ФОТОНАПОНСКИ СИСТЕМ

Технички број: 06 – 11 / 2018

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GLOBAL engineering Int

ОСВЕТЛУВАЊЕ ЕНЕРГЕТИКА АВТОМАТИКА

ОСНОВЕН ПРОЕКТ ЗА УЛИЧНО ОСВЕТЛУВАЊЕ

ПАРК НА АВАНТУРИ, ВЕЛЕС

1. ОПШТ ДЕЛ

Оваа проектна документација е за обезбедување на автономно напојување со електрична енергија на Парк на авантури, Велес преку користење на фотонапонски систем.

Изведбата на нисконапонската мрежа ќе се одвива етапно, според динамиката на изградба на паркот.

2. НАПОЈУВАЊЕ СО ЕЛЕКТРИЧА ЕНЕРЕГИЈА

Напојувањето со електрична енергија на објектот ќе биде од најблистата ТС според електроенергетската согласност издадена од дистрибутерот на електрична енергија. Како дел од системот за напојување со електрична енергија се предлага да се изведе и мини фотонапонска централа сместена на кровот на кујната која ќе ги задоволува потребите од електрична енергија во текот на денот а во ноќните часови ќе се користи превземената електрична енергија од мрежата на дистрибутерот.

3. ФОТОНАПОНСКИ СИСТЕМ

Фотонапонскиот систем ќе биде поставен на јужната страна од кровот на рецепцијата. Истиот ќе се состои од 22 (дваесет и два) фотонапонски панели меѓусебно поврзани во серија и еден инвертер поставен на sид непосредно до КРО-1 ормарот. Врската помеѓу инвертерот и фотонапонските панели ќе биде изведена со кабел од типот SOTAR-ZQ 1x6 mm2 а додке врската помеѓу инвертерот и разводниот ормар ќе биде изведна со кабел од типот NYY 5x16 mm2. Монтажата на панелите на кровот е превидено да биде на соодветна носечка конструкција изведена оа алуминиумски профили. Каблите е предвидено да се водат во соодветно незапаливо UV стабилни флексибилно црево или цевка поставена на шелни.

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Project: **Парк на авантура**

Project number: ---

Location: Former Yugoslav Republic of Macedonia / Skopje

Grid voltage: 220V (220V / 380V)

System overview

22 x .SMA SMA Demo Poly 240 (PV array 1)
Azimuth angle: 0 °, Tilt angle: 30 °, Mounting type: Roof, Peak power: 5,28 kWp

1 x SB5.0-1AV-41

System Monitoring

Sunny Home Manager 2.0

Sunny Portal

PV design data

Total number of PV modules:	22	Performance ratio*:	86,3 %
Peak power:	5,28 kWp	Spec. energy yield*:	1330 kWh/kWp
Number of PV inverters:	1	Line losses (in % of PV energy):	---
Nominal AC power of the PV inverters:	5,00 kW	Unbalanced load:	5,00 kVA
AC active power:	5,00 kW	Annual energy consumption:	17.500 kWh
Active power ratio:	94,7 %	Self-consumption:	5.251,69 kWh
Annual energy yield*:	7.023,79 kWh	Self-consumption quota:	74,8 %
Energy usability factor:	99,9 %	Self-sufficiency quota:	30 %

Signature

*Important: The yield values displayed are estimates. They are determined mathematically. SMA Solar Technology AG accepts no responsibility for the real yield value which can deviate from the yield values displayed here. Reasons for deviations are various external conditions, such as soiling of the PV modules or fluctuations in the efficiency of the PV modules.

