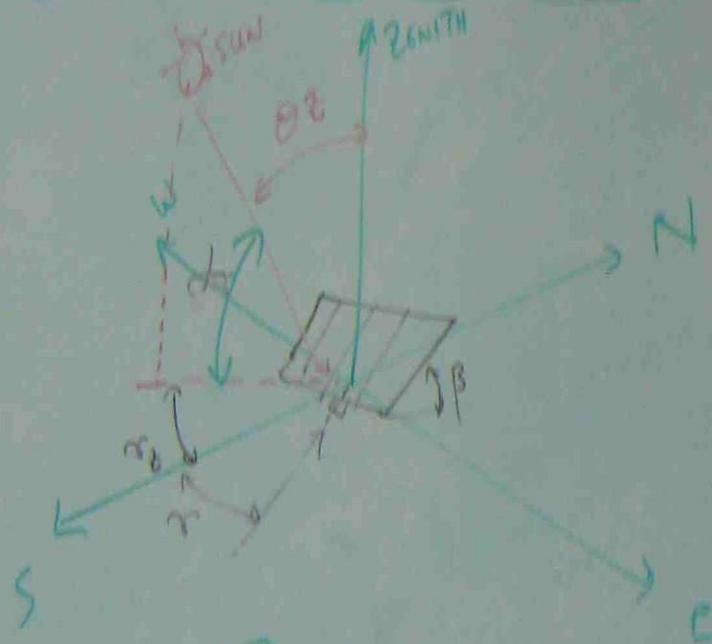


SOLAR RADIATION AND SHADING ASSESSMENT



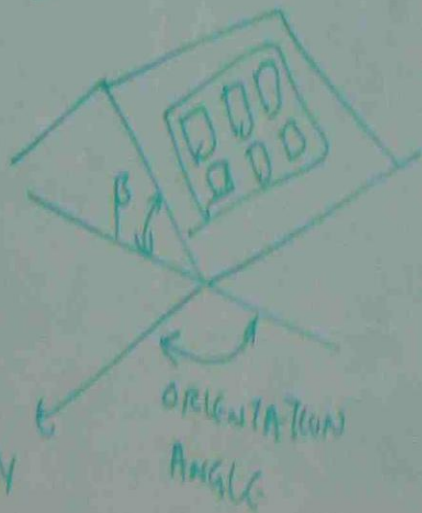
β = TILT ANGLE OF SOLAR PLANE

γ_z = AZIMUTH ANGLE OF THE SUN

γ = ORIENTATION ANGLE OF TILTED PLANE

θ_z = INCIDENCE ANGLE FOR TILTED SURFACE

α = ALTITUDE ANGLE FOR SUN



True North

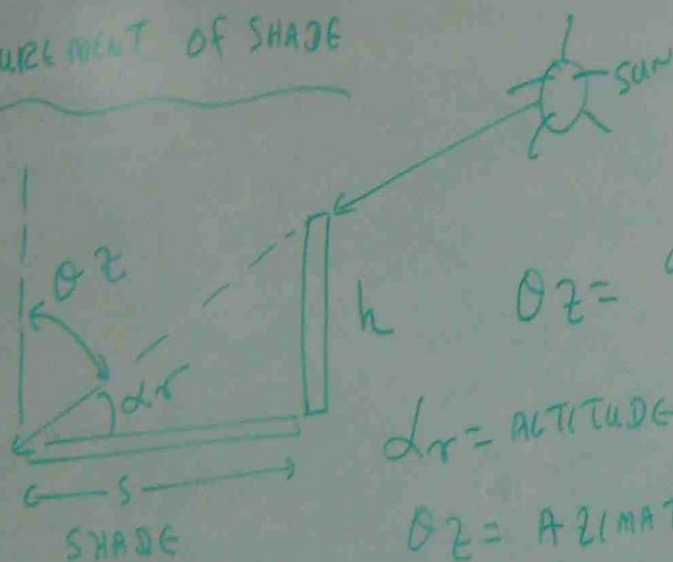
MAGNETIC NORTH

ORIENTATION ANGLE

γ ← CAN BE MEASURED BY COMPASS

β ← TILT ANGLE OF SOLAR PLANE
CAN BE MEASURED BY CLINOMETER

MEASUREMENT OF SHADE



$$\theta_z = 90 - \alpha_r$$

α_r = ALTITUDE ANGLE OF SUN

θ_z = AZIMUTH ANGLE

DAILY IRRADIATION

θ_z	LOCATION & TIME PLANE INCLINATION ANGLE (β)					
	0	10	20	30	40	--
0	mJ/m^2					
10						
20						

LOCATION / TIME

Hour	MONTH Jan	
5		
6	Hourly IRRADIANCE	
10	W/m^2	
20		

USE α_r , θ_z

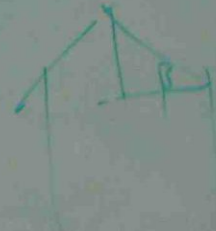
By USING IRRADIANCE

LOCATION AT SPECIFIC TIME

LOCATION / TIME

Hour	MONTH JAN	FEB	MARCH	APRIL
5	Hourly IRRADIANCE W/m^2			
6				
10				
20				

USE \angle_r , θ_z TO CALCULATE IRRADIATION
 BY USING IRRADIATION TABLE OF SPECIFIC
 LOCATION AT SPECIFIC TIME.



