

**Starobesheve**  
12 MW (1)

**Grid-Connected System: Simulation parameters**

**Project :** Starobesheve 12 MW

<b>Geographical Site</b>	<b>Starobeshevo</b>	<b>Country</b>	<b>Ukrainia</b>
<b>Situation</b>	Latitude 47.8°N	Longitude	38.0°E
Time defined as	Legal Time Time zone UT+2	Altitude	118 m
	Albedo 0.20		

**Meteo data :** Starobeshevo from PVGIS, Synthetic Hourly data

**Simulation variant :** New simulation variant

Simulation date 31/05/12 15h33

**Simulation parameters**

<b>Collector Plane Orientation</b>	Tilt 32°	Azimuth 0°
<b>5Sheds</b>	Pitch 7.70 m	Collector width 3.35 m
Inactive band	Top 0.00 m	Bottom 0.00 m
Shading limit angle	Gamma 20.07 °	Occupation Ratio 43.5 %

**Horizon** Free Horizon

**Near Shadings** No Shadings

**PV Arrays Characteristics (2 kinds of array defined)**

<b>PV module</b>	Si-poly	Model <b>SF 220-30-P240</b>	
	Manufacturer	Hanwha SolarOne	
<b>Array#1:</b>	Number of PV modules	In series 20 modules	In parallel 2352 strings
	Total number of PV modules	Nb. modules 47040	Unit Nom. Power 240 Wp
	Array global power	Nominal (STC) <b>11290 kWp</b>	At operating cond. 10165 kWp (50°C)
	Array operating characteristics (50°C)	U mpp 549 V	I mpp 18513 A
<b>Array#2:</b>	Number of PV modules	In series 20 modules	In parallel 148 strings
	Total number of PV modules	Nb. modules 2960	Unit Nom. Power 240 Wp
	Array global power	Nominal (STC) <b>710 kWp</b>	At operating cond. 640 kWp (50°C)
	Array operating characteristics (50°C)	U mpp 549 V	I mpp 1165 A
<b>Total</b>	Arrays global power	Nominal (STC) <b>12000 kWp</b>	Total 50000 modules
		Module area <b>82600 ml</b>	

<b>Inverter</b>	Model <b>Protect PV 630</b>	
	Manufacturer AEG Power Solutions GmbH	
	Operating Voltage 550-820 V	Unit Nom. Power 630 kW AC

<b>Array#1:</b>	Number of Inverter 16.0	Total Power 10080 kW AC
<b>Array#2:</b>	Number of Inverter 1	Total Power 630 kW AC
<b>Total</b>	Number of Inverter 17	Total Power 10710 kW AC

**PV Array loss factors**

Thermal Loss factor	Uc (const) 20.0 W/mIK	Uv (wind) 0.0 W/mIK / m/s
=> Nominal Oper. Coll. Temp. (G=800 W/ml, Tamb=20°C, Wind=1 m/s.)		NOCT 56 °C
Wiring Ohmic Loss	Array#1 0.49 mOhm	Loss Fraction 1.5 % at STC
	Array#2 7.8 mOhm	Loss Fraction 1.5 % at STC
	Global	Loss Fraction 1.5 % at STC

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Module Quality Loss		Loss Fraction	2.5 %
Module Mismatch Losses		Loss Fraction	2.0 % at MPP
Incidence effect, ASHRAE parametrization	IAM = $1 - bo (1/\cos i - 1)$	bo Parameter	0.05

**User's needs :**

Unlimited load (grid)

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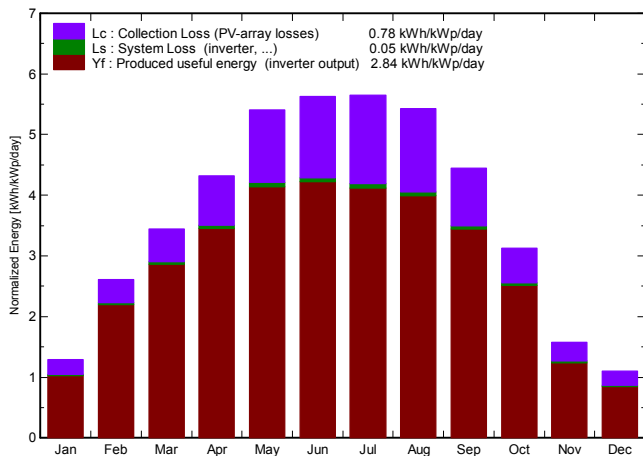
**Grid-Connected System: Main results**

