

Grid-Connected System: Simulation parameters

Project : EcoSmart SunMine

Geographical Site Cranbrook **Country** Canada

Situation Latitude 49.6°N Longitude 115.8°W
 Time defined as Legal Time Time zone UT-8 Altitude 940 m

Monthly albedo values

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Albedo	0.50	0.50	0.35	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.35	0.50

Meteo data : Cranbrook, Canada EPW

Simulation variant : SunMine Pilot 2MWp

Simulation date 20/11/12 19h40

Simulation parameters

Tracking plane, Vertical Axis Plane Tilt 57°
 Rotation Limitations Minimum Azimuth -120° Maximum Azimuth 120°

Models used Transposition Perez Diffuse Measured

Horizon Average Height 2.4°

Near Shadings Linear shadings

PV Array Characteristics

PV module Si-poly Model **TSM-290PC14 APP01**
 Manufacturer Trina Solar
 Number of PV modules In series 12 modules In parallel 572 strings
 Total number of PV modules Nb. modules 6864 Unit Nom. Power 290 Wp
 Array global power Nominal (STC) **1991 kWp** At operating cond. 1767 kWp (50°C)
 Array operating characteristics (50°C) U mpp 388 V I m pp 4552 A
 Total area Module area **13319 m²** Cell area 12029 m²

Inverter Model **SGI500-480V APP01**
 Manufacturer Solectria
 Characteristics Operating Voltage 300-500 V Unit Nom. Power 500 kW AC
 Inverter pack Number of Inverter 4 units Total Power 2000 kW AC

PV Array loss factors

Thermal Loss factor U_c (const) 25.0 W/m²K U_v (wind) 1.2 W/m²K / m/s
 => Nominal Oper. Coll. Temp. (G=800 W/m², T_{amb}=20°C, Wind=1 m/s.) NOCT 47 °C

Wiring Ohmic Loss Global array res. 1.4 mOhm Loss Fraction 1.4 % at STC

Array Soiling Losses

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
9.0%	4.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	3.0%	8.0%

Module Quality Loss Loss Fraction 1.8 %

Module Mismatch Losses Loss Fraction 0.4 % at MPP

Incidence effect, ASHRAE parametrization IAM = 1 - b₀ (1/cos i - 1) b₀ Parameter 0.05



