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PR ENG
DEEET

Basics Of UPS Systems.

Living with loadshedding

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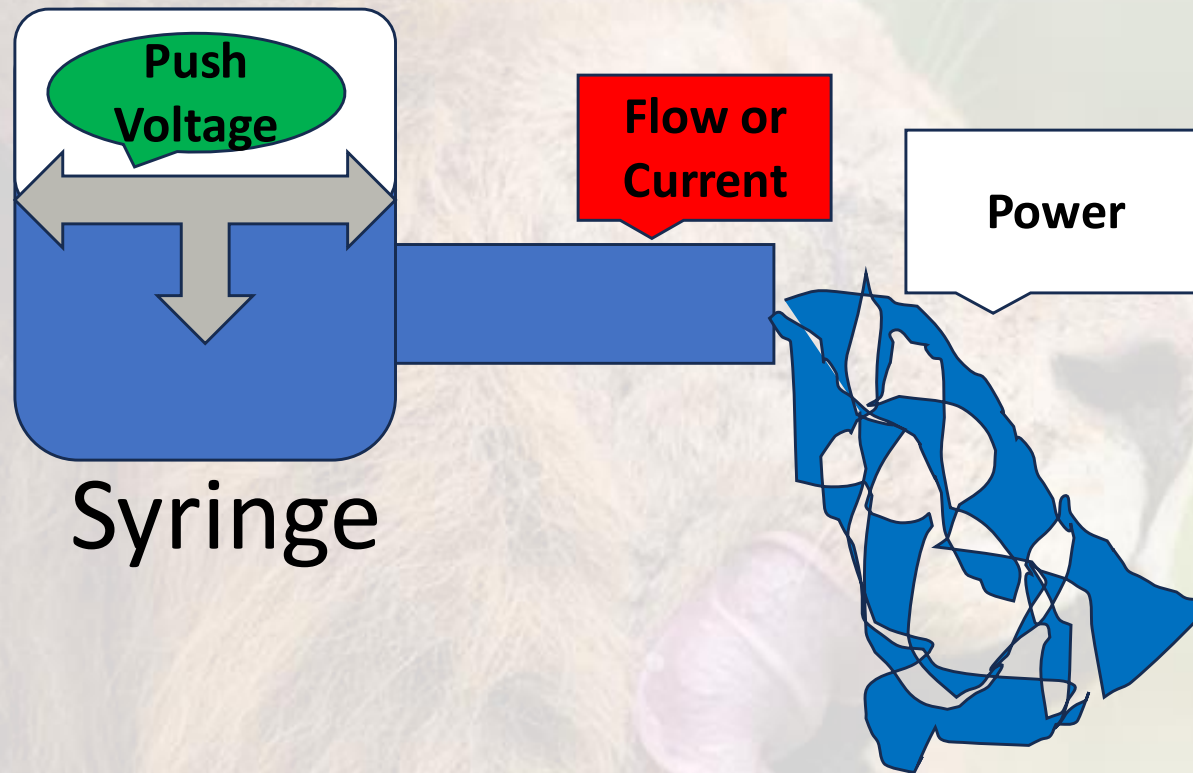
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- (6) Conclusions

1.1 Electricity Costs and Energy saving tips

A Electrical power and Energy



- ☐ **Power** is influenced by both **Current** and **Voltage**
- ☐ Mathematically written as:

Power (P) = Voltage (V) X Current (I) or $P = VI$ to get 'W'

IF the syringe is filled with energy (electricity), both power and time affect the speed of energy removal called kWh / unit.