Inverter designs

Project: Парк на авантура

Project number:

Subproject Парк на анатури

Location: Former Yugoslav Republic of Macedonia / Skopje

Ambient temperature:

Annual extreme low temperature: -15 °C

Average high Temperature: 22 °C

Annual extreme high temperature: 39 °C

1 x SB5.0-1AV-41 (PV system section 1)

Peak power:	5,28 kWp
Total number of PV modules:	22
Number of PV inverters:	1
Max. DC power (cos φ = 1):	5,25 kW
Max. AC active power (cos φ = 1):	5,00 kW
Grid voltage:	220V (220V / 380V)
Nominal power ratio:	99 %
Dimensioning factor:	105,6 %
Displacement power factor cos φ:	1

SB5.0-1AV-41

PV design data

Input A: PV array 1

13 x .SMA SMA Demo Poly 240, Azimuth angle: 0 °, Tilt angle: 30 °, Mounting type: Roof

Input B: PV array 1

9 x .SMA SMA Demo Poly 240, Azimuth angle: 0 °, Tilt angle: 30 °, Mounting type: Roof

	Input A:	Input B:
Number of strings:	1	1
PV modules:	13	9
Peak power (input):	3,12 kWp	2,16 kWp
Typical PV voltage:	✓ 354 V	✓ 245 V
Min. PV voltage:	319 V	221 V
Min. DC voltage (Grid voltage 220 V):	100 V	100 V
Max. PV voltage:	✓ 540 V	✓ 374 V
Max. DC voltage:	600 V	600 V
Max. MPP current of PV array:	✓ 8,1 A	✓ 8,1 A
Max. operating input current per MPPT:	15 A	15 A
Max. input short-circuit current per MPPT:	20 A	20 A
Photovoltaic Output Circuit Current:	✓ 8,5 A	✓ 8,5 A

PV/Inverter compatible

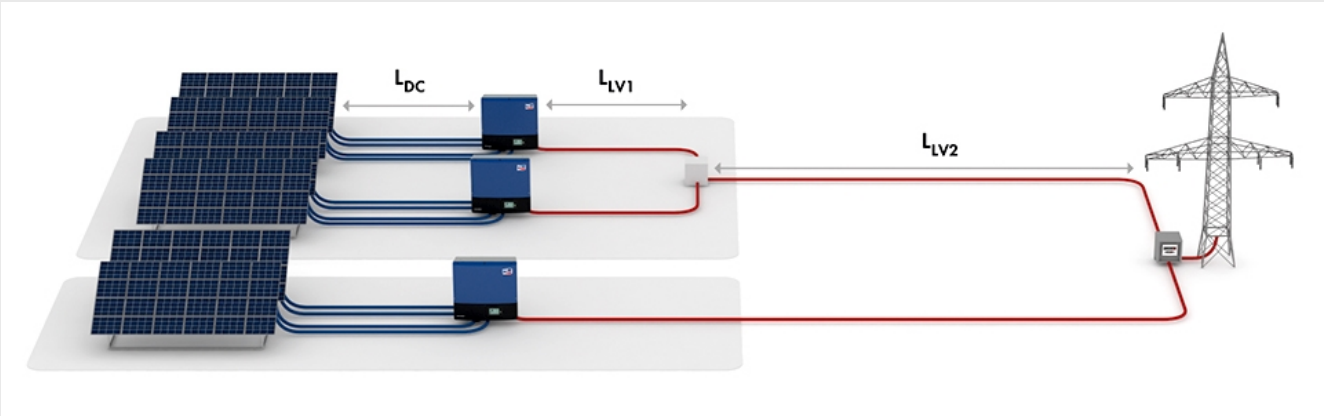
Wire sizing

Project name: Парк на авантура **Location: Former Yugoslav Republic of Macedonia /**
Project number:

Overview

	DC	LV	Total
Power loss at nominal operation	9,81 W	27,76 W	37,58 W
Rel. power loss at rated nominal operation	0,17 %	0,56 %	0,72 %
Total cable length	40,00 m	25,00 m	65,00 m
Cable cross-sections	6 mm²	16 mm²	6 mm² 16 mm²

Graphic



DC cables

		Cable material	Single length	Cross section	Voltage drop	Rel. power loss
Парк на анатури						
1 x SB5.0-1AV-41 PV system section 1	A	Copper	10,00 m	6 mm²	530,4 mV	0,14 %
	B	Copper	10,00 m	6 mm²	530,4 mV	0,21 %

Lines LV1

	Cable material	Single length	Cross section	Line resistance	Rel. power loss
Парк на анатури					
1 x SB5.0-1AV-41 PV system section 1	Copper	15,00 m	16 mm²	R: 32,250 mΩ XL: 2,250 mΩ	0,33 %

Lines LV2

	Cable material	Single length	Cross section	Line resistance	Rel. power loss
Парк на анатури	Copper	10,00 m	16 mm²	R: 10,750 mΩ XL: 0,750 mΩ	0,22 %

The displayed results are approximate values to give a general indication to users of possible operating results. The results are determined mathematically. The actual operating results will be dictated significantly by the actual climatic conditions, the actual efficiency, the system components' operating conditions and the individual consumption behavior and can deviate from the calculated results. SMA Solar Technology AG therefore assumes no liability in the event of deviations between the calculated and actual operating results.

