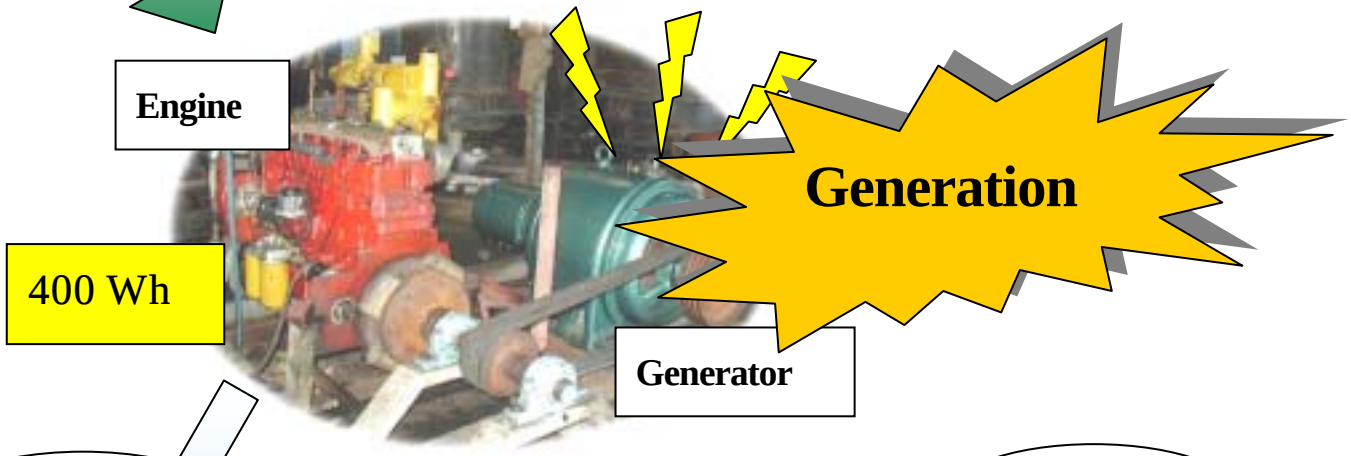
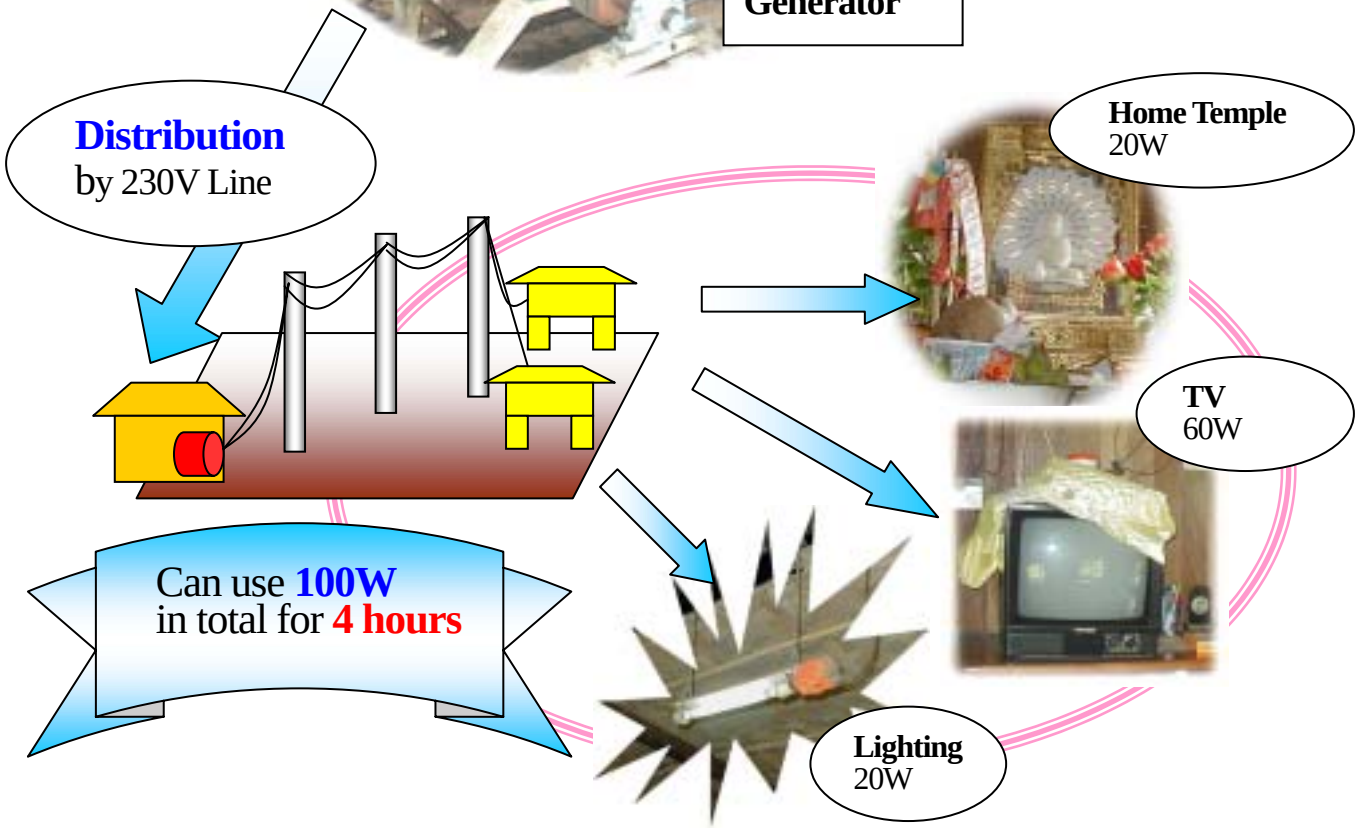
3. Rice Husk Gas Engine Generator