APPLICATION OF COMPUTER

RAD, S_a PV DES

DATA INPUT \rightarrow LOCATION

LATITUDE \rightarrow

TILT ANGLE, ORIENT
 (β)

\uparrow To be measured by
 clinometer

OUT PUT

IRRADIATION \rightarrow

H
 P
 S
 P

APPLICATION OF COMPUTER SOFTWARE TO CALCULATE IRRADIATION

RAD, S_a PV DESIGN

DATA INPUT → LOCATION

LATITUDE →

TILT ANGLE (β), ORIENTATION ANGLE (γ)

↑ To be measured by
clinometer

↓ To be measured by
compass

OUT PUT

IRRADIATION →

H - HORIZONTAL INSOLATION

H_i - INCLINED PLANE HORIZONTAL

SR - TIME OF SUN SET

SR_i - TIME OF FIRST SUN RISE

SS_i - TIME OF FIRST SUN SET



SHADING ASSESSMENT

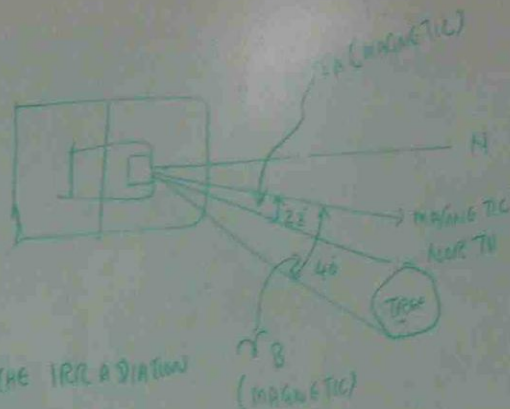
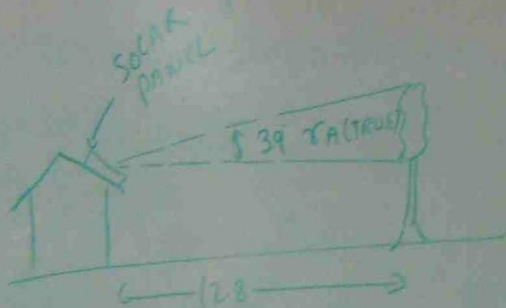
SHADING OF COLLECTORS CAN SIGNIFICANTLY REDUCE THE OUTPUT FROM THE SOLAR ENERGY SYSTEM AND OCCURS DUE TO NEARBY OBSTACLES SUCH AS VEGETATION, BUILDINGS ETC.

- SHADING ASSESSMENT CAN BE MADE BY USING COMPASS AND INCLINOMETER
- SOLAR PATH FINDER CAN ALSO BE USED FOR SHADING ASSESSMENT.

MANUAL SHADING ASSESSMENT

- PLOT THE OBSTACLES CAUSING SHADING ON THE SUN PATH DIAGRAM
- USE IRRADIATION DATA TABLE FOR HOURLY IRRADIANCE
- THEN SHADDED AMOUNT IS DEDUCTED FROM DAILY IRRADIATION.

Pb



METER

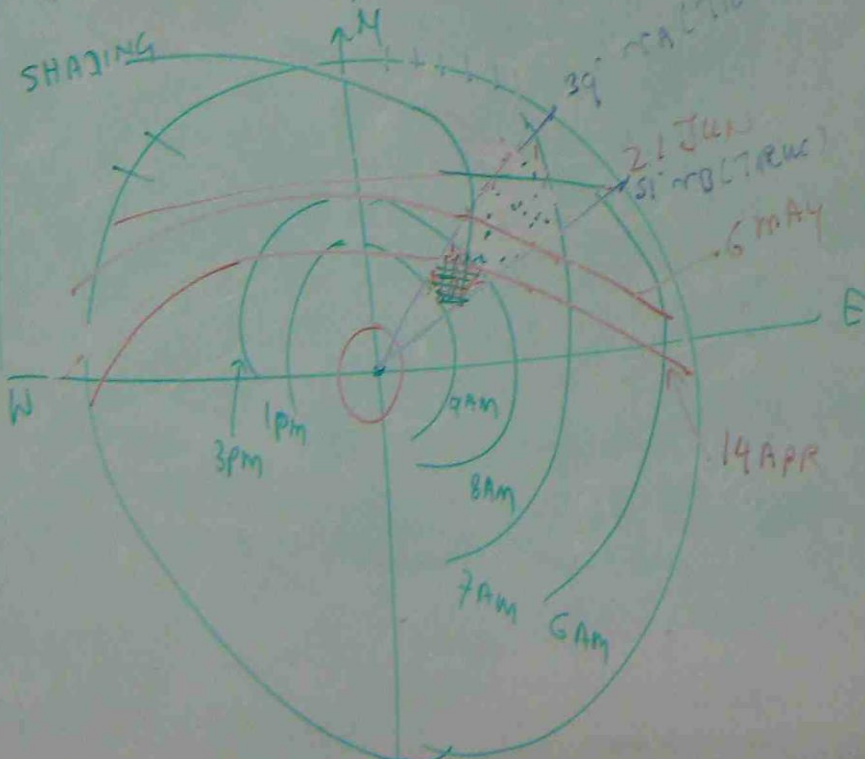
LOCATION - BRISBANE, CALCULATE THE IRRADIATION EFFECTED BY SHADING

BRISBANE
LATITUDE = 27

$\gamma_A (\text{TRUE}) = 39$, $\gamma_A (\text{MAGNETIC}) = 28$, $\gamma_B (\text{MAGNETIC}) = 40$

$\gamma_B (\text{TRUE}) = 90 - \gamma_A (\text{TRUE})$
 $= 90 - 39 = 51$

SHADING



SHADING TIME

DATE	TIME
15 APR	9:30 → 9:40
15 MAY	8:45 → 9:45
15 JUN	8:30 → 9:30