Design energy management

Project name: Парк на авантура **Location: Former Yugoslav Republic of Macedonia /**
Project number:

PV system	System Monitoring	
Парк на анатури	**Within the PV system**	**External**
1 x SB5.0-1AV-41 PV system section 1	**Sunny Home Manager 2.0** The control center with integrated measuring system for smart energy management	**Sunny Portal** Internet portal for monitoring PV systems and for the visualization and presentation of PV system data

Information	
Sunny Home Manager 2.0	For the implementation of the storage management and the limitation of the active power feed-in, the internal measuring system of the Sunny Home Manager 2.0 for measuring the grid feed-in and purchased electricity, must have been connected and configured (see planning guidelines "SMA Smart Home").
General	The maximum communication range for Bluetooth® Wireless Technology in free-field conditions and for Speedwire (SMA Ethernet) is 100 m.

Self-consumption (electricity)

Project: Парк на авантура
Project number:

Location: Former Yugoslav Republic of Macedonia /

Information on self-consumption

Load profile: **Apartment building**

Small energy-efficient apartment house with eleven apartment units and 24 predominantly working residents

Annual energy consumption: **17500 kWh**

Increased self-consumption

Sunny Home Manager 2.0

The control center with integrated measuring system for smart energy management

Result

Without increased self-consumption

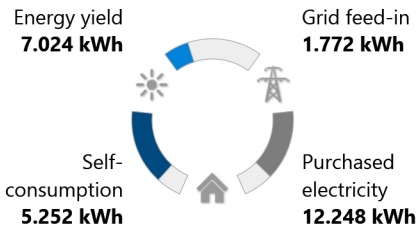
Self-sufficiency quota

30 %

Self-consumption quota

74,8 %

Distribution of PV energy



Details

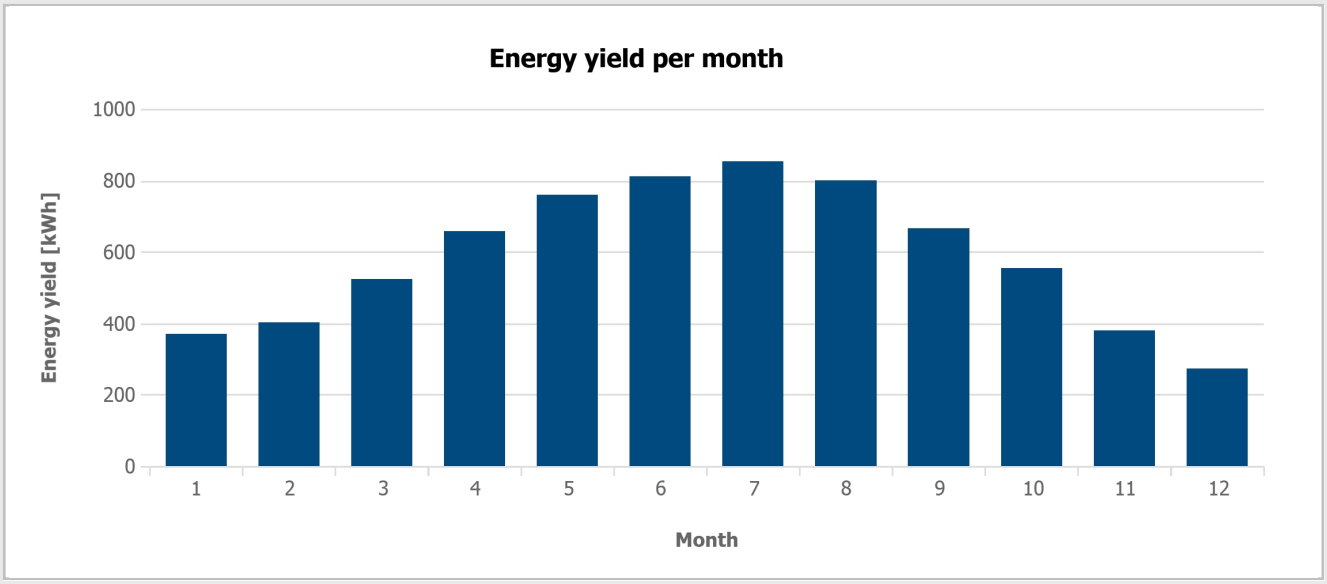
Annual energy consumption	**17.500 kWh**
Annual energy yield	**7.024 kWh**
Grid feed-in	**1.772 kWh**
Purchased electricity	**12.248 kWh**
Self-consumption	**5.252 kWh**
Self-consumption quota (in % of PV energy)	**74,8 %**
Self-sufficiency quota (energy consumption in %)	**30 %**