(wood chips and reed also can be used)

WHAT IS Village Electrification by Rice Hask Gas Engine??



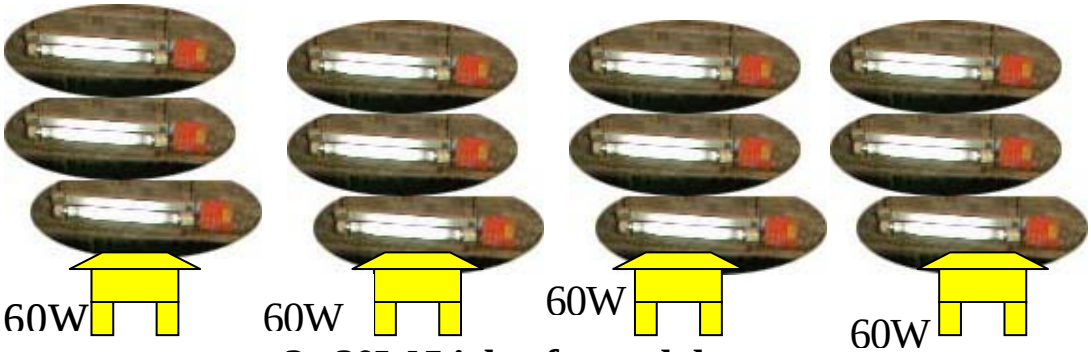


Feasibility Calculations

1 basket
rice husk

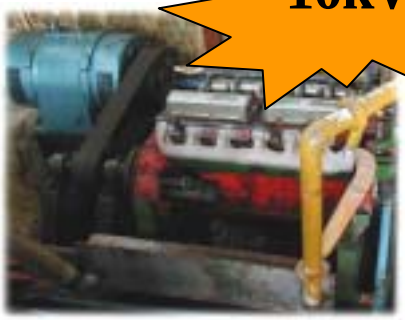
6.25 h
Supply

60W TV
per 4 houses



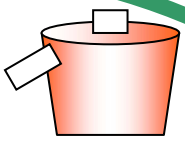
3x 20W Lights for each house

10kWh



5 baskets of
rice husk

=



1 gal of
diesel oil

2.5 ton/day
rice mill
produces

Rice husk
50 baskets
per day

Advandages and Disadvantages

ADVANTAGES

Environment friendly
CO_2 neutral,
exhaust little SOx, NOx

Ash
Can be used as fertilizer, detergent, and fuel

Short lead time
Possible to start power supply just in several months

Low initial cost
400-800$/kW including distribution lines

Local technology
Gasifier can be repaired with local resources

REQUIREMENTS

Need rice husk
If no rice husk, can not be applied

Location
Generator should be installed beside rice mill

Ventilation
Producer gas contains CO that is very hazardous to health. Operation site must be kept well ventilated to cope with gas

Storage
Whole year supply is difficult for rice husk. It needs to be stocked for Sep. and Oct. in particular.

