8 Windsor Square, Silver Street - RG1 2TH - Reading - United Kingdom

Grid-Connected System: Simulation parameters

Project : **Q5571 Maria Fidelis Catholic School**

Geographical Site	**Maria Fidelis CS, NW1 1TA**		Country	**United Kingdom**
Situation	Latitude	51.5°N	Longitude	0.1°W
Time defined as	Legal Time	Time zone UT	Altitude	21 m
	Albedo	0.20		
Meteo data:	**Maria Fidelis CS, NW1 1TA**	Synthetic - Meteonorm 7.1 (1986-2005)		

Simulation variant : **Simulation v9-0**

Simulation date 29/09/17 15h56

Simulation parameters

3 orientations	Tilts/Azimuths	10°/-13°, 10°/-32°, 10°/0°		
Models used	Transposition	Perez	Diffuse	Erbs, Meteonorm
Horizon	Free Horizon			
Near Shadings	Linear shadings			

PV Arrays Characteristics (8 kinds of array defined)

PV module Si-poly — Model **TSM-275 PD05**, Manufacturer Trina Solar

Sub-array "R1S1"	Orientation	#1	Tilt/Azimuth	10°/-13°
Number of PV modules	In series	23 modules	In parallel	2 strings
Total number of PV modules	Nb. modules	46	Unit Nom. Power	275 Wp
Array global power	Nominal (STC)	**12.65 kWp**	At operating cond.	11.38 kWp (50°C)
Array operating characteristics (50°C)	U mpp	649 V	I mpp	18 A
Sub-array "R1S2"	Orientation	#3	Tilt/Azimuth	10°/0°
Number of PV modules	In series	20 modules	In parallel	1 strings
Total number of PV modules	Nb. modules	20	Unit Nom. Power	275 Wp
Array global power	Nominal (STC)	**5.50 kWp**	At operating cond.	4946 Wp (50°C)
Array operating characteristics (50°C)	U mpp	564 V	I mpp	8.8 A
Sub-array "R2S2, R2S3"	Orientation	#3	Tilt/Azimuth	10°/0°
Number of PV modules	In series	15 modules	In parallel	4 strings
Total number of PV modules	Nb. modules	60	Unit Nom. Power	275 Wp
Array global power	Nominal (STC)	**16.50 kWp**	At operating cond.	14.84 kWp (50°C)
Array operating characteristics (50°C)	U mpp	423 V	I mpp	35 A
Sub-array "R1S2"	Orientation	#1	Tilt/Azimuth	10°/-13°
Number of PV modules	In series	23 modules	In parallel	2 strings
Total number of PV modules	Nb. modules	46	Unit Nom. Power	275 Wp
Array global power	Nominal (STC)	**12.65 kWp**	At operating cond.	11.38 kWp (50°C)
Array operating characteristics (50°C)	U mpp	649 V	I mpp	18 A
Sub-array "R3S2, R2S3"	Orientation	#2	Tilt/Azimuth	10°/-32°
Number of PV modules	In series	21 modules	In parallel	4 strings
Total number of PV modules	Nb. modules	84	Unit Nom. Power	275 Wp
Array global power	Nominal (STC)	**23.10 kWp**	At operating cond.	20.77 kWp (50°C)
Array operating characteristics (50°C)	U mpp	592 V	I mpp	35 A

Grid-Connected System: Simulation parameters (continued)

