(1-C)

$$T_{C_1} = T_A + \left(\frac{NoTc - 20}{0.8}\right) G$$

$$= 25 + \left(\frac{40-20}{0.8}\right) \times 0.8 = 45^{\circ}C$$

$$\Delta T = T_{C_2} - T_{C_1} = 56 - 45 = 11^{\circ}C$$

$$\Delta V = -2.3\ mV/^{\circ}C * 36 * 10^{-3} * 11 = 0.9108$$

$$V_{O.C_2} = 20 - 0.9108 = 19.0892V$$

(3-e)

$$\overline{T_0} + \overline{T_1} + \overline{T_2} = \frac{\overline{T}}{4}$$

$$2\overline{T_1} + \overline{T_2} = \frac{\overline{T}}{4}$$

$$\overline{T_2} = \frac{\overline{T}}{4} - 2\overline{T_1}$$

$$V_{rms} = V_{dc}\left[\frac{\overline{T_1}}{T} + \frac{4\overline{T_2}}{T}\right]^{\frac{1}{2}}$$

$$\left(\frac{120}{150}\right)^2 = \left(\left[\frac{\overline{T_1}}{T} + \frac{\overline{T} - 8\overline{T_1}}{T}\right]^{\frac{1}{2}}\right)^2$$

$$\overline{T_1} = 0.0514\,\overline{T}$$

$$\overline{T_2} = 0.147\,\overline{T}$$

c)

$$I = \frac{12W}{12V} = 1A$$

$$q' = \frac{1A \times 14h}{0.9 \times 0.97} = 16 \quad Ah$$

$$\text{The battery capacity} = \frac{16 \times 3 days}{0.8} = 60 \; Ah$$

2 batteries each 12V, 36 Ah are connected in parallel.

The winter peaksun = 4 hours.

$$\text{The array must produce } \frac{q'}{0.9} = \frac{16}{0.9} = 17.8 Ah$$

$$\text{The pv o/p current} = \frac{17.8Ah}{4h} = 4.5A$$

$$\text{The PV o/p volt} = \frac{12}{0.9} \simeq 15V$$

16V, 6A

(5) (a) hybrid

$$q' = \frac{3500w * 24h}{48V * 0.9 * 0.97 * 0.9} =$$

$q' =$ ~~882.8 Ah~~ 2227.3 Ah

$$\text{battery Capacity} = \frac{2227.3 * 4 \text{ days}}{0.8}$$

$= 11136.56$ Ah at 48V

use 1240 Ah 24V

9 // sets each has 2 inseries = 18 batt.

For summerload

$$I_{o/p} = \frac{2227.3 \text{ Ah}}{6 * 0.9} = 412.4A$$

one module deliver 17 volt, 17.4 A

$$\frac{48V}{0.9} = 53V \qquad \frac{53V}{17V} \cong 4 \text{ modules}$$

are connected inseries

$$\text{no. of connections} = \frac{412.4}{17.4A} = 24$$

connection

no. of mod = 24 x 4 = 96 mod.

To size gen.

The total energy req. of the battery system
= 11136.56Ah * 48V = 543.5 kwh

rate of charge the baltory = 10h
90% Conversion ≈

The gen = $\frac{543.5\ kwh}{10h * 0.9}$ = 59.3kw

≃ 60 kwh

inverter
o/p → 3500w
≈ = 0.9
48V → 220V

(b) utility

q' = $\frac{3500\ w}{0.9 * 0.9}$ = 4321 w

inverter ← 0.9 * 0.9 → ≈ PV

o/p power of each module = 17V * 17.4A
= 296w

No. of modules = $\frac{4321w}{296w} \simeq 15 mod.$

The modules are connected in series that deliver

17.4A & (17V * 15mod).

255V

Inverter 255V dc → 220V AC

$\eta = 0.9$

$P_o = 3500W$