Grid-Connected System: Horizon definition

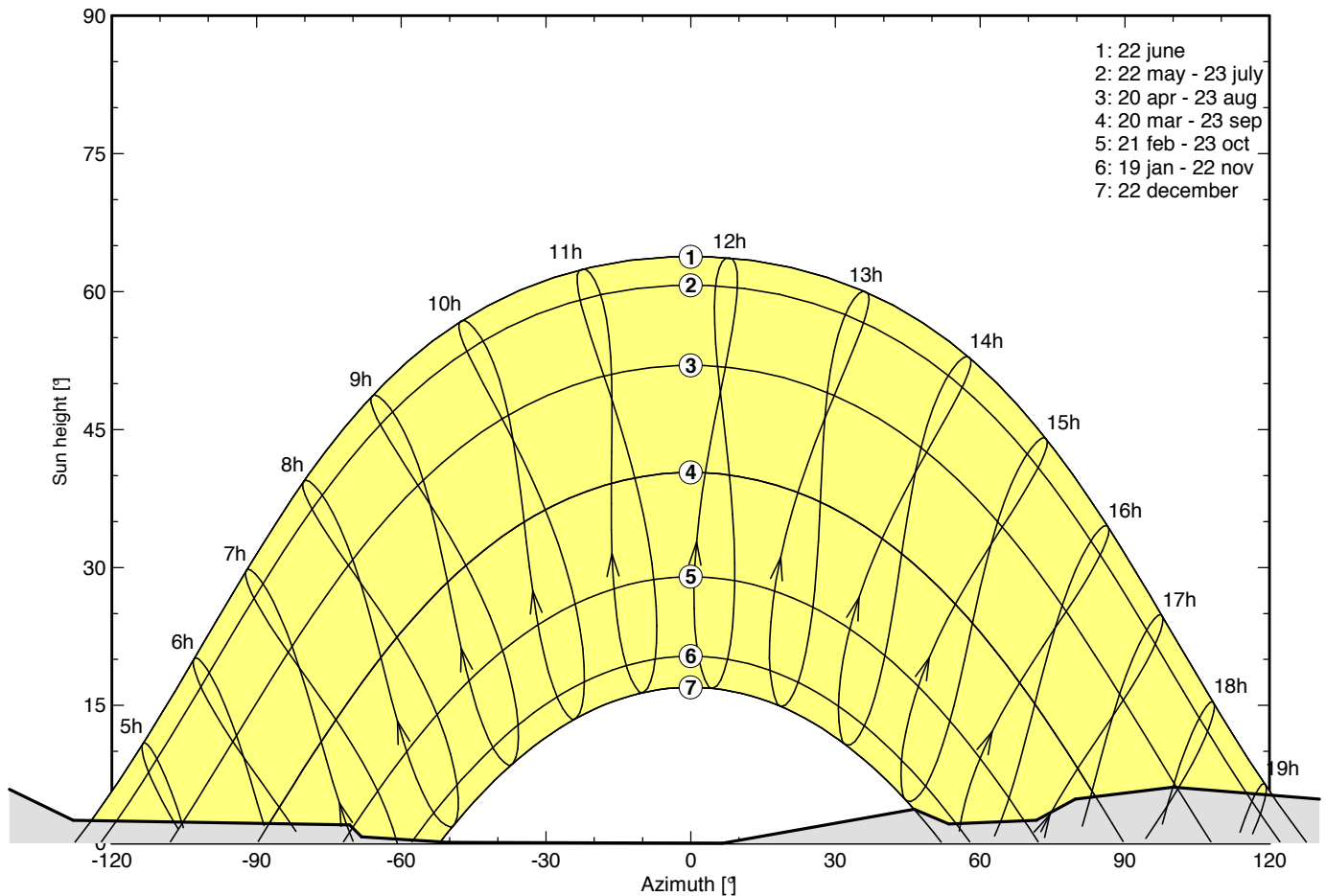
Project : EcoSmart SunMine
Simulation variant : SunMine Pilot 2MWp

Main system parameters	System type	Grid-Connected	
Horizon	Average Height	2.4°	
Near Shadings	Linear shadings		
PV Field Orientation	Tracking plane, Vertical Axis, Plane Tilt	57°	
PV modules	Model	TSM-290PC14 APP01	Pnom 290 Wp
PV Array	Nb. of modules	6864	Pnom total 1991 kWp
Inverter	Model	SGI500-480V APP01	Pnom 500 kW ac
Inverter pack	Nb. of units	4.0	Pnom total 2000 kW ac
User's needs	Unlimited load (grid)		

Horizon	Average Height	2.4°	Diffuse Factor	0.99
	Albedo Factor	100 %	Albedo Fraction	0.95

Height [°]	6.6	2.5	2.0	0.7	0.1	0.0	3.7	2.1	2.5	4.8	6.1	4.6
Azimuth [°]	-144	-128	-71	-68	-50	6	46	53	72	80	100	135

