

Energipark Vedlum Kær

Bilag 7B

Produktionsberegninger for
solcelleanlæg fra Eurowind Energy
LDA

PVSYST V6.88	Eurowind Energy LDA (Portugal)			30/09/20	Page 1/6
Grid-Connected System: Simulation parameters					
Project :		Veddum Kaer EnergyPark			
Geographical Site		Rønholt		Country	Denmark
Situation		Latitude	56.78° N	Longitude	10.20° E
Time defined as		Legal Time	Time zone UT+1	Altitude	6 m
		Albedo	0.20		
Meteo data:		Rønholt	PVGIS CMSAF hourly time series averages 01/01/07 to 31/12/16 - Synthetic		
Simulation variant :		2020 09 30_VeddumKaer_LONGi445Bi+SUNGROW250k_1,31_OneAxis Tracker withTrees			
		Simulation date	30/09/20 16h31		
Simulation parameters		System type	Tracking system with backtracking		
Tracking plane, tilted Axis		Axis Tilt	0°	Axis Azimuth	0°
Rotation Limitations		Minimum Phi	-60°	Maximum Phi	60°
		Tracking algorithm	Astronomic calculation		
Backtracking strategy		Nb. of trackers	185	Identical arrays	
		Tracker Spacing	4.20 m	Collector width	2.11 m
Backtracking limit angle		Phi limits	+/- 59.5°		Ground cov. Ratio (GCR) 50.3 %
Models used		Transposition	Perez	Diffuse	Perez, Meteonorm
Horizon		Free Horizon			
Near Shadings		According to module strings		Electrical effect	100 %
Bifacial system		Model	Unlimited trackers, 2D calculation		
		Tracker Spacing	4.20 m	Tracker width	2.15 m
		Backtracking limit angle	59.0°	GCR	51.3 %
		Ground albedo	30.0 %	Axis height above ground	2.00 m
		Module bifaciality factor	70 %	Rear shading factor	5.0 %
		Module transparency	0.0 %	Rear mismatch loss	10.0 %
User's needs :		Unlimited load (grid)			
Grid power limitation		Active Power	15.2 MW	Pnom ratio	1.315
PV Array Characteristics					
PV module		Si-mono	Model	LR4-72 HBD 445 M	
Custom parameters definition		Manufacturer	Longi Solar		
Number of PV modules		In series	27 modules	In parallel	1666 strings
Total number of PV modules		Nb. modules	44982	Unit Nom. Power	445 Wp
Array global power		Nominal (STC)	20017 kWp	At operating cond.	18353 kWp (50°C)
Array operating characteristics (50°C)		U mpp	1013 V	I mpp	18123 A
Total area		Module area	97772 m²	Cell area	88805 m²
Inverter		Model	SG250HX		
Custom parameters definition		Manufacturer	Sungrow		
Characteristics		Operating Voltage	600-1500 V	Unit Nom. Power	225 kWac
				Max. power (=>30°C)	250 kWac
Inverter pack		Nb. of inverters	61 units	Total Power	13725 kWac
				Pnom ratio	1.46
Fordi temperaturen i Danmark ikke er så høj, kan panelerne producere mere, Der regnes derfor med en produktion på 61*250= 15.250 kWac					
PV Array loss factors					

Grid-Connected System: Simulation parameters

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	Global array res. 0.31 mOhm	Loss Fraction	0.5 % at STC
LID - Light Induced Degradation		Loss Fraction	0.5 %
Module Quality Loss		Loss Fraction	-0.4 %
Module Mismatch Losses		Loss Fraction	1.0 % at MPP
Strings Mismatch loss		Loss Fraction	0.10 %
Incidence effect (IAM): Fresnel AR coating, n(glass)=1.526, n(AR)=1.290			

0°	30°	50°	60°	70°	75°	80°	85°	90°
1.000	0.999	0.987	0.962	0.892	0.816	0.681	0.440	0.000