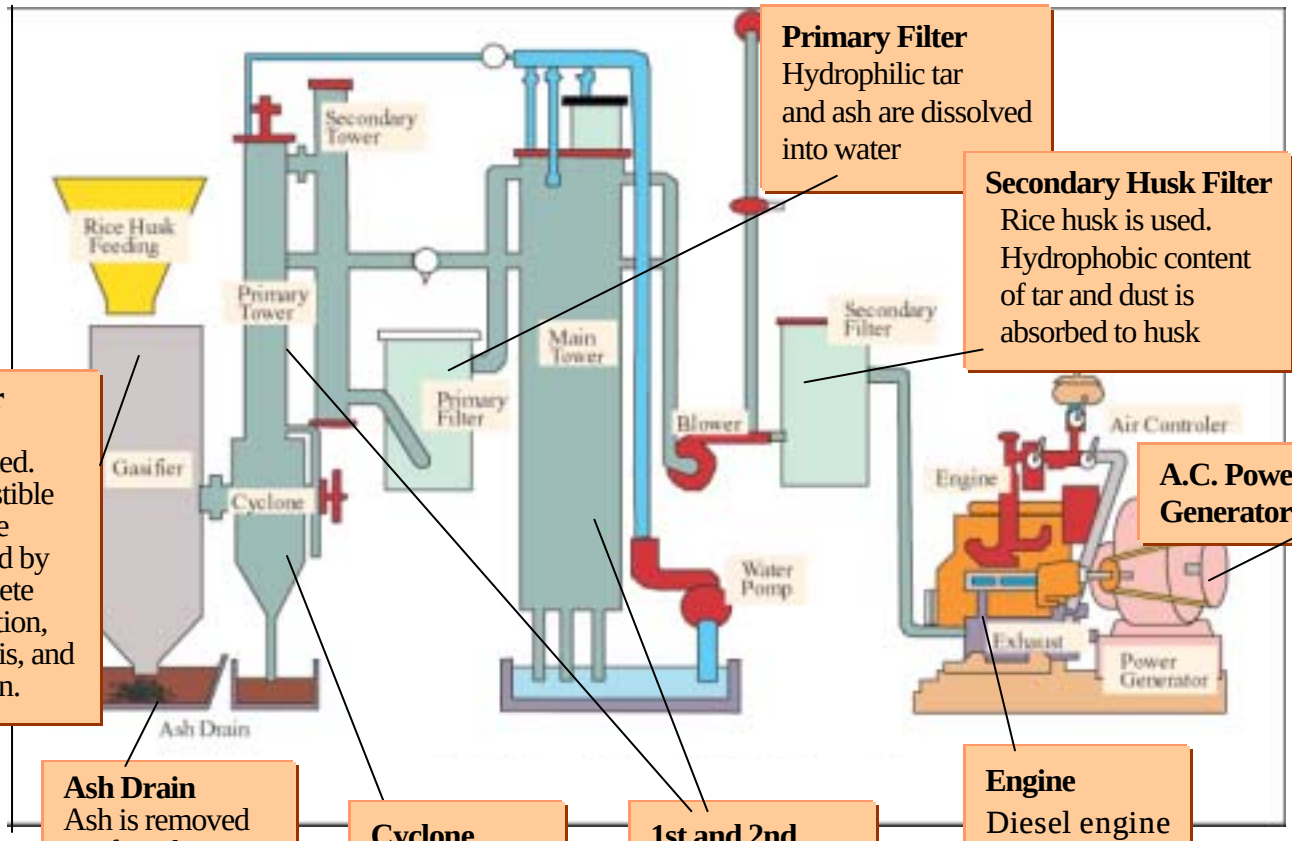
Transportation
Rice husk is bulky. Collection and transportation are costly.

DISADVANTAGES

Spear Parts
It is difficult to get spare parts when second hand engine is installed..

Maintenance
Daily cleaning of gasifier is essential.

Gasification and Power Generation System with Rice Husk



Primary Filter
Hydrophilic tar and ash are dissolved into water

Secondary Husk Filter
Rice husk is used. Hydrophobic content of tar and dust is absorbed to husk

Gasifier
Husk is humigated. Combustible gases are produced by incomplete combustion, pyrolyisis, and reduction.

A.C. Power Generator

Ash Drain
Ash is removed out from bottom of gasifier and collected in water.

Cyclone
Dust of ash is separated by centrifuge.

1st and 2nd purification
Ash is trapped by water drip.

