CASE STUDY REGARDING THE REALIZATION OF A SOLAR PARK IN MIERSIG, BIHOR, ROUMANIA

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ABSTRACT: The study will result in a range of benefits at both financial and economic to the community concerned, using electricity from renewable sources, photovoltaic panels being directly connected to the grid via transformers so without energy storage, but also by alteration in angle inclination of the panels for hot and cold season. The main objective is to cover part of the electricity for community energy obtained through panels polycrystalline photovoltaic and as a secondary objective of this photovoltaic power plant is to reduce environmental impact by replacing electricity produced in power plants with electricity from renewable energy sources, and use this energy in daily activities.
KEYWORDS: solar panels, renewable, power plants

1. INTRODUCTION

Regarding Bihor County, where it is located the photovoltaic power systems average of the annual solar radiation is 2990,0 Wh/m^2. If we reported to the maximum potential and to the minimum potential of solar radiation in Bihor County, in a year we have the following values: 5659,2 Wh/m^2 in June and 626,4 Wh/m^2 in January

Is totally clean - all the components of are recyclable the plant: glass surface, modules, silicon and aluminum frames are all reusable and recyclable, It has a very long lifetime and not least significantly increases quality of life;

It provides us independence - solar energy makes us independents of conventional sources of energy that are constantly decreasing and whose prices are constantly increasing;

Growing trend is to obtain electricity with fuel still smaller and less polluting, so that all orientation is for the renewables, which is why we completed this study using solar energy.

Next to this utility a new trend of using solar energy is the production of heat using thermal systems Vacuum tube, which would again lead to another profit can use the agent as both domestic hot water and space heating winter storage .[13]

The total amount of radiation emitted by the sun, only part of it reaches the Earth, because some is absorbed into space and another part is reflected due to the presence at water and carbon dioxide from atmosphere and so that was reaching the surface of the Earth it is known as direct radiation, which as described before can be influenced by the atmosphere, and geographic positioning, seasonal variation and what the daily, which is why must take into account all of this as well as by angle of inclination of the panels of having the optimal efficiency.[10]

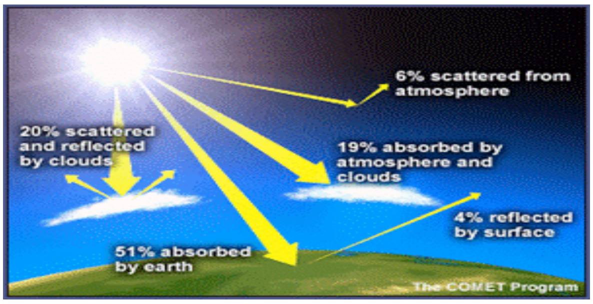

Figure 1. Solar radiation and its evolution [1]

2. DESIGN AND DIMENSIONING THE PHOTOVOLTAIC SYSTEMS

As it is well known the photovoltaic effect is directly influenced by the energy transfer from photons to electrical charges, absorption of light and the tasks of collecting and efficiency of such a system is directly influenced by the electrical energy generated by the solar cell of radiant energy captured by the latter which are directly influenced by the distance between panels and sun, but also their position night there by forming two angles: azimuth and elevation angle. [10].

After studies it was concluded that the optimum angle can be placed under the panels is between 15 and 55°, with some minor deviations according to directions, and after it was set can be determined instantaneous position of the sun mentioning that the higher the angle is less will receive less and less diffused radiation, but in this case appears rediation reflected from the ground, Rate of which will influence the production of electricity.

To have a better collection must take into account the geographical latitude of the site, because solar radiation its varieble , directly related to the angle and orientation of the panels.

Main goal for that is to have this paper is to cover as much of the consumption of electricity using photovoltaic panels necessary communities Miersig that would exceed over 1000 MWh that are connected to the national distribution a view to reducing the price of energy from consumers, which are interconnected distribution network but without energy storage and the secondary is of using electricity generated from renewable sources.

Main objectives of the European Union relation to energy and climate protection is well defined as follows: for the years 2020 should be reduced emissions of greenhouse gas emissions by at least 20% for the 30 to reach a 40% because in 2050 to reach a reduce up to 95% compared to the 90 fact that will exercise heavy pressure on energy systems present a different case being the yield energy from renewable sources by 20% the first stage, 27% for years 2030 and reach a level of interconnection between countries at least 15% between member states. [2].

