	PVSYST V5.05		19/04/10	Page 1/6
<div>Stand Alone System: Simulation parameters</div>				
<div>Project :South Africa Solar Challenge</div>				
<div>Geographical Site</div>		<div>Johannesburg</div>	<div>Country</div>	<div>South Africa</div>
<div>Situation</div>		<div>Latitude 26.2°S</div>	<div>Longitude 28.0°E</div>	
<div>Time defined as</div>		<div>Legal Time Time zone UT+1</div>	<div>Altitude 1649 m</div>	
<div>Albedo 0.20</div>				
<div>Meteo data :</div>		<div>Johannesburg, Synthetic Hourly data</div>		
<div>Simulation variant :Johannesburgo middle cell</div>				
		<div>Simulation date 19/04/10 12h39</div>		
<div>Simulation parameters</div>				
<div>Collector Plane Orientation</div>		<div>Tilt 0°</div>	<div>Azimuth 0°</div>	
<div>Horizon</div>		<div>Average Height 3.0°</div>		
<div>Near Shadings</div>		<div>According to strings</div>	<div>Electrical effect 80 %</div>	
<div>PV Array Characteristics</div>				
<div>PV module</div>		<div>Si-mono Model</div>	<div>Electric car 39 cell middle</div>	
		<div>Manufacturer Electric car cell</div>		
<div>Number of PV modules</div>		<div>In series 1 modules</div>	<div>In parallel 20 strings</div>	
<div>Total number of PV modules</div>		<div>Nb. modules 20</div>	<div>Unit Nom. Power 52 Wp</div>	
<div>Array global power</div>		<div>Nominal (STC) 1.04 kWp</div>	<div>At operating cond. 973 Wp (50°C)</div>	
<div>Array operating characteristics (50°C)</div>		<div>U mpp 18 V</div>	<div>I mp p 53 A</div>	
<div>Total area</div>		<div>Module area 6.0 m²</div>	<div>Cell area 12.0 m²</div>	
<div>PV Array loss factors</div>				
<div>Thermal Loss factor</div>		<div>Uc (const) 29.0 W/m²K</div>	<div>Uv (wind) 0.0 W/m²K / m/s</div>	
<div>=&gt; Nominal Oper. Coll. Temp. (G=800 W/m², Tamb=20°C, Wind velocity = 1m/s.)</div>		<div>NOCT 45 °C</div>		
<div>Wiring Ohmic Loss</div>		<div>Global array res. 5.6 mOhm</div>	<div>Loss Fraction 1.4 % at STC</div>	
<div>Serie Diode Loss</div>		<div>Voltage Drop 0.7 V</div>	<div>Loss Fraction 3.4 % at STC</div>	
<div>Module Quality Loss</div>			<div>Loss Fraction 3.0 %</div>	
<div>Module Mismatch Losses</div>			<div>Loss Fraction 2.0 % at MPP</div>	
<div>Incidence effect, ASHRAE parametrization</div>		<div>IAM = 1 - bo (1/cos i - 1)</div>	<div>bo Parameter 0.05</div>	
<div>System Parameter</div>		<div>System typeStand Alone System</div>		
<div>Battery</div>		<div>ModelCompact Power</div>		
		<div>Manufacturer Oerlikon</div>		
<div>Battery Pack Characteristics</div>		<div>Voltage 48 V</div>	<div>Nominal Capacity 39 Ah</div>	
		<div>Nb. of units 4 in series</div>		
		<div>Temperature Fixed (20°C)</div>		
<div>Regulator</div>		<div>ModelGeneric Default with MPPT converter</div>		
		<div>Technology MPPT converter</div>	<div>Temp coeff. -5.0 mV/°C/elem.</div>	
<div>Converter</div>		<div>Maxi and EURO efficiencies 96.0/94.0 %</div>		
<div>Battery Management Thresholds</div>		<div>Charging 54.0/52.3 V</div>	<div>Discharging 47.0/50.4 V</div>	
		<div>Back-Up Genset Command 47.3/51.6 V</div>		
<div>User's needs :</div>		<div>Daily household consumers averageConstant over the year 4.9 kWh/Day</div>		