System loss factors

AC loss, transfo to injection	Grid Voltage	20 kV	
	Wires: 3x500.0 mm²	6753 m	Loss Fraction 1.3 % at STC
External transformer	Iron loss (24H connexion)	17785 W	Loss Fraction 0.1 % at STC
	Resistive/Inductive losses	182.2 mOhm	Loss Fraction 0.9 % at STC
Unavailability of the system	7.3 days, 3 periods		Time fraction 2.0 %

Auxiliaries loss

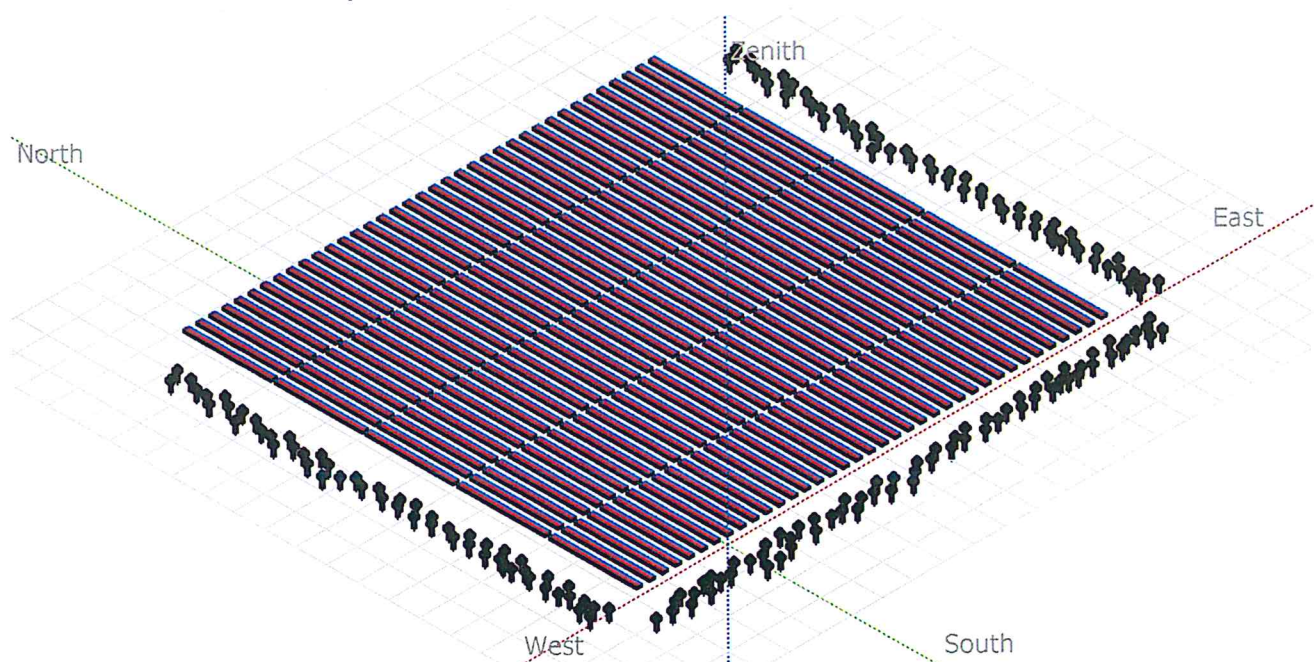
Proportionnal to Power 2.0 W/kW ... from Power thresh. 0.0 kW