As is well- known solar radiation intensity reduced by 25-30% of the gas atoms and ions present in the air (O_2 , N_2 , CO_2 , ozone , etc.) [12]

After all analysis made can see that prospects 2050 s shows that what the greatest amount of energy will come from renewable energy sources, thus becoming a central component of European energy mix, but here there is a big problem, namely current producers, and conversion technologies in electricity from renewables must also evolve, which require large investments, however a new landscape causing but also greater competitiveness. [3]

10/12/2015 Miersig Google Maps

Solenation in Oradea are average each month, with positioning: 45' 07" N 21' 54" E 1.33 2.09 3.13 4.36 5.31 5.93 6.22 5.40 3.98 2.58 1.54 1.15 3.59 Oradea. [4]

Performance of Grid-connected PV
NOTE: before using these calculations for anything serious, you should read [this]
PVGIS estimates of solar electricity generation

Location: 46°53'22" North, 21°51'1" East, Elevation: 132 m a.s.l.,

Solar radiation database used: PVGIS-CMSAF
Nominal power of the PV system: 900.0 kW (crystalline silicon)

Power of the PV system: 900.0 kW (crystalline silicon)
Estimated losses due to temperature and low irradiance: 9.4% (using local ambient temperature)
Estimated loss due to angular reflectance effects: 2.9%
Other losses (cables, inverter etc.): 14.0%
Combined PV system losses: 24.4%

Table 1

Fixed system: inclination=35°, orientation=0°				
Month	E_d	E_m	H_d	H_m
Jan	1090.00	33800	1.45	44.9
Feb	1750.00	49000	2.37	66.3
Mar	3010.00	93400	4.25	132
Apr	3700.00	111000	5.45	164
May	3740.00	116000	5.66	176
Jun	3860.00	116000	5.93	178
Jul	3960.00	123000	6.11	189
Aug	3940.00	122000	6.05	188
Sep	3160.00	94900	4.69	141
Oct	2620.00	81200	3.75	116
Nov	1630.00	48800	2.24	67.2
Dec	888.00	27500	1.18	36.7
Yearly average	**2780**	**84700**	**4.10**	**125**
Total for year		**1020000**		**1500**

Ed: Average daily electricity production from the given system(kWh)

Em: Average monthly electricity production from the given system(kWh).

Hd: Average daily sum of global irradiation per square meter received by the modules of the given system (kWh/m^2)

Hm: Average sum of global irradiation per square meter received by the modules of the given system (kWh/m^2)

PVGIS Estimates of long-term monthly averages

Location: 46°53'22" North, 21°51'1" East, Elevation: 132 m a.s.l.,Solar radiation database used: PVS-CMSAF
Optimal inclination angle is: 35 degrees
Annual irradiation deficit due to shadowing (horizontal): 0.0 %

Take in account the geographical position of Bihor County, power of solar radiation annual is about 3000 Wh / m^2 Relating to the potential minimum and maximum, and thus the total investment would go for 1 million euros, but with time and using green certificates can be recovered relatively quickly compared with the life of the photovoltaic panel, about 3 years.

Month	H_h	H_{opt}	$H(90)$	DNI	I_{opt}	T_L	D/G	T_D	T_{24h}	N_{DD}
Jan	968	1450	1420	1010	61	2.8	0.70	0.8	-0.6	581
Feb	1680	2370	2140	1710	55	3.0	0.62	2.1	0.5	455
Mar	3330	4250	3360	3250	46	3.1	0.53	7.7	5.7	340
Apr	4840	5450	3460	4720	32	3.1	0.44	14.0	11.9	117
May	5630	5660	2950	4860	18	3.5	0.45	18.8	16.8	33
Jun	6180	5930	2780	5400	13	3.6	0.43	21.8	20.1	5
Jul	6200	6110	2960	5730	17	3.9	0.40	23.5	21.9	0
Aug	5540	6050	3490	5870	28	3.9	0.35	23.7	21.7	19
Sep	3800	4690	3450	3840	42	4.0	0.46	18.6	16.6	92
Oct	2570	3750	3360	3120	55	3.4	0.49	13.7	11.5	295
Nov	1370	2240	2270	1840	64	2.9	0.58	8.4	6.5	456
Dec	774	1180	1180	835	62	2.8	0.72	2.1	0.7	592
Year	3580	4100	2740	3530	35	3.3	0.46	12.9	11.1	2985

H_h: Irradiation on horizontal plane (Wh/m^2/day)

H_{opt}: Irradiation on optimally inclined plane (Wh/m^2/day)

$H(90)$: Irradiation on plane at angle: 90deg. (Wh/m^2/day)

DNI: Direct normal irradiation (Wh/m^2/day)

I_{opt}: Optimal inclination (deg.)