Engine
Diesel engine

Gasifier tank (above), husk feeding to the tank (top right), and the entire system (bottom right).

How Many Rice Husks Do We Need?

Is there plenty of rice husk more than below ??

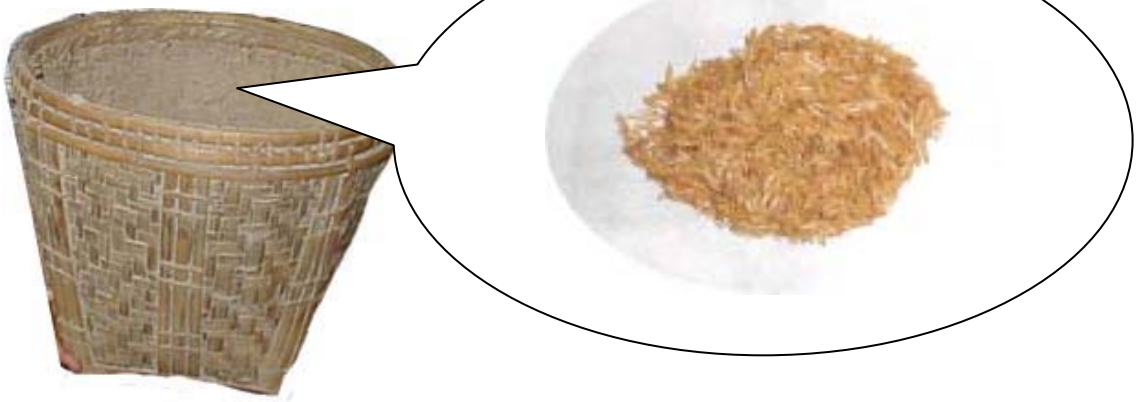
NO ?

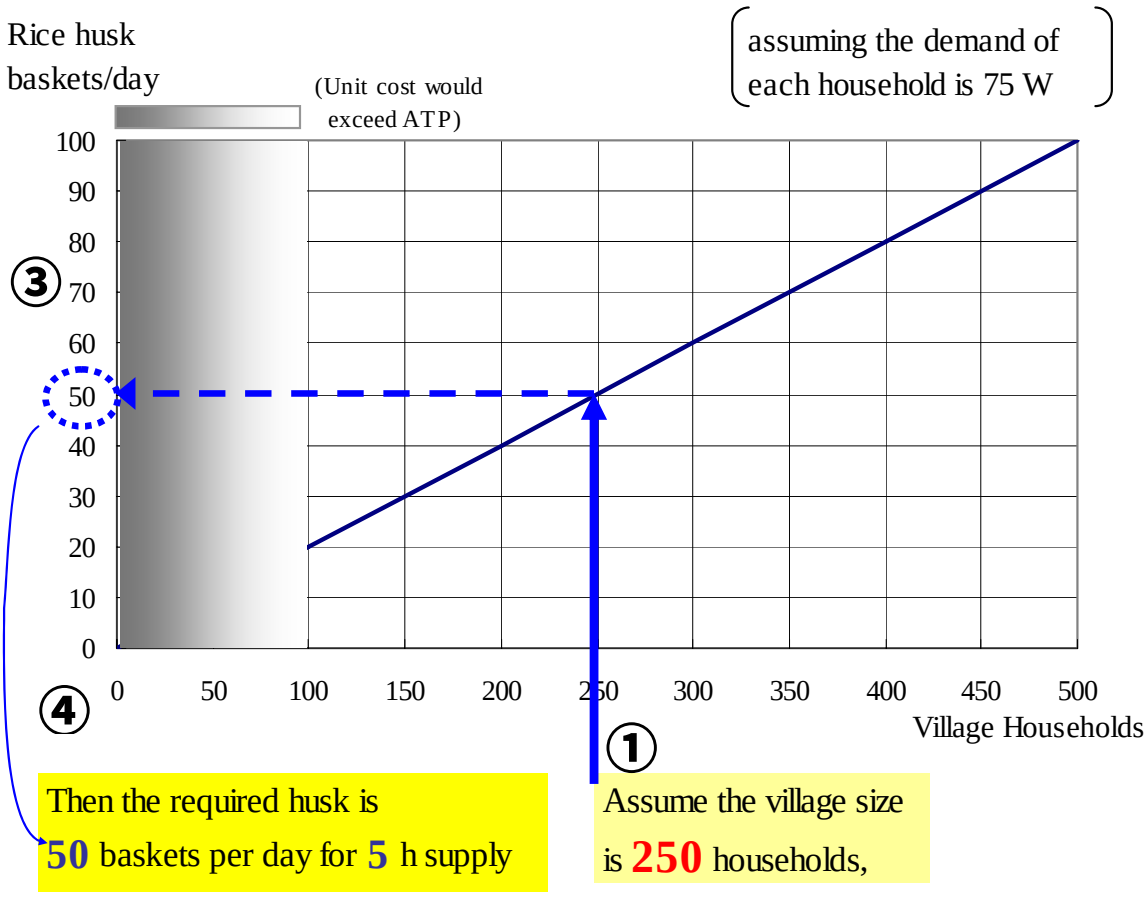
Need to look for another way, wood tip, hydro, solar, wind, etc.

