Home lighting has been traditionally power from the incoming mains power supply. In Australia this is 240VAC and in other countries it may be 120VAC or 220VAC. Incandescent (filament type) and fluorescent lighting have been designed to run directly from these voltages.

Incandescent lamps operate at approximately 6% efficiency. This means, that of the energy being used, only 6% produces light, the rest of the energy produces heat. They are easily dimmed by the use of phase angle firing with triacs which operate between full and half voltage. Despite being low cost, Governments have forced a reduction in their use due to their inefficient operation.

Fluorescent lights operate at approximately 30% efficiency. Fluorescent lamps operate by exciting mercury vapour and then converting the ultra-violet light they produce into white light, by the use of a phosphorescent coating on the inside of the glass. Although only very small amounts of mercury are used, it is a poisonous substance. It is undesired in landfill and leach into ground water if the landfill dump is not properly constructed. Fluoro tube expected life is between 2,000 and 8,000 hours of operation. On home usage of 4 hours per night, this equates to about 1.4 to 5yrs if you are lucky. They also take a few minutes to warm up before they reach full brilliance. Some can be dimmed, but because of their warm up period, it tends not to be satisfactorily achieved.

Light **E**mitting **D**iodes also operate at approximately 30% efficiency. Research has suggested that this will reach 50% efficiency in the future. Their expected life is 50,000 hrs with some manufacturers claiming up to 100,000 hrs. On home usage of 4 hours per night, this equates to somewhere between 34 to 68 years of operation. They are easily dimmed with pulse width modulated drives and have no warm up period. The pulse width modulation requires electronic controls. LEDs are manufactured from semiconductor material and therefore only tolerate extra low voltages. To run them from a 120VAC to 240VAC supply, electronic transformers are required to step down to suitable voltage levels. In a 240VAC house with LED lighting, a good part of the cost is the step down power supply associated with each light. To date, manufacturers have tried to fit LED technology into the current incandescent and fluorescent lighting markets.

As LEDs become more cost effective and with improvements in technology, it may be time to re-think the best way to design and power your lighting system.

There are advantages in using DC, extra low voltage to power the LED lighting in your house. Extra Low voltage is that which does not exceed 50VAC or 120VDC without ripple.

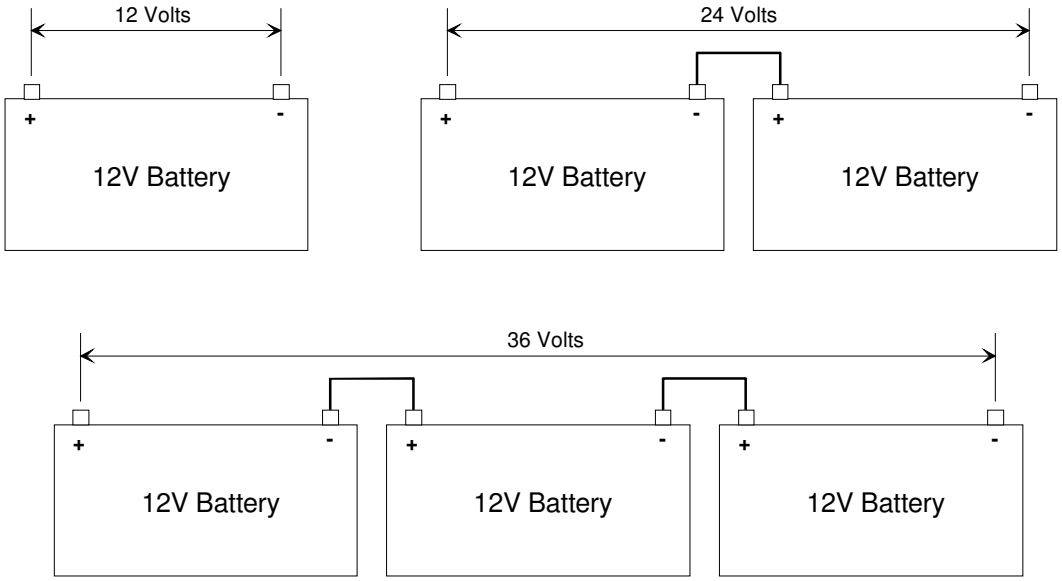
1. Safety – Extra low voltage will not cause electrocution. (Note you may get a tingle, but it won't kill you like your house supply voltage will.)
2. Low cost componentry to limit and control the current in your LEDs.
3. Batteries may be used as a supply source. This gives the option of charging via solar cells during the day or using a battery charger on the off peak tariff. It also allows lighting during blackouts. Battery usage reduces the peak demand on mains electricity in the 5.30 pm to 9.30 pm period for the electricity suppliers. This provides a long term saving on the need for electricity infrastructure designed to meet the evening peaks.
4. It is legal to install it yourself, without being a qualified electrician. (A word of caution is required however. You will still need to know how to select the right cable size for the job and how to terminate cables correctly. Inability to do so can create a hot cable or connection and create a fire hazard.)

Selecting the Extra Low Voltage

What voltage should I run from? There is no rule to say you have to use a particular voltage, but availability of suitable equipment should act as a guideline.

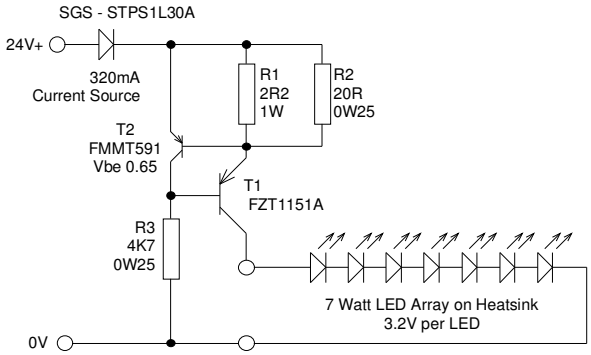
Lead acid batteries are produced in 2.2 volt cells. Several cells are then manufactured in a package to produce 6 volt or 12 volt batteries for the mass market. The most common usage is the automotive market which has selected 12 volts for most models of vehicle. This makes 12 volt batteries easily

available. By placing two batteries in series you can operate from 24 volts. Three batteries in series will operate from 36 volts. Four batteries in series will operate from 48 volts.