1.2 Electricity Billing

Estimated daily cost

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PR ENG Technologist
IPHC



8 kWh					TV, Lights, Fridge, Kettle,iron, Stove, Gyser (monitored)
7 kWh					
6 kWh					
5 kWh				TV,lights Kettle,Iro n& Fridge	
4 kWh					
3 kWh			TV,Light s& μ-wave		
2 kWh		TV,Lights &Fridge			
1 kWh	TV&Lights				

- ❑ On Average, a family my spend: R 2,50 / unit x 8 units
- ❑ R20 for electricity per day

1.3 Electricity cost saving

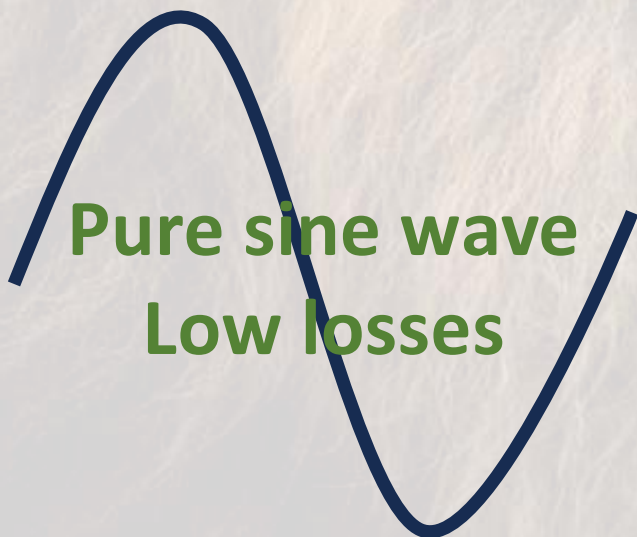
8 kWh					TV, Lights, Fridge, Kettle,iron, Stove, heating and Geyser (monitored)
7 kWh					
6 kWh					
5 kWh				TV, lights Kettle, Iron & Fridge	
4 kWh					
3 kWh			TV, Lights & μ-wave		
2 kWh		TV, Lights &Fridge			
1 kWh	TV & Lights				

- ☐ Monitor your geyser, especially during winter
- ☐ Avoid heating equipment
- ☐ Switch off any unused appliances

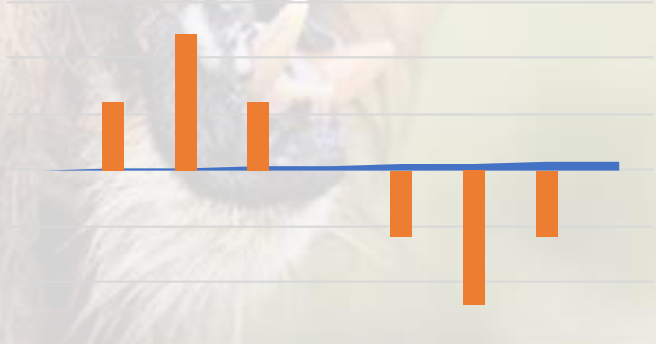
2 LOW POWER ELECTRICAL APPLIANCES

2.1 For energy efficient systems, losses have to be avoided.

2.3 The shape of an electrical produced waveform has major impact to losses. Other factors that influence losses are material used, number of units within the system, cable sizes, etc.



Stair case
Medium loss



A staircase waveform is shown with orange bars of varying heights above and below a central blue line. The text 'Stair case' and 'Medium loss' is written in orange above the bars.

SQUARE WAVE
HIGH LOSSES



A square wave is shown with a blue outline. The text 'SQUARE WAVE' and 'HIGH LOSSES' is written in red inside the outline.

2 LOW POWER ELECTRICAL APPLIANCES

2.2 Electrical Specifications



$$\text{Power} = 1.8 \text{ A} \times 230 \text{ V} \\ = 414 \text{ W}$$

In this case 14 W may
be rated as a los for the
rated 400 W shown

- ❖ To tell the power rating of the device, look for the plate that is like the one of this slide.
- ❖ To tell how much the device cost per hour :
 $400 \text{ W} \times 1\text{h} \times \text{R}2,50/1000$, note 1000 is used for conversion to kilo.
- ❖ Costing R 1 per hour. Therefore, a low power in our perception