## Stand Alone System: Horizon definition

**Project :** South Africa Solar Challenge

**Simulation variant :** Johannesburgo middle cell

### Main system parameters

#### Horizon

#### Near Shadings

PV Field Orientation

PV Array

Battery

battery Pack

User's needs

System type

Average Height

According to strings

tilt

Nb. of modules

Model

Nb. of units

Daily household consumers

**Stand alone**

3.0°

0°

20

Compact Power

4

Constant over the year

azimuth

0°

Pnom total

**1.04 kWp**

Technology

sealed, plates

Voltage / Capacity

**48 V / 39 Ah**

global

1788 kWh/year

### Horizon

Average Height

3.0°

Albedo Factor

100 %

Diffuse Factor

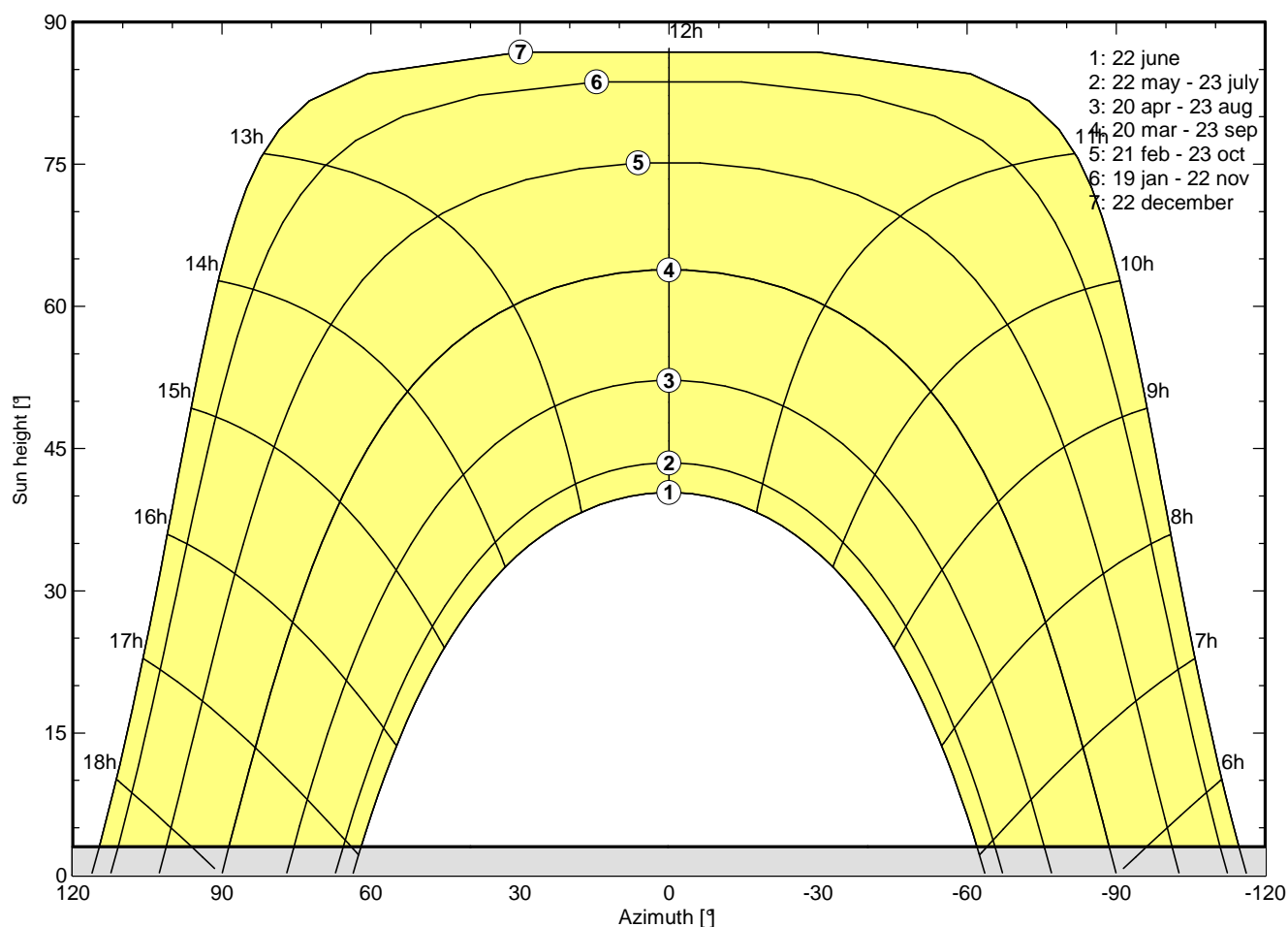
1.00

Albedo Fraction

0.00

Height [°]	3.0	3.0	3.0	3.0	3.0
Azimuth [°]	-120	-40	0	40	120

### Horizon line at Johannesburg, (Lat. 26.2°S, long. 28.0°E, alt. 1649 m)



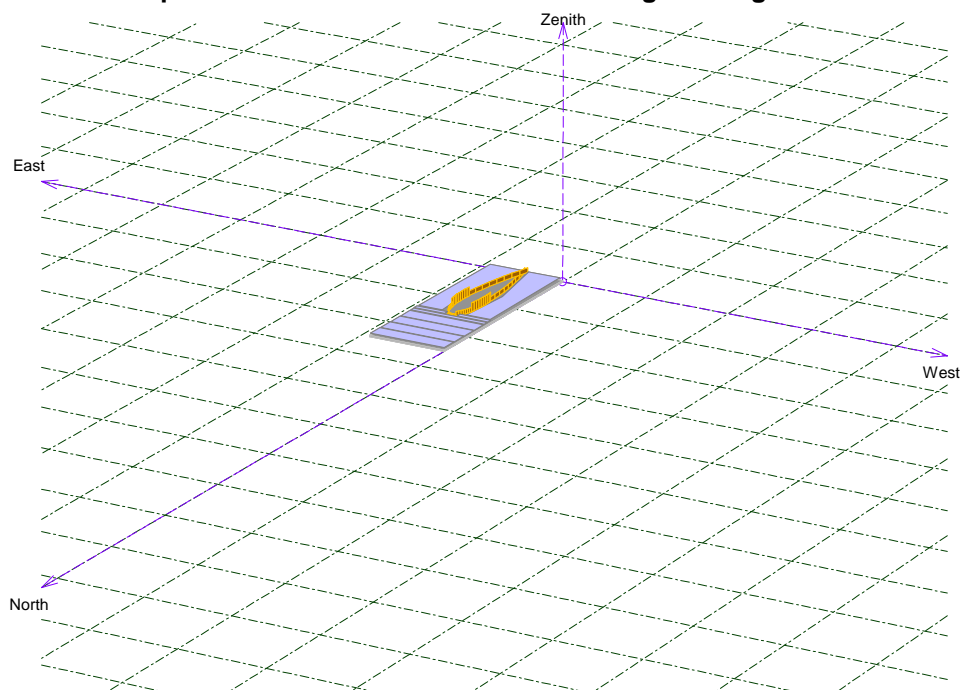
## Stand Alone System: Near shading definition