Yes ?

Let's think of the Electrification by Rice Husk Gas

a





Data Sheet for Basic Planning of Biomass Gas Engine

No.	Item	Fill in	Range	Advice
1	Name of Village			
2	Division / State			
3	Distance to National Grid (km)		L > 1 km	OK. Proceed further below.
			L < 1 km	Extension of distribution line after 2005 is also possible
4	Possibility of power supply by rehabilitation of existing hydros nearby		Yes	Rehabilitation is to be studied.
			No	OK. Proceed further below.
5	Existence of suitable hydro potential site nearby		Yes	Hydropower development is to be studied first.
			No	OK. Proceed further below.
6	Existence of rice mills or sawmills nearby		Yes	OK. Proceed further below.
			No	Other power sources are to be studied again.
7	Households to be electrified		500 > H.H. > 100	OK. Proceed below.
			< 100	Solar/Wind BCS is also to be studied.
8	Distance of 230 V distribution line		< 1.0 km	OK. Proceed with your biomass plan.
			> 1.0 km	Combination with BCS is recommended.
9	List of public facilities	No. / Facility / Nos.		
		1		
		2		
		3		
		4		
		5		
		6		
10	List of village industries	No. / Industry / Nos.		
		1		
		2		
		3		
		4		
		5		
		6		
11	Ability to pay (Kyat)			
12	Notes		Capacity 10-50 kW	
			Power generation for 5-20 hr/day	
			Cost level : US$ 400-800/kW including distribution line	

4. Solar and Wind Power

Solar Home System (SHS)

Battery Charging Station (BCS)

What is Solar and Wind Energy

Infinite, renewable, and clean energy….

Advantages

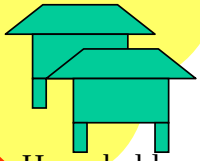
- Easy transportation and installation
- Short lead time
- Maintenance free
- No fuel needed
- Suitable to any size of village, small size in particular
- Technology and market for BCS (battery charging station) + BRS (battery recycling station) exist in Myanmar
- Life time for 20 years or more

If your village:

No hydro potential

Far from Grid

No rice husk in excess



Households less than 100

Then

The solution would be...

Solar and Wind Power

Disadvantage

-- High capital cost (getting cheaper)
-- Dependent on weather, output changes
-- Need battery to store electricity

Photovoltaics (PV)

PV panel converts sunlight into direct current electricity (D.C.).

- No moving parts, little maintenance but cleaning
- Highly reliable, long-lived
- Potential in whole Myanmar (3 kWh/m^2/day)
- International price of PV panel is currently at US$ 4.0/Wp, and would decrease to US$ 2.0/Wp by 2010

Wind Power

Blade: capture the energy from the wind.

Yaw bearing: allows a wind turbine to rotate according to wind direction.

Overdrive: converts revolutions of rotor to adequate revolutions for generator.

Brake: stop the rotor during storm or inspection.