Grid-Connected System: Near shading definition

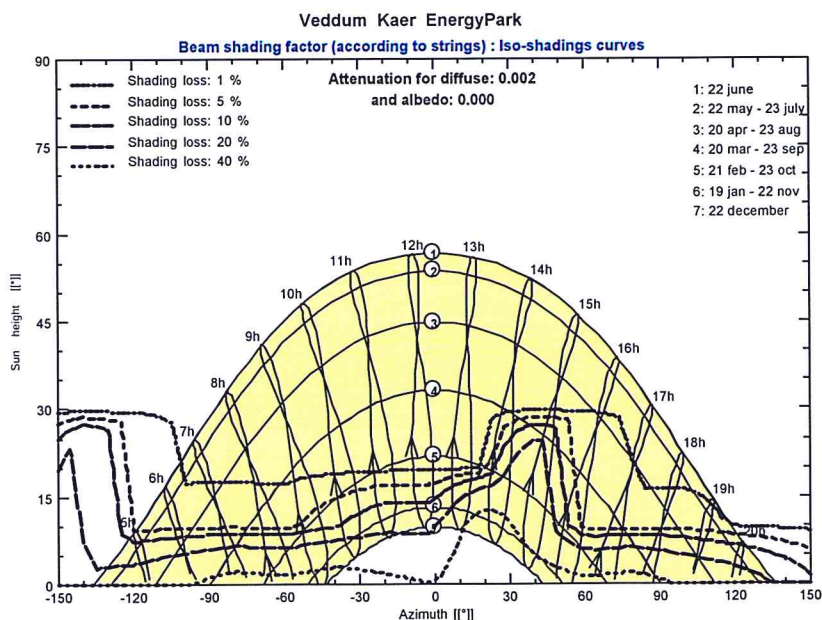
Project : Veddum Kaer EnergyPark
Simulation variant : 2020 09 30_VeddumKaer_LONGi445Bi+SUNGROW250k_1,31_OneAxis Tracker withTrees

Main system parameters	System type	Tracking system with backtracking	
Near Shadings	According to module strings	Electrical effect	100 %
PV Field Orientation	tracking, tilted axis, Axis Tilt	Axis Azimuth	0°
PV modules	Model	Pnom	445 Wp
PV Array	Nb. of modules	Pnom total	20017 kWp
Inverter	Model	Pnom	225 kW ac
Inverter pack	Nb. of units	Pnom total	13725 kW ac
User's needs	Unlimited load (grid)		

Perspective of the PV-field and surrounding shading scene



Iso-shadings diagram



Grid-Connected System: Main results

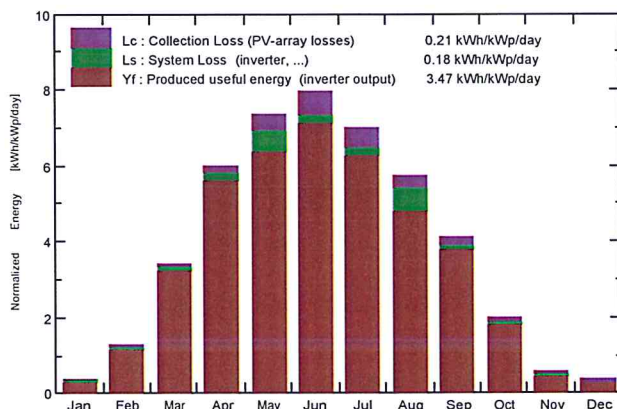
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Main system parameters	System type	Tracking system with backtracking	
Near Shadings	According to module strings	Electrical effect	100 %
PV Field Orientation	tracking, tilted axis, Axis Tilt	Axis Azimuth	0°
PV modules	Model	LR4-72 HBD 445 M	Pnom 445 Wp
PV Array	Nb. of modules	44982	Pnom total 20017 kWp
Inverter	Model	SG250HX	Pnom 225 kW ac
Inverter pack	Nb. of units	61.0	Pnom total 13725 kW ac
User's needs	Unlimited load (grid)		

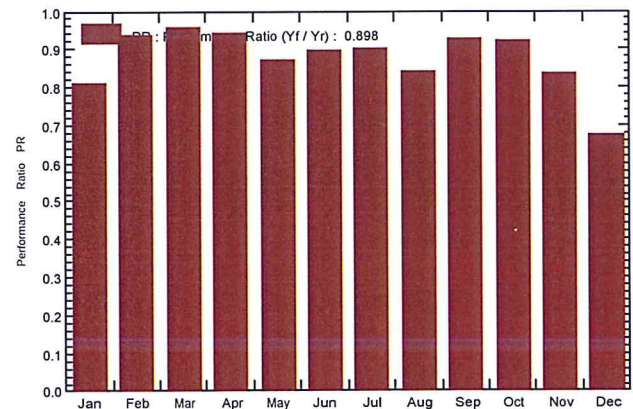
Main simulation results

System Production **Produced Energy** **25322011 kWh/year** **Specific prod.** 1265 kWh/kWp/year
Performance Ratio PR 89.79 %

