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LIGHTS & APPLIANCES

in

OFF-GRID

SOLAR SYSTEMS

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Themes

- Lights / efficacy / efficiency
- Measuring energy consumption of appliances
  - DC appliances
  - AC appliances

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Light efficacy

- Light output is measured in lumens (lm)
- The efficacy of a lumiere is measured in lumens per watt (lm / W)
- Excellent article on **Luminous Efficacy** in www.wikipedia.com

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Comparison of lights

Incandescent

80 W x 4 h = 320 Wh

Low energy light bulb

18 W x 4 h = 72 Wh

LED (less light)

4 W x 4 h = 16 Wh

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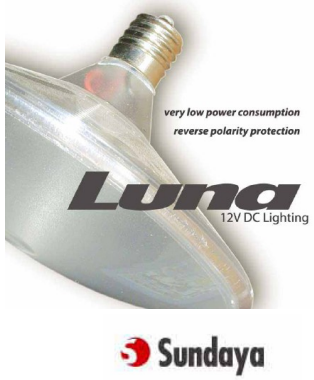
DC lights

Sollatek
Lumina
7 - 13W
12V

Labcraft, Trilite, 8W, 12V



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Incandescent lights

- 9 lumens per watt
- Output
  - 15 watts → 135 lumens
  - 25 watts → 225 lumens
  - 80 watts → 720 lumens
- 1,000 hours
- Cheapest
- Generally not recommended

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Halogen lights

- 14 to 18 lumens per watt
- Output
  - 10 watts → 140 lumens
  - 20 watts → 350 lumens
- 2,000 hours
- Cheaper than fluorescent
- Generally not recommended

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Fluorescent lights - baton type

- 40 to 55 lumens per watt
- Output
  - 6 watts → 240 lumens
  - 8 watts → 340 lumens
  - 13 watts → 715 lumens
- 5,000 hours

Labcraft, Trilite, 8W, 12V

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Fluorescent lights - PL type

- 45 to 55+ lumens per watt
- Output
  - 7 watts → 315 lumens
- 10,000 hours

Sollatek

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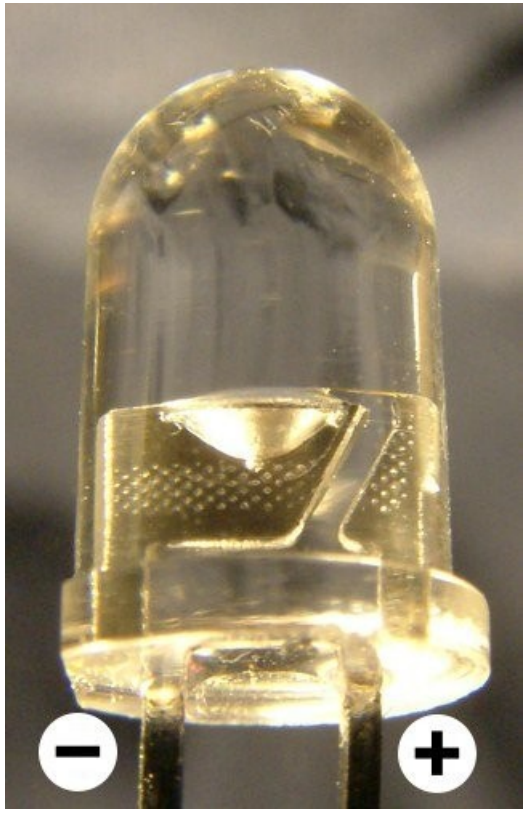
LEDs (Light Emitting Diodes)

- On the market
  - up to 70 lumens per watt
- Prototypes
  - up to 150 lumens per watt
- 100,000 plus hours



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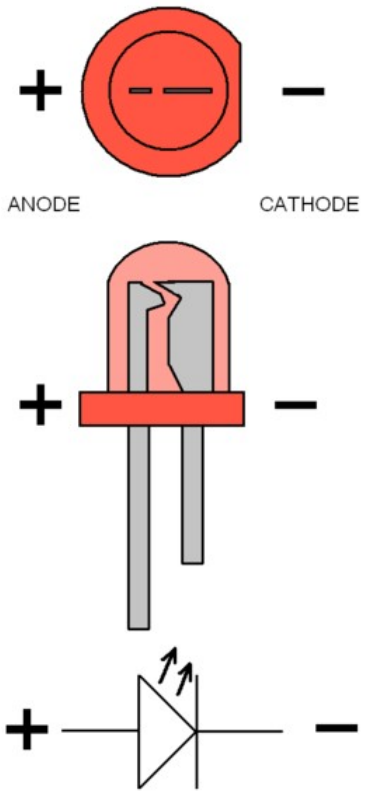
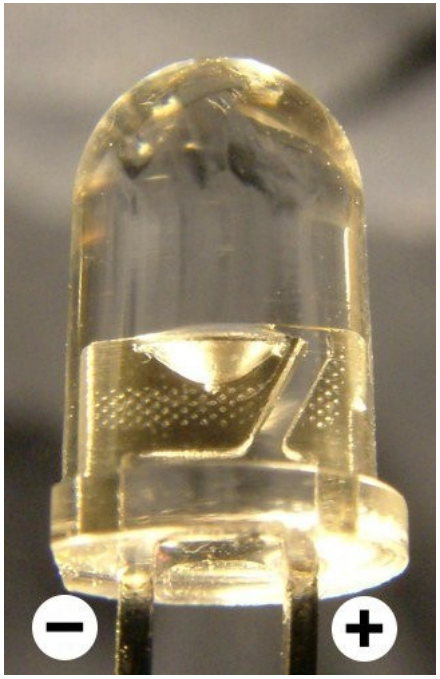
LED lights