2 LOW POWER ELECTRICAL APPLIEANCES

2.3 Electrical losses

- ❖ We have mentioned a loss of 14 W for the previous example. You may easily notice losses through heating or audible noise.
- ❖ Here with typical energy losses:
- ❖ A drilling machine is supposed to be rotating without heating, any heat is accounted for and is a loss.
- ❖ A freezer should cool food without sounds any sound is a loss.
- ❖ A stove should just transfer heat to pot and not atmosphere
- ❖ Light should give people light but not heat or light empty room

3. Matching Electricity Production System With The Appliances

3.1 Power considerations

- ❖ The supplied power should be at least twice of that of all appliances when added together.
- ❖ For the same power high currents are available for lower voltage and low currents for higher voltages

3.2 Energy consideration

Lets't say you need 1 kWh /1000 Wh (1 unit) of eskom unit from UPS

- ❖ Since $Wh = \text{Volt (V)} \times \text{Current (A)} \times \text{hours of operation (h)}$
- ❖ A 24 V battery size = $1000 \text{ V.A.h} \div 24 \text{ V} = 41,7 \text{ AH}$
- ❖ The battery should reserve at least 50 % to avoid self damage
- ❖ We therefore need a 83,4 AH battery ($41,7 \text{ AH} \times 2$) ,almost 100 AH

3. Matching Electricity Production System With The Appliances

3.3 Solar Energy Charging consideration

- ❖ Solar energy has rise and falls, where the maximum supply occur between 11h30 and 12h30.
- ❖ It has been proved that it is like having a continuous maximum supply (PSH) of about 4½ sun hours in South Africa .
- ❖ This is like having 4 ½ hours per day to charge using solar
- ❖ The solar panels will replenish the current drawn, or ensure that nothing is taken from the battery.
- ❖ To give 41.7 Ah in 4.5 hours. Charge current = $\frac{41.7Ah}{4.5h} = 9.3 A$
- ❖ Charger is 50 percent higher $9.3 A \times 1.5 =$ about 15 A (20 A exist)
- ❖ Solar panel power for 24 volt system = $24 V \times 9.3 A = 222 W$