Normalized productions (per installed kWp): Nominal power 20017 kWp



Performance Ratio PR



2020 09 30_VeddumKaer_LONGi445Bi+SUNGROW250k_1,31_OneAxis Tracker withTrees

Balances and main results

	GlobHor kWh/m ²	DiffHor kWh/m ²	T_Amb °C	GlobInc kWh/m ²	GlobEff kWh/m ²	EArray kWh	E_Grid kWh	PR
January	10.3	7.01	1.38	12.2	10.5	219019	197005	0.810
February	29.3	18.56	1.18	35.9	32.4	700488	673520	0.937
March	82.1	40.38	3.64	105.7	98.5	2089387	2025878	0.957
April	136.3	53.03	7.46	180.1	169.9	3498385	3393104	0.941
May	174.2	69.47	11.44	228.2	215.5	4304010	3973256	0.870
June	183.0	72.74	14.58	238.8	225.6	4425057	4291019	0.898
July	168.0	71.79	17.06	216.5	204.0	4031086	3909374	0.902
August	134.3	57.85	16.55	177.5	166.7	3365552	2985819	0.840
September	94.0	43.06	13.50	122.7	114.7	2348220	2278230	0.927
October	47.6	25.65	9.29	61.9	56.6	1182621	1143406	0.923
November	14.0	8.90	5.74	17.4	15.2	313418	290762	0.836
December	9.4	6.01	3.39	11.9	9.9	183864	160636	0.674
Year	1082.4	474.45	8.81	1408.8	1319.7	26661106	25322011	0.898

Legends:

GlobHor	Horizontal global irradiation	GlobEff	Effective Global, corr. for IAM and shadings
DiffHor	Horizontal diffuse irradiation	EArray	Effective energy at the output of the array
T_Amb	T amb.	E_Grid	Energy injected into grid
GlobInc	Global incident in coll. plane	PR	Performance Ratio