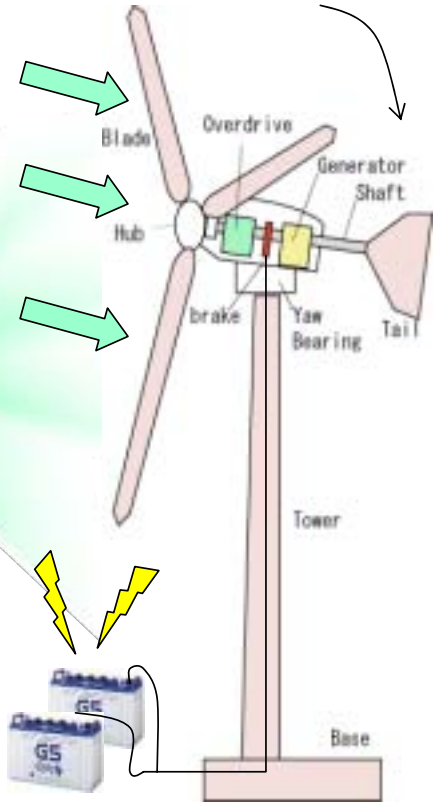


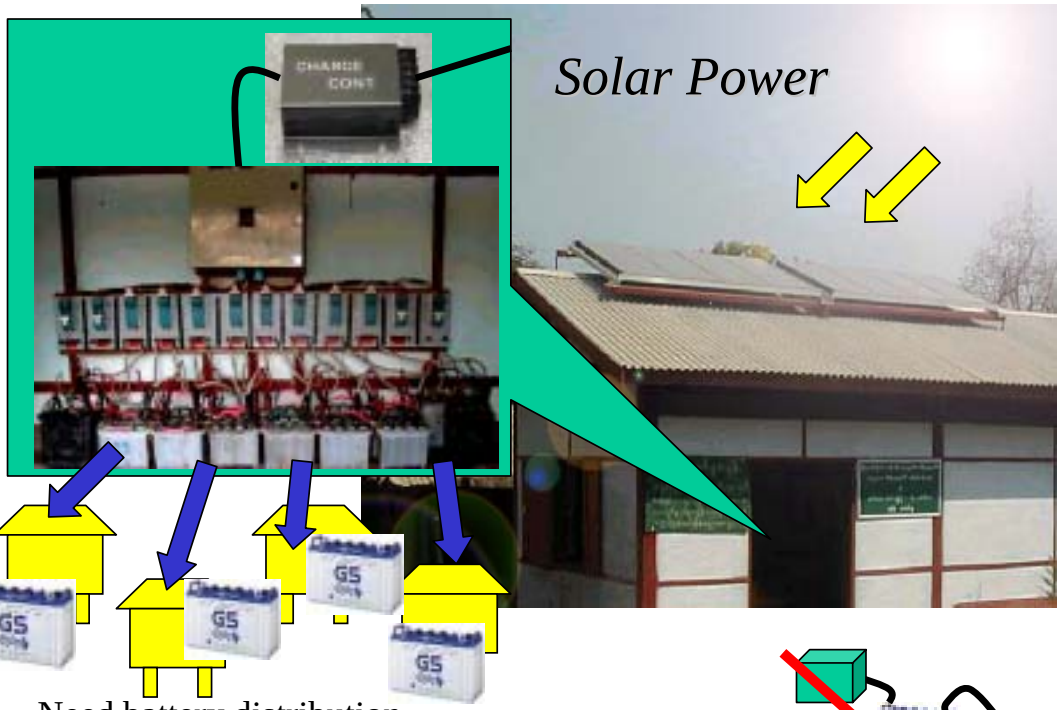
Figure Wind Power System

Wind generation is highly dependent on the wind speed. Power is proportional to the cube of wind. **2 times speed equals to 8 times generation power**.

Wind power can be generated when wind speed exceeds:

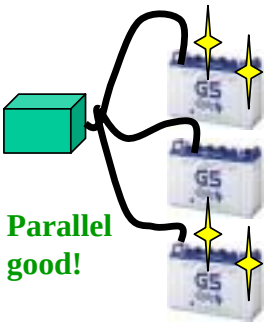
3 m/s

Solar Battery Charging Station



Need battery distribution

Serial charging damages even a new battery when connected to old and deteriorated ones. **Parallel charging** is recommended and charging history of each battery should be recorded to avoid damaging good batteries.



To prevent overcharge and over-discharge, charge controller for BCS and discharge indicator for user batteries are necessary.

