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Tel: 07933 858 529 Email: resource.living@yahoo.com
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