Grid-Connected System: Special graphs

Project : Veddum Kaer EnergyPark

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Main system parameters

System type Tracking system with backtracking

Near Shadings

According to module strings

Electrical effect 100 %

PV Field Orientation

tracking, tilted axis, Axis Tilt

0°

Axis Azimuth

0°

PV modules

Model LR4-72 HBD 445 M

Pnom 445 Wp

PV Array

Nb. of modules 44982

Pnom total 20017 kWp

Inverter

Model SG250HX

Pnom 225 kW ac

Inverter pack

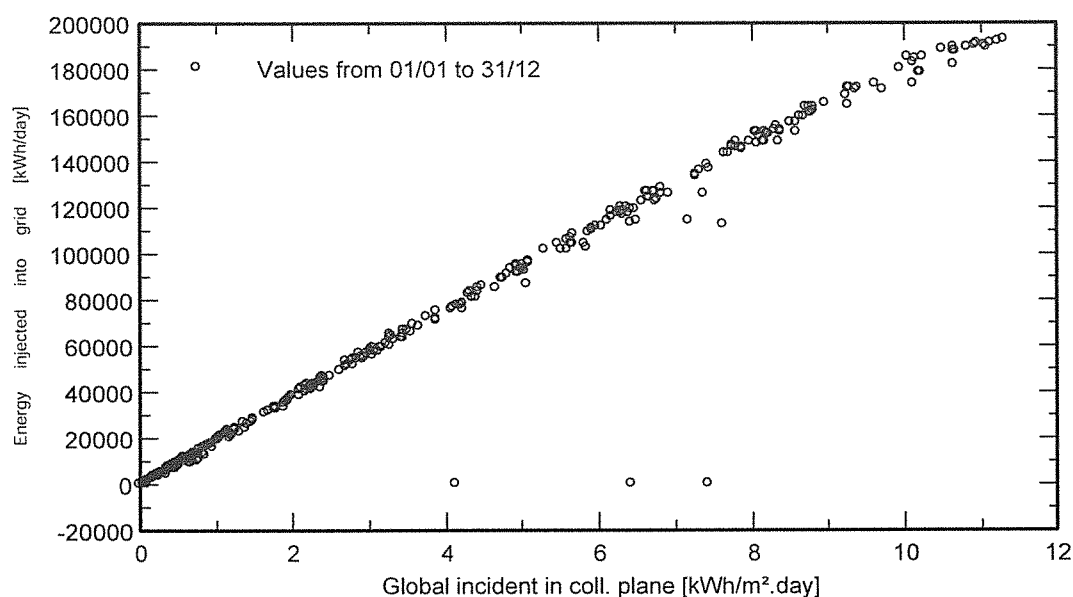
Nb. of units 61.0

Pnom total 13725 kW ac

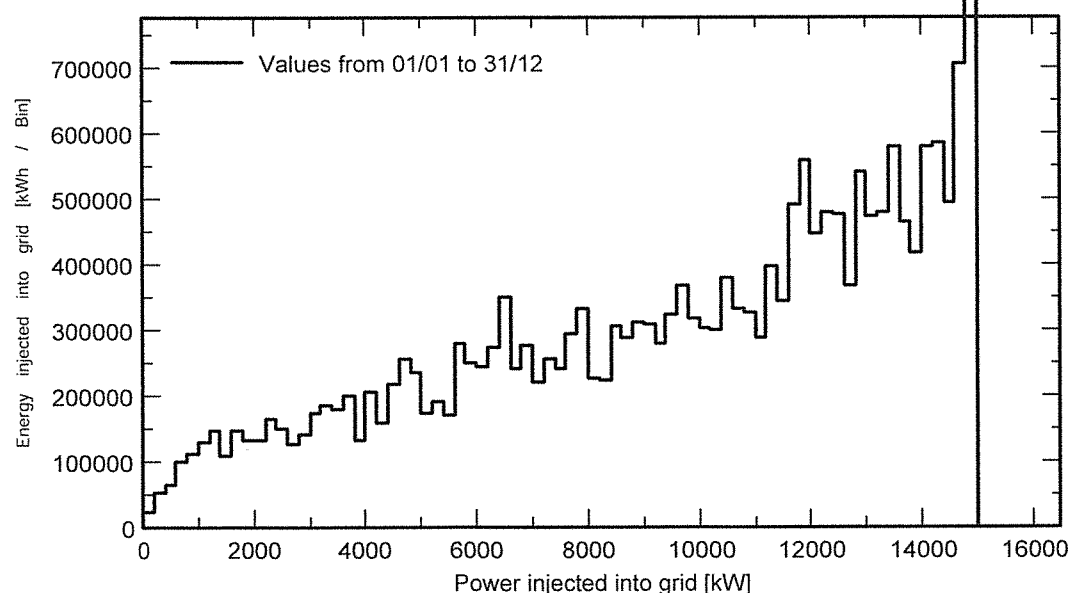
User's needs

Unlimited load (grid)

Daily Input/Output diagram



System Output Power Distribution



Grid-Connected System: Loss diagram

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Main system parameters

System type

Tracking system with backtracking

Near Shadings

According to module strings

Electrical effect 100 %

PV Field Orientation

tracking, tilted axis, Axis Tilt

0°

Axis Azimuth 0°

PV modules

Model

LR4-72 HBD 445 M

Pnom

445 Wp

PV Array

Nb. of modules

44982

Pnom total

20017 kWp

Inverter

Model

SG250HX

Pnom

225 kW ac

Inverter pack

Nb. of units

61.0

Pnom total

13725 kW ac

User's needs

Unlimited load (grid)

Loss diagram over the whole year