Sub-array "R1S3"	Orientation	#1	Tilt/Azimuth	10°/-13°
Number of PV modules	In series	22 modules	In parallel	2 strings
Total number of PV modules	Nb. modules	44	Unit Nom. Power	275 Wp
Array global power	Nominal (STC)	**12.10 kWp**	At operating cond.	10.88 kWp (50°C)
Array operating characteristics (50°C)	U mpp	620 V	I mpp	18 A
Sub-array "R3S1"	Orientation	#2	Tilt/Azimuth	10°/-32°
Number of PV modules	In series	21 modules	In parallel	2 strings
Total number of PV modules	Nb. modules	42	Unit Nom. Power	275 Wp
Array global power	Nominal (STC)	**11.55 kWp**	At operating cond.	10.39 kWp (50°C)
Array operating characteristics (50°C)	U mpp	592 V	I mpp	18 A
Sub-array "R1S4, R3S4"	Mixed orient.	#1/2: 1/1 strings	Tilt/Azimuth	10°/-13°, 10°/-32°
Number of PV modules	In series	23 modules	In parallel	2 strings
Total number of PV modules	Nb. modules	46	Unit Nom. Power	275 Wp
Array global power	Nominal (STC)	**12.65 kWp**	At operating cond.	11.38 kWp (50°C)
Array operating characteristics (50°C)	U mpp	649 V	I mpp	18 A
Total Arrays global power	Nominal (STC)	**107 kWp**	Total	388 modules
	Module area	**635 m²**	Cell area	567 m²

Inverter	Model	**Solis-30K**		
	Manufacturer	Solis		
Characteristics	Operating Voltage	200-800 V	Unit Nom. Power	30.0 kWac
Sub-array "R1S1"	Nb. of inverters	1 * MPPT 25 %	Total Power	7.5 kWac
Sub-array "R1S2"	Nb. of inverters	1 * MPPT 25 %	Total Power	7.5 kWac
Sub-array "R2S2, R2S3"	Nb. of inverters	2 * MPPT 25 %	Total Power	15.0 kWac
Sub-array "R1S2"	Nb. of inverters	1 * MPPT 25 %	Total Power	7.5 kWac
Sub-array "R3S2, R2S3"	Nb. of inverters	2 * MPPT 25 %	Total Power	15.0 kWac
Sub-array "R1S3"	Nb. of inverters	2 * MPPT 25 %	Total Power	15.0 kWac
Sub-array "R3S1"	Nb. of inverters	1 * MPPT 25 %	Total Power	7.5 kWac
Sub-array "R1S4, R3S4"	Nb. of inverters	2 * MPPT 25 %	Total Power	15.0 kWac
Total	Nb. of inverters	3	Total Power	90 kWac

PV Array loss factors

Array Soiling Losses			Loss Fraction	1.0 %
Thermal Loss factor	Uc (const)	29.0 W/m²K	Uv (wind)	0.0 W/m²K / m/s
Wiring Ohmic Loss	Array#1	1247 mOhm	Loss Fraction	3.0 % at STC
	Array#2	208 mOhm	Loss Fraction	0.3 % at STC
	Array#3	208 mOhm	Loss Fraction	1.5 % at STC
	Array#4	208 mOhm	Loss Fraction	0.5 % at STC
	Array#5	208 mOhm	Loss Fraction	1.1 % at STC
	Array#6	208 mOhm	Loss Fraction	0.5 % at STC
	Array#7	208 mOhm	Loss Fraction	0.5 % at STC
	Array#8	208 mOhm	Loss Fraction	0.5 % at STC
	Global		Loss Fraction	0.7 % at STC
LID - Light Induced Degradation			Loss Fraction	1.0 %
Module Quality Loss			Loss Fraction	-1.0 %
Module Mismatch Losses			Loss Fraction	0.3 % at MPP
Incidence effect, ASHRAE parametrization	IAM =	1 - bo (1/cos i - 1)	bo Param.	0.02

System loss factors

~~Wires: 3x50.0 mm²~~		~~122 m~~	~~Loss Fraction~~	~~3.0 % at STC~~
Unavailability of the system	2.0 days, 3 periods		Time fraction	0.5 %