The displayed results are estimated values which are derived mathematically. SMA Solar Technology AG accepts no liability for the actual self-consumption which may deviate from the values displayed here. The potential self-consumption essentially depends on individual load patterns, which may deviate from the load profile on which the calculation is based.

Monthly values

Project name: Парк на авантура **Location: Former Yugoslav Republic of Macedonia /**
Project number:

Diagram



Table

Month	Energy yield [kWh]	Self-consumption [kWh]	Grid feed-in [kWh]	Purchased electricity [kWh]
1	369 (5,2 %)	307	62	1308
2	400 (5,7 %)	347	53	1094
3	522 (7,4 %)	412	110	1121
4	656 (9,3 %)	484	172	890
5	757 (10,8 %)	529	228	838
6	808 (11,5 %)	579	228	802
7	850 (12,1 %)	598	252	803
8	797 (11,3 %)	522	275	762
9	663 (9,4 %)	491	172	924
10	552 (7,9 %)	413	139	1065
11	379 (5,4 %)	322	57	1255
12	272 (3,9 %)	248	24	1385

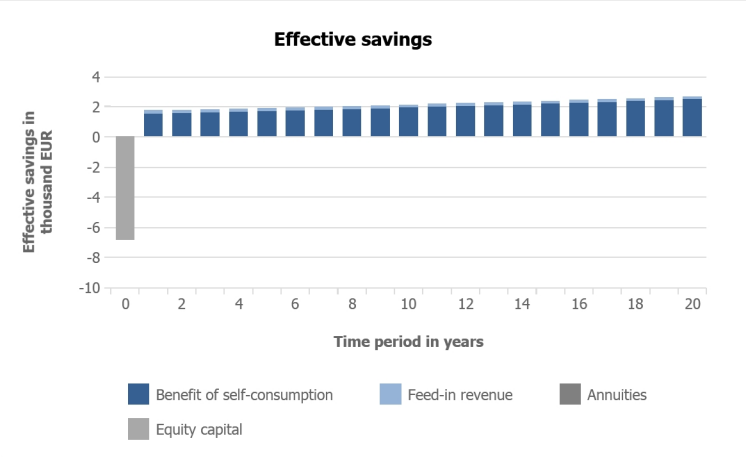
Profitability analysis

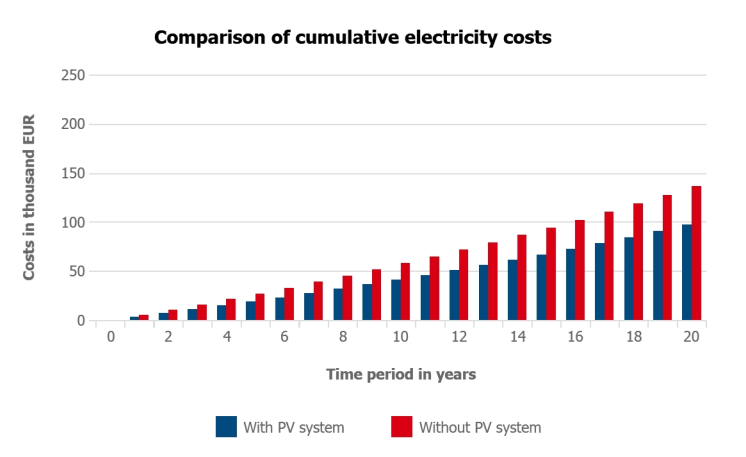
Project: Парк на авантура
Project number:

Location: Former Yugoslav Republic of Macedonia /

Details

Electricity purchase costs avoided in the first year (approx.)	**1.470 EUR**
Total savings after 20 year(s) (approx.)	**33.543 EUR**
Electricity purchase costs avoided after 20 year(s) (approx.)	**39.008 EUR**
Total revenue from grid feed-in after 20 year(s) (approx.)	**4.166 EUR**
Expected amortization period in years (approx.)	**5**
Electricity production cost over 20 year(s) (approx.)	**0,072 EUR/kWh**
Annual rate of return (approx.)	**17,41 %**
The total investment is	**6.864,00 EUR**
The specific investment costs of the PV system (CapEx / kWp) are	**1.300,00 EUR/kWp**





Comparison of annual electricity costs

Today without PV system

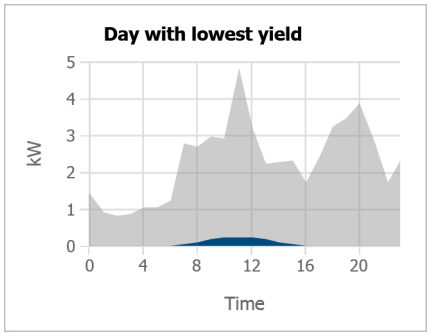
4.900 EUR

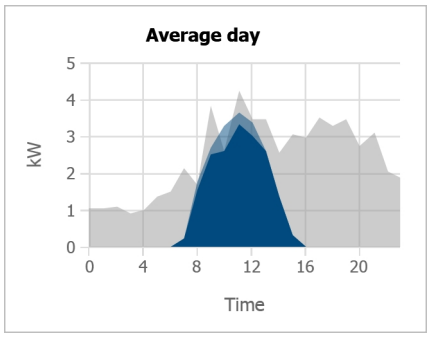
In 20 year(s) without PV system

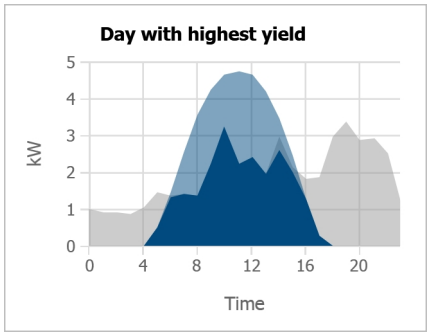
8.850 EUR

Today with PV system

3.311 EUR







Energy consumption
Max. available PV energy
Self-consumption

Project: Парк на авантура **Location: Former Yugoslav Republic of Macedonia /**
Project number:

Cost structure

PV system costs

The total costs for the PV modules are **---**

The average power degradation of the PV modules is **0,50 %**

The total costs for the inverters and PV system monitoring are **---**

The costs for planning and installation are **---**

The annual fixed costs are **102,96 EUR**

The total investment is **6.864,00 EUR**

The specific investment costs of the PV system (CapEx / kWp) are **1.300,00 EUR/kWp**

Financing

The currency is **EUR**

The equity ratio is **100 %**

The debt ratio is **0 %**

The grant amount is **0,00 EUR**

The inflation rate is **3,00 %**

The analysis period of profitability is **20 Years**

Electricity purchase costs and feed-in tariff

The electricity purchase price is **0,28000 EUR/kWh**

Special tariffs are not taken into account

The annual rate of electricity price increase is **3,0 %**

The feed-in tariff is **0,12900 EUR/kWh**

The duration of the feed-in tariff is **20 Years**

Deduction or feed-in tariff in case of self-consumption is **0,00000 EUR/kWh**

The feed-in revenue on expiration of the remuneration period is **0,05000 EUR/kWh**