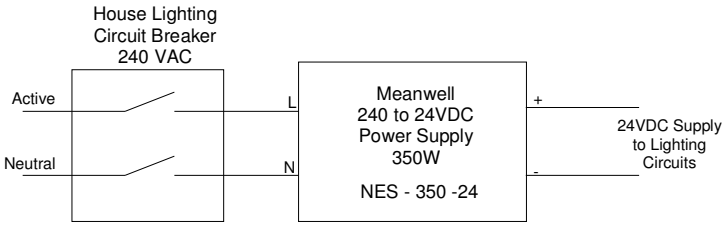


Although the primary voltage in the automotive industry is 12 volts, there is also a portion that builds for trucks and uses 24 volts. So 24 volt equipment is available from automotive suppliers. The extra low voltage used in the manufacturing and mining sectors is also 24VDC. This voltage is universal across all countries. It means that 24VDC has the widest range of equipment for use.

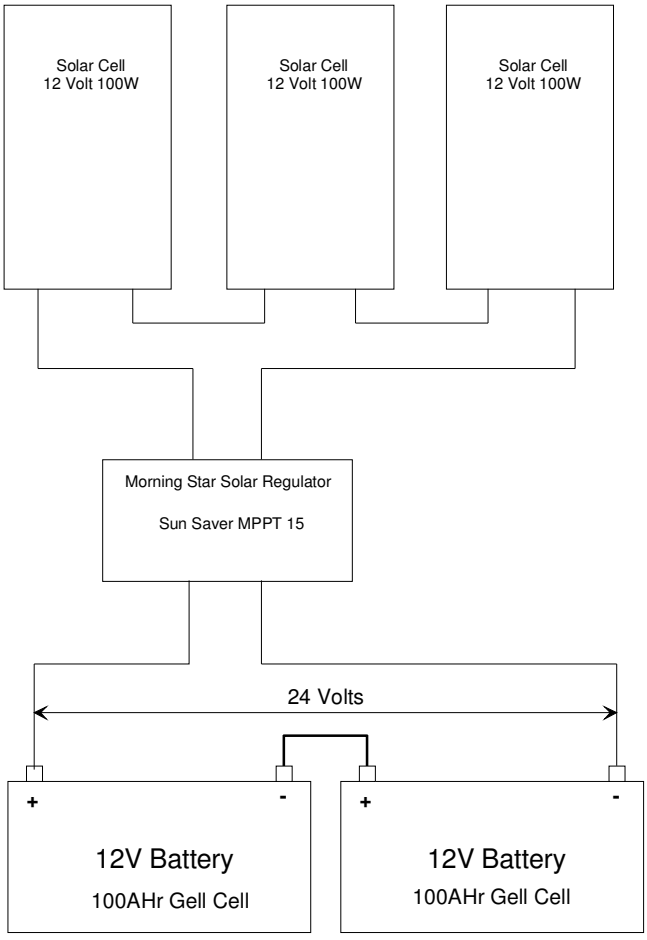
Why select 24V over 12V? Wouldn't the lowest possible voltage be the safest? The answer is yes to safety, but there is also the consideration of installation costs. If you use a 12 volt system instead of a 24 volt system, then your cable sizes will have double the cross sectional area of copper. For the same power delivery (watts), you will need double the current for a 12V system than you would for a 24V system. This costs more initially and it means that your energy losses in transmission are increased. (This follows the current squared times resistance law) In short runs of wiring, like a car, then this is not a problem. In longer runs, like a house, it is better to reduce the losses. Losses and installation costs can be improved by stepping up to a 36V or 48V system. Unfortunately, there is not a lot of equipment produced for these voltages and so you are moving away from the advantages of mass production for lowering costs.



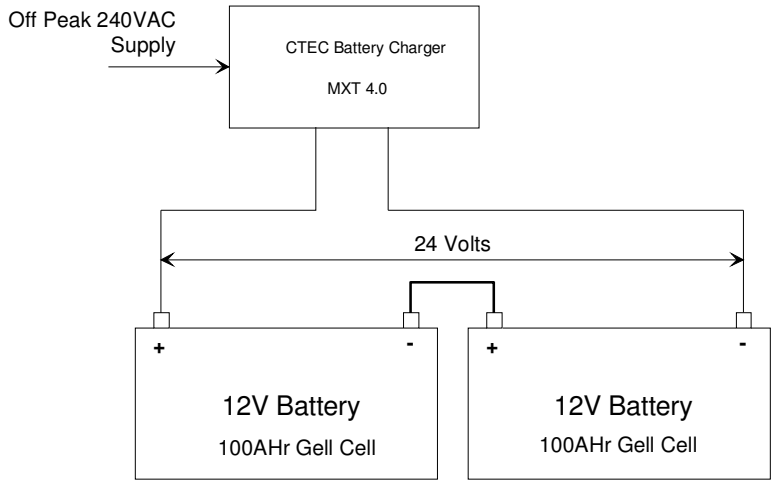
Example of simple current source and 7 watt LED array for 24VDC use.



Example of Lighting from mains driven DC Power Supply



Example of a Lighting 24VDC supply using Solar Cells



Example of a Lighting 24VDC supply using Off Peak Mains Electricity