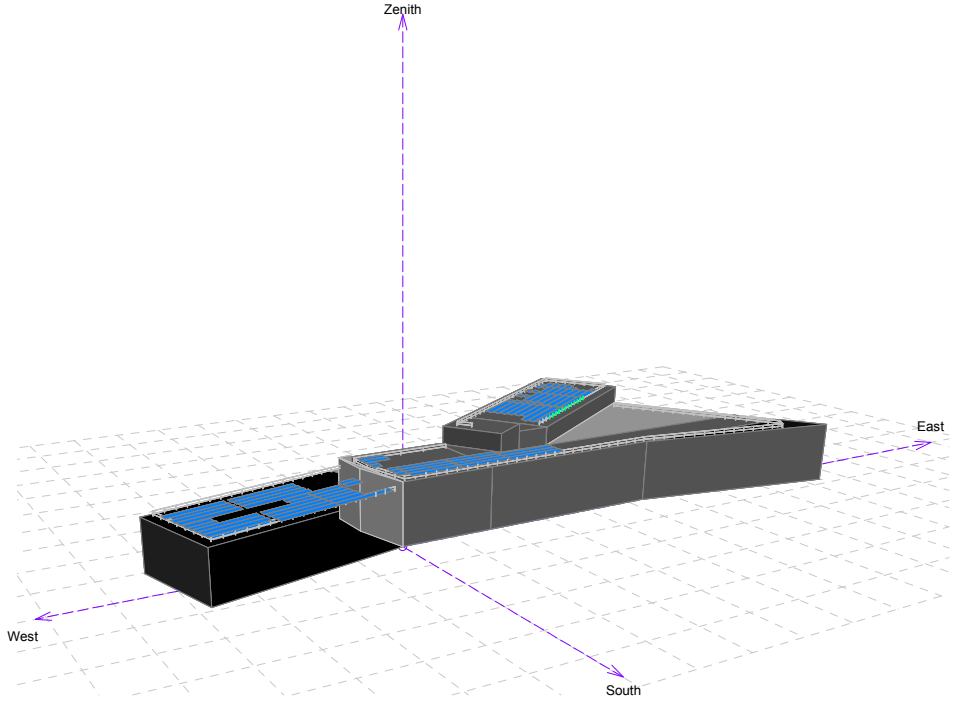
Grid-Connected System: Near shading definition

Project : **Q5571 Maria Fidelis Catholic School**

Simulation variant : **Simulation v9-0**

Main system parameters	System type	**Grid-Connected**		
Near Shadings	Linear shadings			
PV Field Orientation	3 orientations	Tilt/Azimuth = 10°/-13°, 10°/-32°, 10°/0°		
PV modules	Model	TSM-275 PD05	Pnom	275 Wp
PV Array	Nb. of modules	388	Pnom total	**107 kWp**
Inverter	Model	Solis-30K	Pnom	30.0 kW ac
Inverter pack	Nb. of units	3.0	Pnom total	**90.0 kW ac**
User's needs	Unlimited load (grid)			

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram

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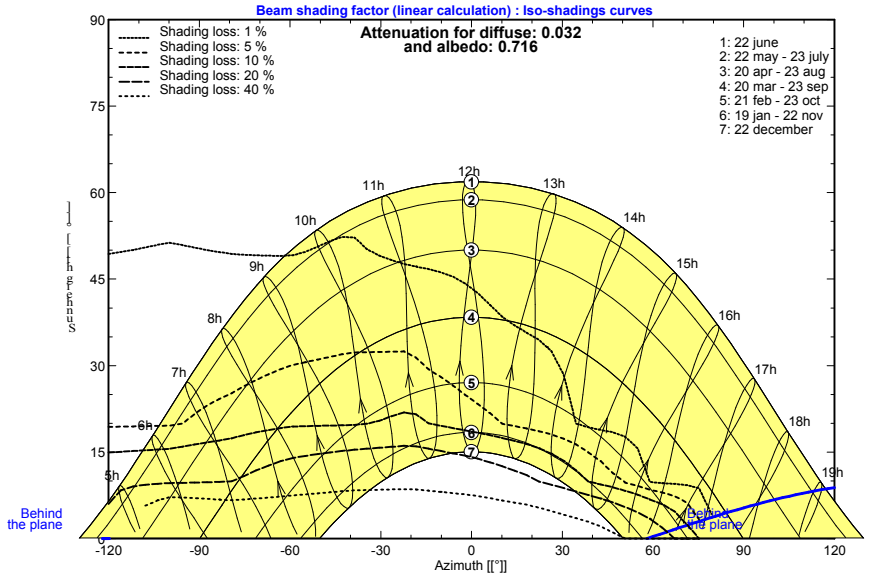