**Project :** South Africa Solar Challenge

**Simulation variant :** Johannesburgo middle cell

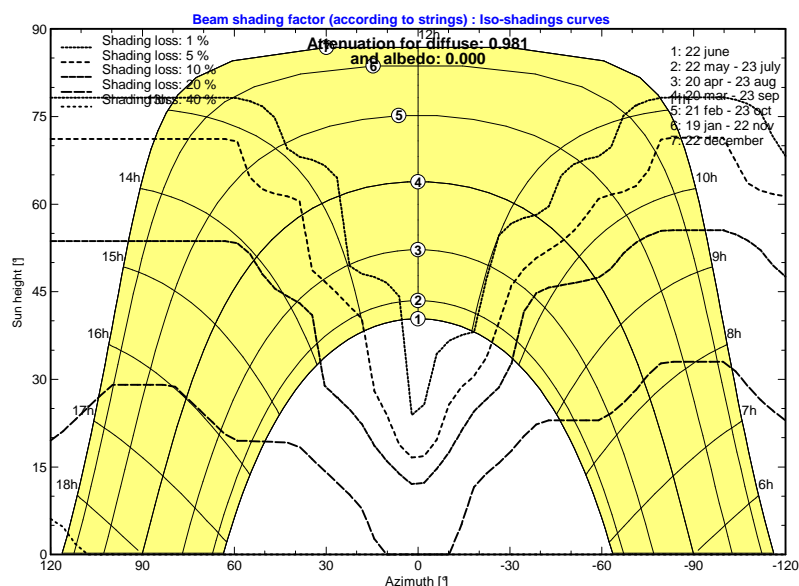
<b>Main system parameters</b>	System type	<b>Stand alone</b>	
<b>Horizon</b>	Average Height	3.0°	
<b>Near Shadings</b>	According to strings		
PV Field Orientation	tilt	0°	azimuth 0°
PV Array	Nb. of modules	20	Pnom total <b>1.04 kWp</b>
Battery	Model	Compact Power	Technology sealed, plates
battery Pack	Nb. of units	4	Voltage / Capacity <b>48 V / 39 Ah</b>
User's needs	Daily household consumers	Constant over the year	global 1788 kWh/year

### Perspective of the PV-field and surrounding shading scene



### Iso-shadings diagram

South Africa Solar Challenge: Solar car1



## Stand Alone System: Detailed User's needs

**Project :** **South Africa Solar Challenge**

**Simulation variant :** **Johannesburgo middle cell**

<b>Main system parameters</b>	System type	<b>Stand alone</b>		
<b>Horizon</b>	Average Height	3.0°		
<b>Near Shadings</b>	According to strings			
PV Field Orientation	tilt	0°	azimuth	0°
PV Array	Nb. of modules	20	Pnom total	<b>1.04 kWp</b>
Battery	Model	Compact Power	Technology	sealed, plates
battery Pack	Nb. of units	4	Voltage / Capacity	<b>48 V / 39 Ah</b>
User's needs	Daily household consumers	Constant over the year	global	1788 kWh/year

**Daily household consumers, Constant over the year, average = 4.9 kWh/day**

### Annual values

	Number	Power	Use	Energy
Other uses	1	700 W tot	7 h/day	4900 Wh/day
Total daily energy				4900 Wh/day

## Stand Alone System: Main results

**Project :** South Africa Solar Challenge

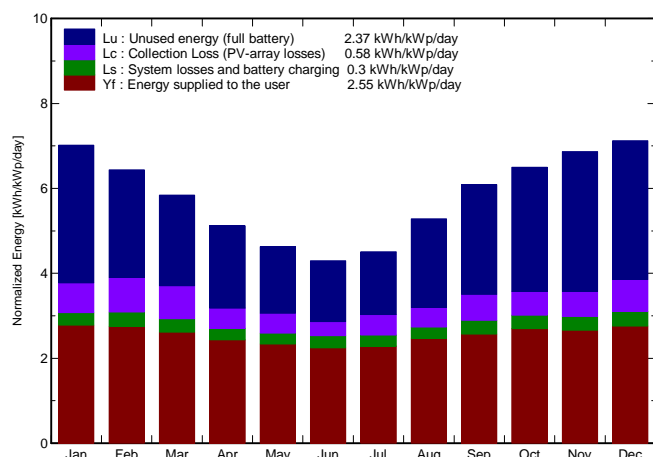
**Simulation variant :** Johannesburgo middle cell

<b>Main system parameters</b>	System type	<b>Stand alone</b>
<b>Horizon</b>	Average Height	3.0°
<b>Near Shadings</b>	According to strings	
PV Field Orientation	tilt	0°
PV Array	Nb. of modules	20
Battery	Model	Compact Power
battery Pack	Nb. of units	4
User's needs	Daily household consumers	Constant over the year
	azimuth	0°
	Pnom total	<b>1.04 kWp</b>
	Technology	sealed, plates
	Voltage / Capacity	<b>48 V / 39 Ah</b>
	global	1788 kWh/year