SunMine Horizon Line

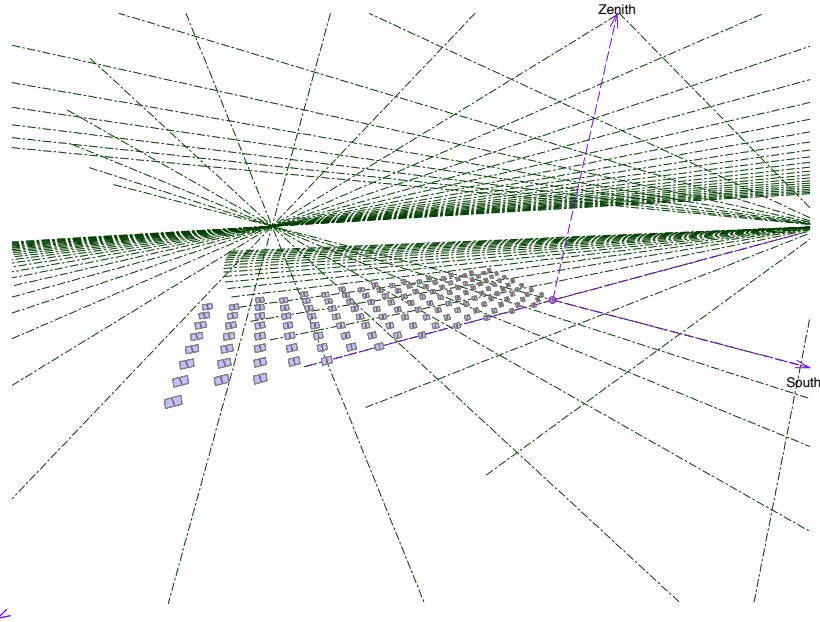


Grid-Connected System: Near shading definition

Project : EcoSmart SunMine
Simulation variant : SunMine Pilot 2MWp

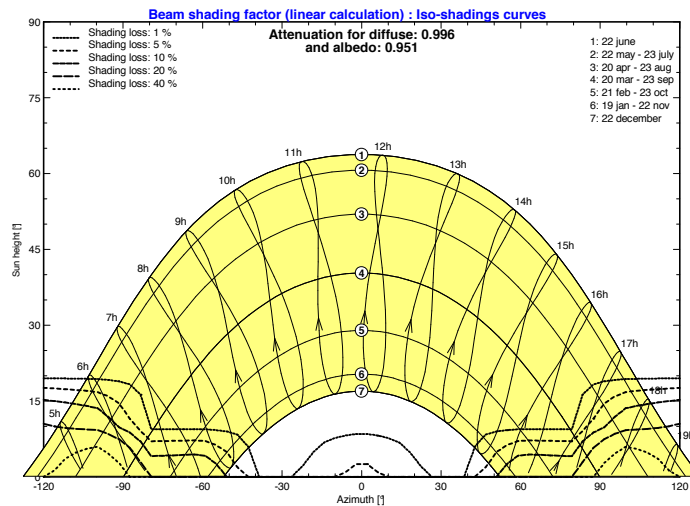
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PV Field Orientation	Tracking plane, Vertical Axis, Plane Tilt	57°		
PV modules	Model	TSM-290PC14 APP01	Pnom	290 Wp
PV Array	Nb. of modules	6864	Pnom total	1991 kWp
Inverter	Model	SGI500-480V APP01	Pnom	500 kW ac
Inverter pack	Nb. of units	4.0	Pnom total	2000 kW ac
User's needs	Unlimited load (grid)			