Grid-Connected System: Main results

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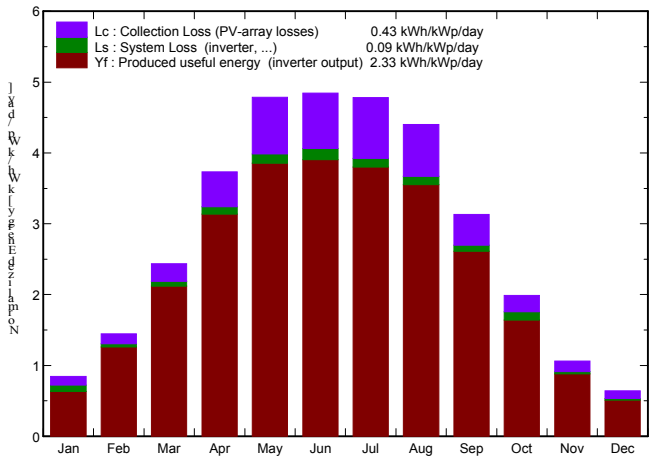
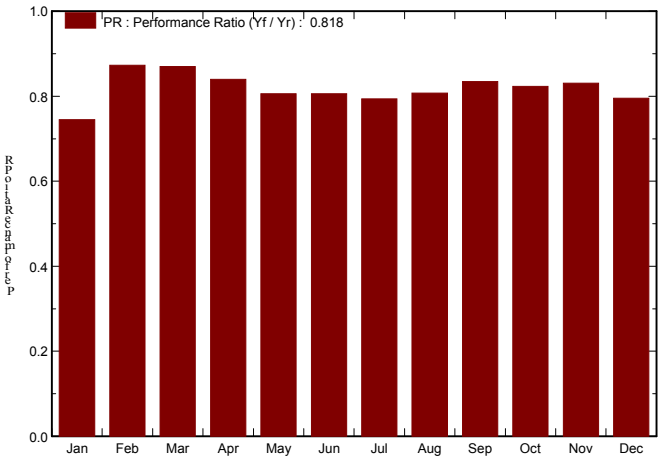
Main simulation results

System Production	**Produced Energy**	**90779 kWh/year**	Specific prod.	851 kWh/kWp/year
	Performance Ratio PR	81.8 %		

Normalized productions (per installed kWp): Nominal power 107 kWp



Performance Ratio PR



Simulation v9-0

Balances and main results

	GlobHor kWh/m²	T Amb °C	GlobInc kWh/m²	GlobEff kWh/m²	EArray kWh	E_Grid kWh	EffArrR %	EffSysR %
January	20.9	6.51	26.2	22.6	2391	2086	14.35	12.52
February	35.3	6.50	40.5	36.4	3899	3771	15.16	14.67
March	69.6	8.17	75.5	68.2	7236	7009	15.09	14.61
April	105.1	10.73	112.0	99.8	10369	10039	14.58	14.11
May	143.3	14.09	148.4	131.4	13180	12756	13.99	13.54
June	143.7	17.12	145.3	128.7	13003	12498	14.09	13.55
July	145.4	18.83	148.3	130.7	12976	12565	13.78	13.34
August	130.2	18.81	136.5	120.7	12135	11757	14.00	13.56
September	86.6	16.08	93.9	84.3	8632	8364	14.47	14.02
October	53.6	12.79	61.7	55.8	5822	5419	14.87	13.84
November	26.0	9.15	31.9	27.8	2928	2827	14.46	13.95
December	16.0	6.55	19.9	16.8	1762	1689	13.95	13.37
Year	975.7	12.14	1040.1	923.4	94334	90779	14.28	13.74

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