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LED pathway, Carmarthen, Wales

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Comparison of lights

Energy for Sustainable Development Africa, Nairobi, Kenya

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Installing lights

- Appropriate level of light
- Light only areas requiring lighting
- Reflectors
- Standing and desk lights
- Avoid wall lights generally

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Outdoor lights

AMPAIR Natural Energy

Sollatek

SolarGen

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Portable solar lanterns

Sollatek™
solar systems

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Efficiency of appliances

$$\text{Efficiency} = \frac{\text{Energy Output}}{\text{Energy Input}} \times 100$$

- Inefficiencies also referred to as *losses*
  - Cables losses, battery losses etc.
    - Nothing is 100% efficient

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Efficiency example

$$\text{Efficiency} = \frac{\text{Energy Output}}{\text{Energy Input}} \times 100$$

$$\text{Efficiency} = \frac{150\ \text{W}}{200\ \text{W}} \times 100$$

Efficiency = 75%

Useful work done = 75% Heat = 25%

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DC – measuring energy consumption

- Use a multimeter (fused)
- Measure voltage and current at battery

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AC – measuring energy consumption

- Use plug in power meter
- Measure on mains – not on inverter

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DC appliances

- Generally more efficient than AC equivalents
- Designed to run on batteries
- More expensive
- Not as easy to find
- Mobile home and boating suppliers
- DC-DC adaptors
- Always useful to have a small inverter

Lights

TV / videos

2 way radios

Fridges

Pumps

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Fridges & freezers (DC)

- DC is usually more efficient than AC
- No inverter required
- Manufacturers
  - *Kissmann*
  - *Sunfrost*
  - *Steca*
- The *fridge* or *freezer* is more expensive

Kissmann GTR 300 freezer
157 x 88 x 70 cm
323 litres, 24 V

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AMPAIR Natural Energy

www.ampair.com

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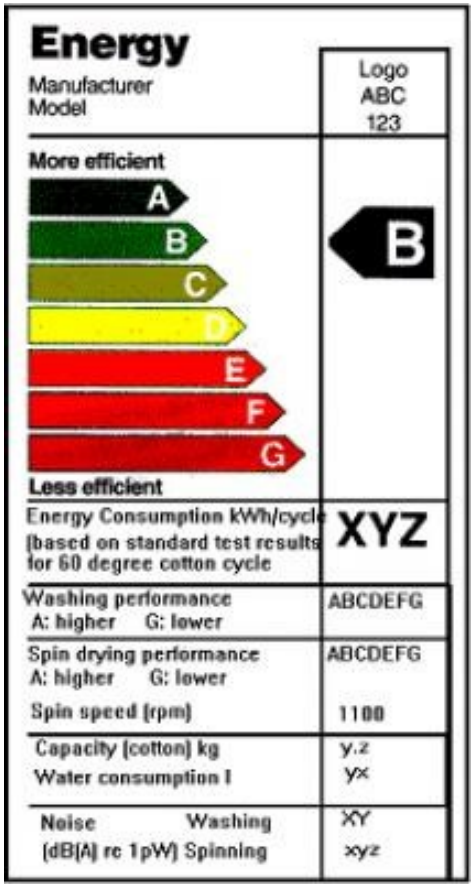
Fridges & freezers (AC)

- Generally not as efficient as DC versions
- Important figure is yearly energy consumption figure
- Size
- Inverter ***may*** be an issue



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Fridges & freezers (medical)

- Self-contained units
- To WHO and UNICEF standards
- Medical
- Vaccine cold chain
- Veterinary

NAPS Power of Light

www.napssystems.com

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PQS performance specification

WHO/PQS/E03/PV01.1
Original: English
Distribution: General

TITLE: Solar power system for compression-cycle vaccine refrigerator or combined refrigerator-icepack freezer.

Specification reference:	E03/PV01.1
Product verification protocol:	E03/PV01-VP.1
Date of origin:	02.08.2007
Date of last revision:	New specification

Contents:

World Health Organisation has standards for solar medical refrigeration

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Screens

- Size is the most import thing
- Rated wattage is a good guide but usually refers to max. power consumption
- Cathode ray and LCD similar
  - 3.4 W per inch (av.) (est.)
- Plasma less efficient
  - 9.4 W per inch (av.) (est.)
- Look at the labels
- Take measurements

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Sound equipment

- Energy consumption difficult to predict
- *Audio power* ratings on amplifiers are not a good guide
- Car stereos are a good DC option
  - DC power consumption can be measured using a simple ammeter
- Measure energy + power on mains?

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Two way radio

- DC
- Power consumption
  - 1/3 of rated, rule of thumb
- User education

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Microwave ovens

- DC microwave ovens are available
- Recreational vehicle & boating suppliers

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Non-electric alternatives

- Gas fridges
  - more expensive
  - but cheaper than PV

Electrolux do a range of gas-powered fridges