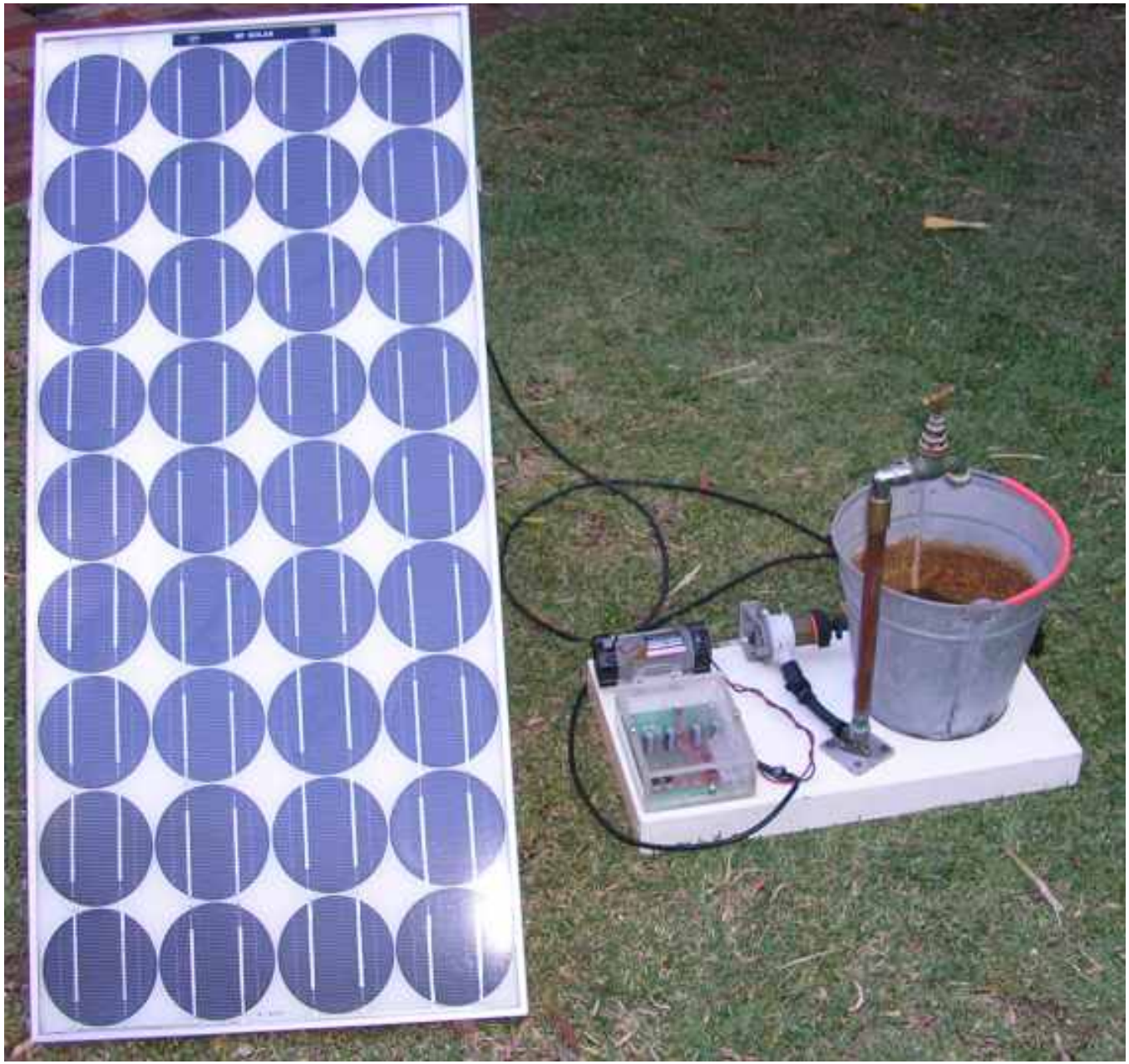
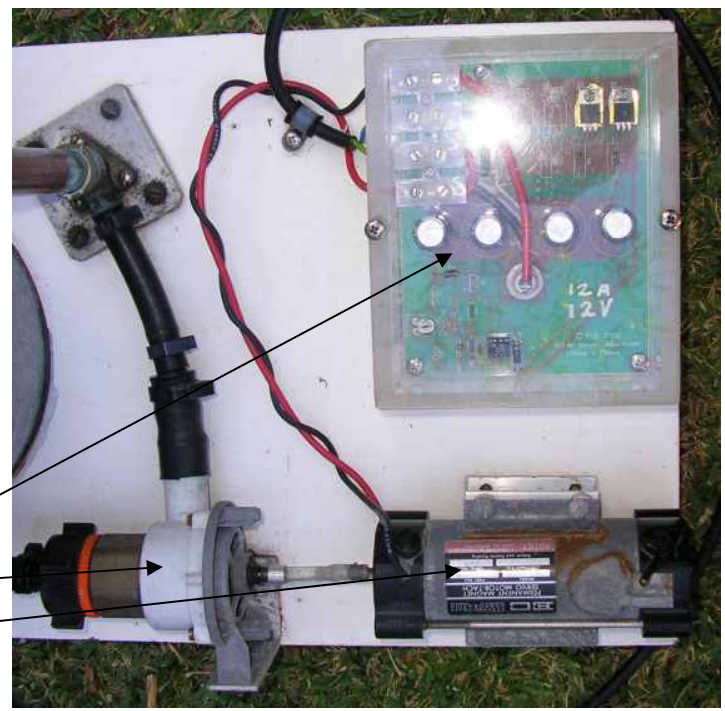
Solar water pump display