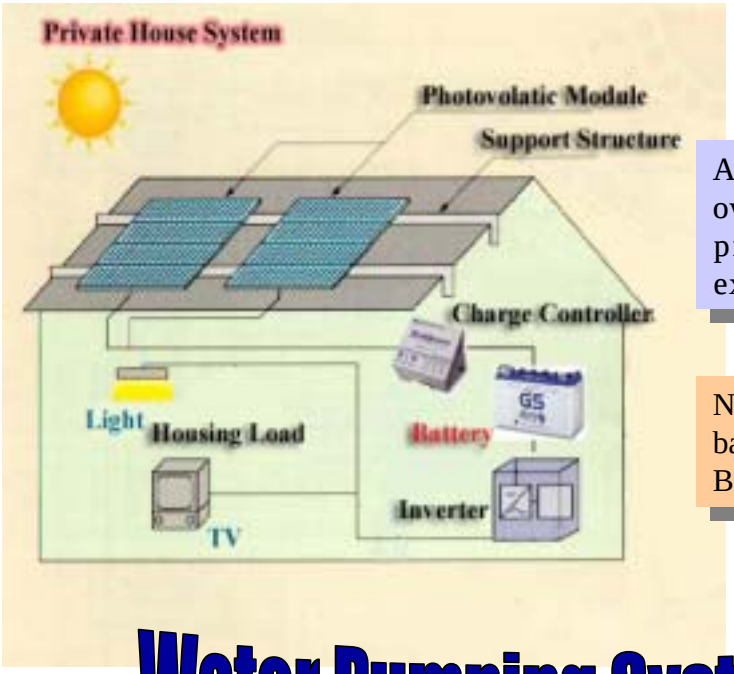
Battery recycle station (BRS) is needed for:

--Renewal of used batteries

--Supplying distilled water or of similar quality

--Neutralization of electrolyte in a battery with lime

SHS (Solar Home System)



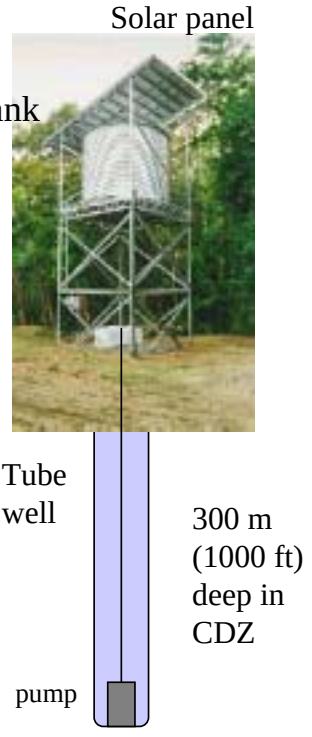
All of the system to be owned and maintained privately at villagers' own expenses.

No need of transportation of batteries between home and BCS

Water Pumping Systems by PV

For pumping up drinking water and irrigation water

As battery is not required, maintenance cost is low.



PV for Community and Health Center

- Vaccine refrigerators
- Sterilization equipment
- Water treatment and disinfection
- Emergency radios
- Ice pack freezing

Rural Health Center

School and community center

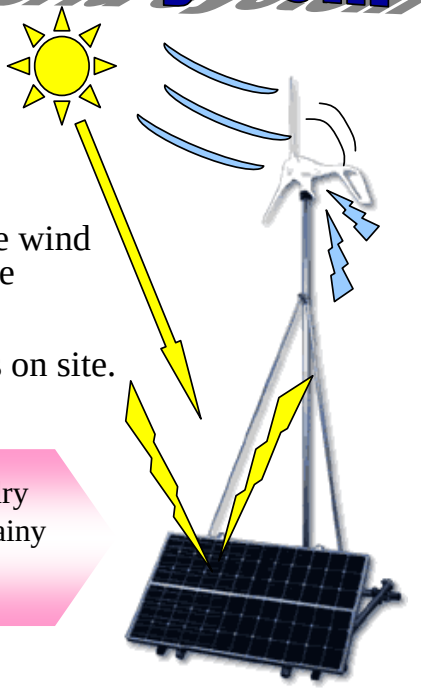
Study, homework, and communication for children at school and community center after sunset.

PV and Wind Hybrid System

In Myanmar sites where wind speed exceeds 3 m/s are limited.