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

EcoSmart SunMine: SunMine_RealCase_01





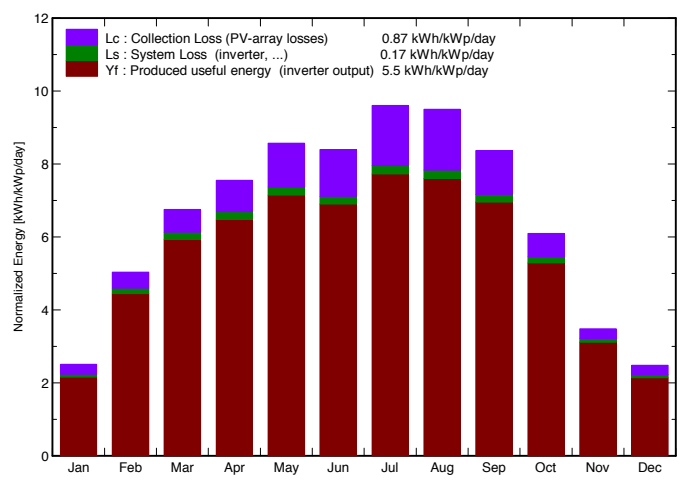
Grid-Connected System: Main results

Project : EcoSmart SunMine
Simulation variant : SunMine Pilot 2MWp

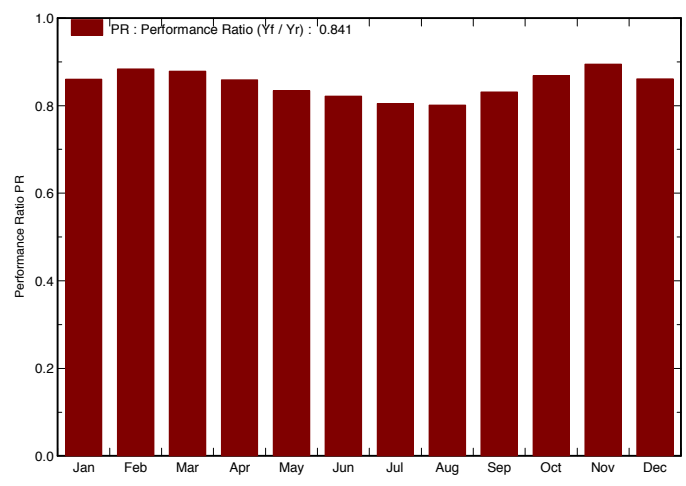
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User's needs	Unlimited load (grid)	
	Pnom	290 Wp
	Pnom total	1991 kWp
	Pnom	500 kW ac
	Pnom total	2000 kW ac

Main simulation results
System Production **Produced Energy 3996 MWh/year** Specific prod. 2008 kWh/kWp/year
Performance Ratio PR **84.1 %**

Normalized productions (per installed kWp): Nominal power 1991 kWp



Performance Ratio PR



**SunMine Pilot 2MWp
Balances and main results**

	GlobHor	T Amb	GlobInc	GlobEff	EArray	E_Grid	EffArrR	EffSysR
	kWh/m ²	°C	kWh/m ²	kWh/m ²	MWh	MWh	%	%
January	36.1	-7.90	78.0	74.8	138.3	133.6	13.32	12.86
February	66.2	-3.23	141.1	135.2	256.2	248.2	13.64	13.21
March	109.5	2.41	209.5	201.2	378.4	366.5	13.56	13.13
April	143.0	5.99	226.7	214.3	399.7	387.4	13.24	12.83
May	178.4	10.54	265.8	248.2	454.8	441.4	12.85	12.47
June	175.6	14.36	251.9	236.8	424.9	412.2	12.66	12.29
July	197.8	18.66	297.7	280.1	491.1	476.8	12.39	12.03
August	182.3	17.29	294.4	277.7	483.6	469.6	12.33	11.98
September	132.1	11.66	251.1	240.3	428.3	415.6	12.80	12.42
October	86.0	5.40	188.9	181.5	336.9	326.7	13.39	12.98
November	39.9	-2.03	104.6	100.8	192.6	186.4	13.82	13.38
December	29.3	-6.56	77.1	73.7	136.9	132.1	13.34	12.87
Year	1376.0	5.60	2386.7	2264.7	4121.7	3996.4	12.97	12.57

Legends: GlobHor Horizontal global irradiation EArray Effective energy at the output of the array
T Amb Ambient Temperature E_Grid Energy injected into grid
GlobInc Global incident in coll. plane EffArrR Effic. Eout array / rough area
GlobEff Effective Global, corr. for IAM and shadings EffSysR Effic. Eout system / rough area



Grid-Connected System: Loss diagram

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Loss diagram over the whole year