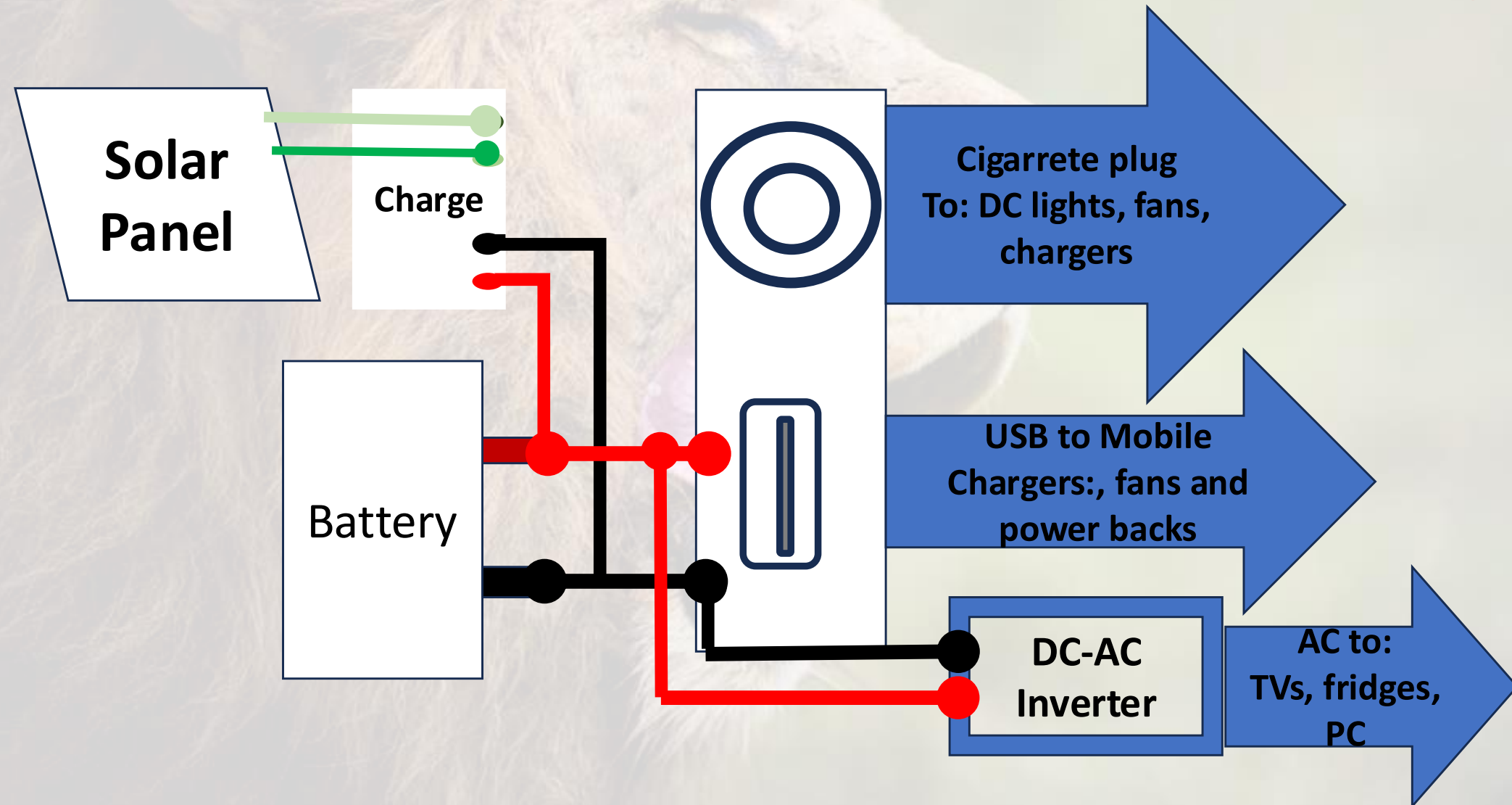
In terms of cost you need : (1) 2x 100 AH battery @ R4400, (2) 20 A charger

@R1500 (2) 250 W Solar Panel @R1800, 2000 W INV@R4000. Total = R 11700 excl
cables, brackets, fuses, etc.