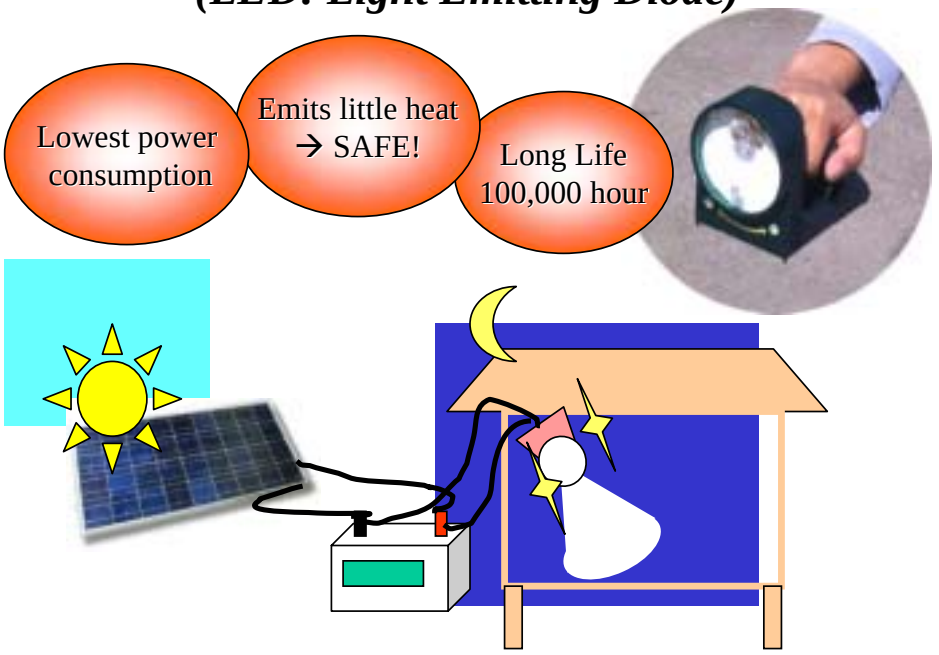
Wind potential depends on site.

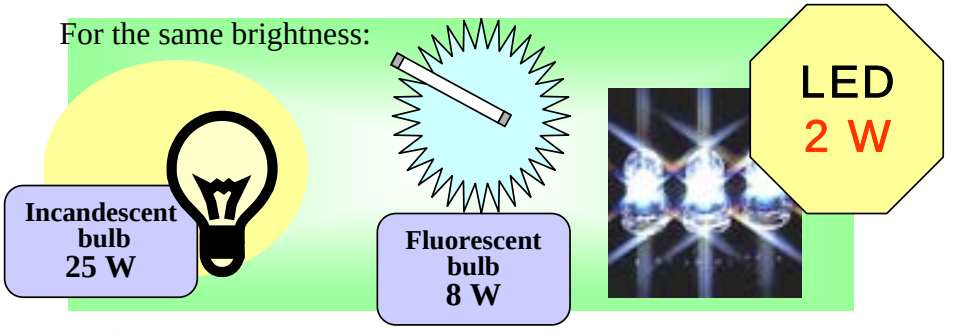
Solar to generate in the dry season and wind in the rainy season



White LED for Battery Lighting

(LED: Light Emitting Diode)





A 1.0 W white LED with solar 1.2 W panel built-in
(charge daytime by sun shine outside house)

Data Sheet for Basic Planning of Solar/Wind BCS

No.	Item	Fill in	Range	Advice
1	Name of Village			
2	Division / State			
3	Distance to National Grid (km)		L > 1 km	OK. Proceed further below.
			L < 1 km	Extension of distribution line is recommended.
4	Possibility of power supply by rehabilitation of existing hydros nearby		Yes	Rehabilitation is to be studied.
			No	OK. Proceed further below.
5	Existence of suitable hydro potential site nearby		Yes	Hydropower development is to be studied.
			No	OK. Proceed further below.
6	Existence of rice mills or sawmills nearby		Yes	Biomass gas engine is to be studied.
			No	OK. Proceed further below.
7	Accessibility to the target village from large urban centers nearby		Time < 3 hours	Other power sources are to be studied.
			Time > 3 hours	OK. Proceed below.
8	Households to be electrified		> 100	Other power sources are to be studied again.
			< 100	OK. Proceed with your solar/wind plan.

9 List of public facilities	No.	Facility	Nos.
	1		
	2		
	3		
	4		
	5		
	6		

10 List of village industries	No.	Industry	Nos.
	1		
	2		
	3		
	4		
	5		
	6		

No.	Item	Fill in	Range	Advice
11	Ability to pay (Kyat)			
12	Wind speed (m/sec) 10 minutes average every one hour for 24 hours		V_{mean} > 2.7 m/s	OK. Proceed.
			V_{mean} < 2.7 m/s	Not enough for wind power
13	Notes		Solar BCS : 0.1-3.0 kW	
			Wind BCS : 0.5-3.0 kW	
			Full RE with 24 hr not available	
			Cost level : US$ 7,000/kW_p for PV array set.	