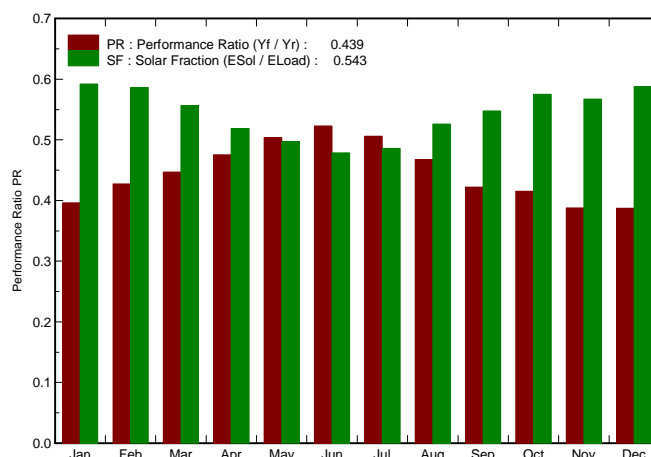
### Main simulation results

System Production	<b>Available Energy</b>	<b>2008 kWh/year</b>	Specific prod.	1923 kWh/kWp/year
	Used Energy	971 kWh/year	Excess (unused)	904 kWh/year
	Performance Ratio PR	43.9 %	Solar Fraction SF	54.3 %
Loss of Load	Time Fraction	44.8 %	Missing Energy	817 kWh

Normalized productions (per installed kWp): Nominal power 1.04 kWp



Performance Ratio PR and Solar Fraction SF



### Johannesburgo middle cell

#### Balances and main results

	GlobHor kWh/m²	GlobEff kWh/m²	E Avail kWh	EUnused kWh	E Miss kWh	E User kWh	E Load kWh	SolFrac
January	217.6	200.4	206.7	104.9	61.93	89.97	151.9	0.592
February	180.3	165.8	170.6	74.1	56.78	80.42	137.2	0.586
March	181.2	166.0	168.9	69.1	67.36	84.54	151.9	0.557
April	153.6	139.4	144.1	60.8	70.74	76.26	147.0	0.519
May	143.5	127.9	137.2	50.7	76.38	75.52	151.9	0.497
June	128.8	113.3	118.9	44.7	76.68	70.32	147.0	0.478
July	139.7	123.2	131.5	47.7	78.07	73.83	151.9	0.486
August	163.8	147.0	158.9	67.6	71.99	79.91	151.9	0.526
September	182.7	165.9	174.3	81.0	66.46	80.54	147.0	0.548
October	201.5	185.0	191.6	94.7	64.55	87.35	151.9	0.575
November	206.1	190.1	196.9	103.4	63.59	83.41	147.0	0.567
December	220.9	203.1	208.1	105.7	62.63	89.27	151.9	0.588
Year	2119.7	1927.0	2007.6	904.4	817.16	971.34	1788.5	0.543

Legends:	GlobHor	Horizontal global irradiation	E Miss	Missing energy
	GlobEff	Effective Global, corr. for IAM and shadings	E User	Energy supplied to the user
	E Avail	Available Solar Energy	E Load	Energy need of the user (Load)
	EUnused	Unused energy (full battery) loss	SolFrac	Solar fraction (EUsed / ELoad)

## Stand Alone System: Loss diagram

**Project :** South Africa Solar Challenge

**Simulation variant :** Johannesburgo middle cell

<b>Main system parameters</b>	System type	<b>Stand alone</b>		
<b>Horizon</b>	Average Height	3.0°		
<b>Near Shadings</b>	According to strings			
PV Field Orientation	tilt	0°	azimuth	0°
PV Array	Nb. of modules	20	Pnom total	<b>1.04 kWp</b>
Battery	Model	Compact Power	Technology	sealed, plates
battery Pack	Nb. of units	4	Voltage / Capacity	<b>48 V / 39 Ah</b>
User's needs	Daily household consumers	Constant over the year	global	1788 kWh/year

### Loss diagram over the whole year