Solar water pump display

Modified plug so
It cant be used
elsewhere

False bottom bucket
ring of garden hose for spacer



Maximum power point tracker
Washing machine pump
Wind screen wiper motor

Maximum Power point Tracker and Solar Panels - Maximiser

A Photovoltaic (PV) solar panel can be directly connected to a motor (eg pumping) without a battery and works well.

There is however a problem in that the panels cannot provide extra power, as a battery can, to start the motor turning.

The panels are effectively a constant current (current is the flow rate of electrons) source of power – you cannot draw electrons out of the panel faster than the light falling on the panel can liberate them. So there is some constant maximum current the panel can make.

When the motor is stationary, before it has started turning, it is simply a big loop of copper wire and has very low resistance (almost a short circuit). The voltage on the positive terminal of the panel will be almost the same as on the negative terminal as the two are simply connected by a length of copper wire in the motor winding.

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Solar panel - power produced

Power is equal to the voltage x the current; P = V x I

Because the voltage across the terminals of the panel is small and the current limited, the power, P = V x I will be small.

More power from the panels can be made available by ensuring there is not a dead short across the panels so there is some reasonable voltage (often about 12V). This is done by increasing the effective resistance or impedance across the panel terminals. The current drops a bit but over all the V x I equation above ends up giving a much high Power P.

The curve shown here is how the V and I are related for a typical PV panel. The turning point is where the power is at a maximum.

The circuit uses the trick of storing electrical energy in a capacitor, this keeps the panel voltage high. The energy in the capacitor is then fed at the right rate and voltage to the motor, intermittently rather, than continuously.

Solar panel - power produced - optimisation

The next level of sophistication

The turning point in the graph attached changes with changing panel temperature. Circuits can be build that will track the changing turning point in the graph. This device would be called a **maximum power point tracker.**

Temperature and efficiency

The graphs are repeated for different panel temperatures and the change in the turning point can be seen.

Note that as the panel gets hotter the turning point current doesn't change much. The turning point voltage however falls quite rapidly. So the Power, P = V x I has to fall as well.

This means that as the panel gets hotter it produces less power even at its maximum point. The drop is usually about 5% per 2.5^{o}C.

The panels should be kept cool to avoid this loss of power or efficiency. For this reason there should be good air flow under the panels.

Solar panel performance characteristics