4. OFF Grid Power Supplies and Appliances

4.1 Power Supplies and loads

❖ Power backs, Cigarette Plugs / Sockets, SLA batteries, USB plugs

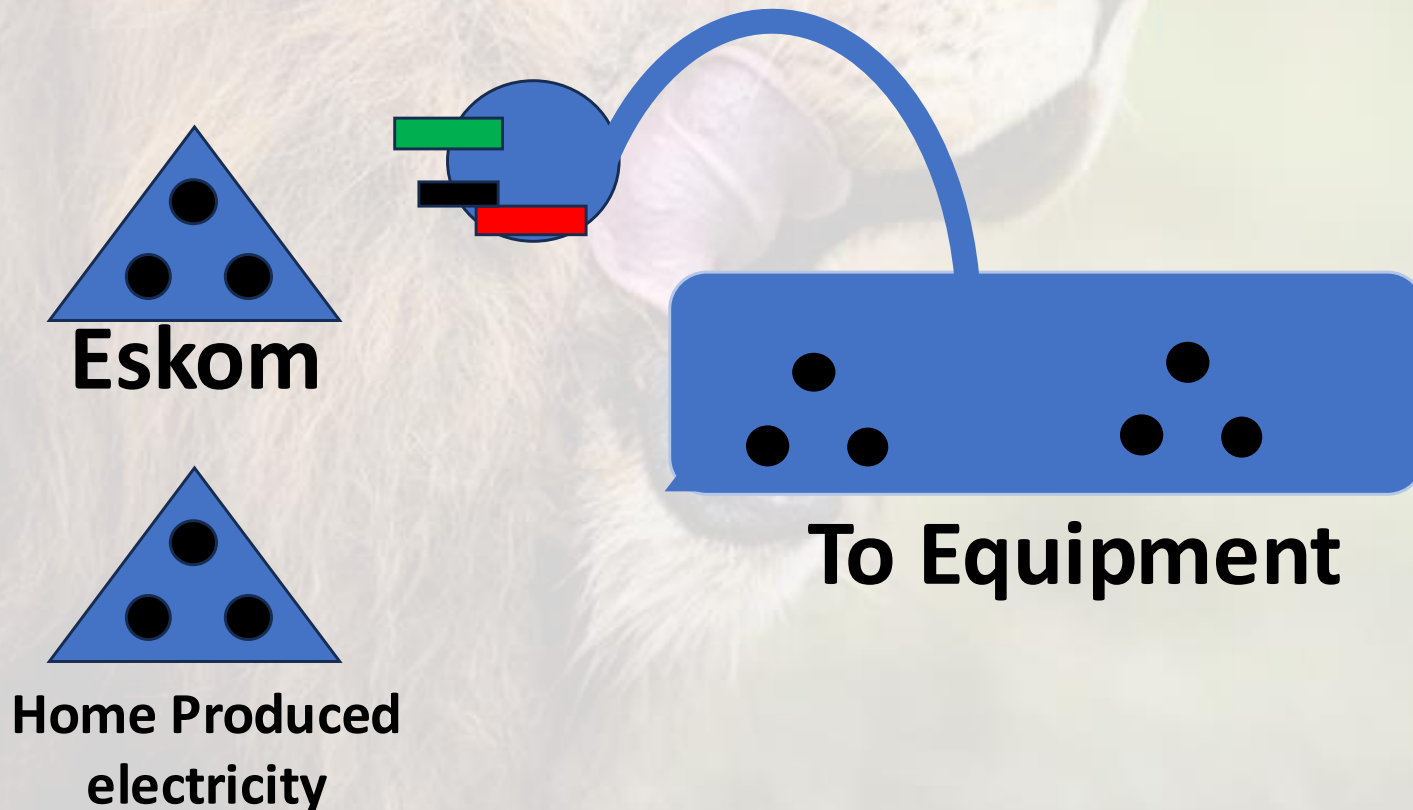


○ 5.1 Principle of change over

You can not apply two different ac power sources to the same load

* For Diagram below: either plug to Eskom or home based

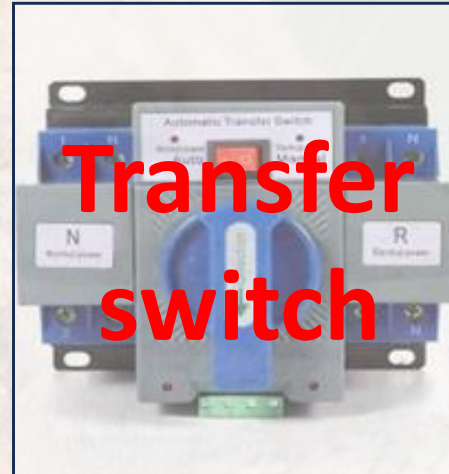
* connecting to both will results onto burning of house based equipment and explosions



5.2 Inverters and Transfer switches:



Normal Inverter



Transfer switch



Hybrid Dc to ac inverter

5.3 Comparing Solar Electricity to Eskom electricity

	Eskom Per day	Solar Per day	Eskom for 5 years	Solar for 5 Yeas
1 Unit	± R2,50	± R9,86	R 4 565,60	R 18 000
2 Units	± R5.00	± R9,86	R 9 131,20	R 36 013.65
5 Units	± 12,50	± R9,86	R 22 828.00	R 90 034.13
10 Units	± R25.00	± R9,86	R 45 656.00	R 180 068,25

CONCLUSIONS

- ❑ It takes a long period to acquire cost benefit of solar Energy.
- ❑ Immediate benefit of solar power will be:
 - Back up to grid supply
 - Noise free
 - No environmental pollution

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