**Project :** Starobesheve 12 MW  
**Simulation variant :** New simulation variant

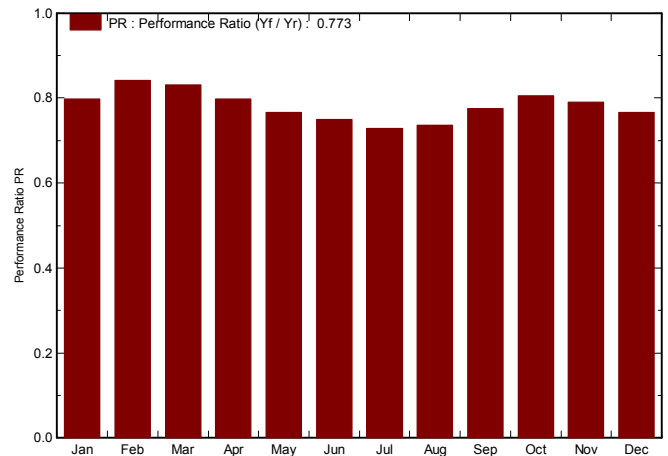
<b>Main system parameters</b>	System type	<b>Grid-Connected</b>		
PV Field Orientation	Sheds disposition, tilt	32°	azimuth	0°
PV modules	Model	SF 220-30-P240	Pnom	240 Wp
PV Array	Nb. of modules	50000	Pnom total	<b>12000 kWp</b>
Inverter	Model	Protect PV 630	Pnom	630 kW ac
Inverter pack	Nb. of units	17.0	Pnom total	<b>10710 kW ac</b>
User's needs	Unlimited load (grid)			

**Main simulation results**  
System Production **Produced Energy 12438 MWh/year** Specific prod. 1037 kWh/kWp/year  
Performance Ratio PR **77.3 %**

**Normalized productions (per installed kWp): Nominal power 12000 kWp**



**Performance Ratio PR**



**New simulation variant**  
**Balances and main results**

	GlobHor	T Amb	GlobInc	GlobEff	EArray	E_Grid	EffArrR	EffSysR
	kWh/ml	°C	kWh/ml	kWh/ml	MWh	MWh	%	%
<b>January</b>	27.1	-3.50	39.9	36.4	392	382	11.89	11.60
<b>February</b>	49.3	-2.50	73.1	68.5	750	738	12.43	12.22
<b>March</b>	86.2	2.30	106.6	100.7	1080	1063	12.27	12.07
<b>April</b>	117.9	10.10	129.7	121.9	1263	1242	11.79	11.60
<b>May</b>	165.2	16.00	167.5	157.6	1566	1540	11.32	11.13
<b>June</b>	174.6	20.00	168.9	158.7	1545	1519	11.07	10.89
<b>July</b>	177.6	22.90	175.1	164.7	1558	1530	10.77	10.58
<b>August</b>	157.8	21.80	168.2	158.3	1509	1486	10.86	10.69
<b>September</b>	111.6	16.00	133.3	126.1	1260	1239	11.45	11.26
<b>October</b>	68.5	9.50	97.0	91.4	952	936	11.89	11.69
<b>November</b>	31.8	3.10	47.2	43.1	457	447	11.73	11.48
<b>December</b>	22.0	-2.00	34.2	30.2	324	315	11.45	11.14
<b>Year</b>	1189.6	9.54	1340.6	1257.5	12656	12438	11.43	11.23

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

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**Grid-Connected System: Loss diagram**

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User's needs	Unlimited load (grid)		

**Loss diagram over the whole year**