T_L: Linke turbidity (-)

D/G: Ratio of diffuse to global irradiation (-)

T_D: Average daytime temperature (°C)

T_{24h}: 24 hour average of temperature (°C)

N_{DD}: Number of heating degree-days (-)

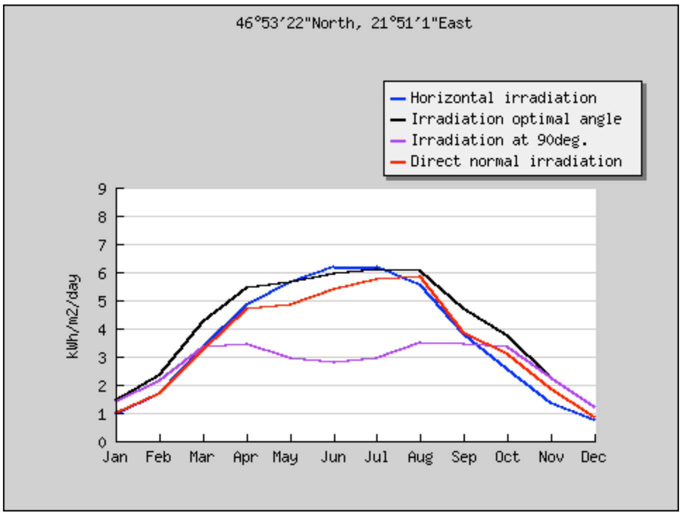

Figure 2. Irradiation

How is the average solar flux between 1700-2050 sunshine hours / year, we will capture 1m^2 surface between 800-1500kWh. [5]

After technical details of implementing the project can proceed to the next step of obtaining project approvals and implementation, but also for cleaning and arrangement land.

Having all the data and the purpose of this theme we will move to the constructive and calculations relating thereto.

To get the voltage and current to higher power, photovoltaic cells forming group generate with different characteristics will be electrically connected both in series and parallel, but care should be taken imbalances that may arise during operation due to the dispersion of consumption, the panels will be mounted on the metal surfaces 35° angle of inclination of the panels can produce a maximum of 1020 MWh / year.

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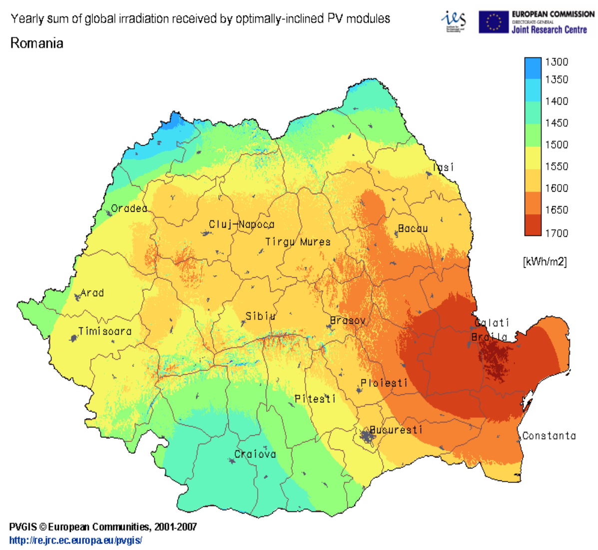

Figure 3. Yearly sum of global irradiation received by optimally – inclined PV modules [5]

The photovoltaic generator produces a continuous current, and in order to be fed into the network it has to be converted into alternating current using an inverter. The panels that we use will be made of polysilicon having a power of 250 W, each of which will be connected to the inverter asphalt near them to eliminate CATS much can current losses.[12]

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The necessary of panels for this projects will be 4,080 photovoltaic panels, divided into 51 groups of 80 panels connected to one inverter 20kW provided with boxes of primary protection to protect each row of panels and some side with index IP65 and all of them will be directed to transformer of 1,000 kVA provided with counters to record the energy charged in the network medium and low voltage a power supply which will be connected to a line 20kV using transformer station [6, 11].

Regarding the protection system to follow the regulations provided by the IEC 60 364-712, both in the current and in what was the current alternatives, and technical compliance for connecting photovoltaic installations to the low voltage network. Beside that we have to consider harmonization and to electromagnetic compatibility linked to low voltage uses installations, involving inverters and thereof associated components [7].

For the calculation of solar radiation [W/m^2] under ideal conditions of temperature and light radiation (25°, 1,000W/m^2), we calculated the surface capture of two panels, one for 35W and 250W one, to find the necessary surface and the energy difference between the two on the same surface. [8]

$$S = L \cdot l = 1{,}58 \cdot 0{,}8 = 1{,}264\text{m} \quad (1)$$

- panel at 35 W monocristalin

$$S = L \cdot l = 1{,}645 \cdot 0{,}99 = 1{,}628\text{m}^2 \quad (2)$$

- panel at 250 W policristaline

These, the difference representing the difference of 1.485 m^2 surface between the two, the energy gain is 878MWh of calculi resulting in a yield of 15.35% at this intensity.

$$P_{in} = 1.000\ [\text{W/m}^2] \cdot 1{,}628[\text{m}^2] = 1.628[\text{W}] \quad (3)$$

And how panel is chosen Pout = 250W, the yield will be:

$$\eta = P_{out} / P_{in} = 250 / 1.628 = 15{,}35\ [\%] \quad (4)$$

In order to avoid of shadowing phenomenon created by panels and other obstacles we considered namely 22.12 December the height of the sun is that the smaller distances between the lines shall be 4.82 m, because the shadows are long. When we also discuss efficiency of the system we must bear in account the losses caused by cables, inverters, conductor.

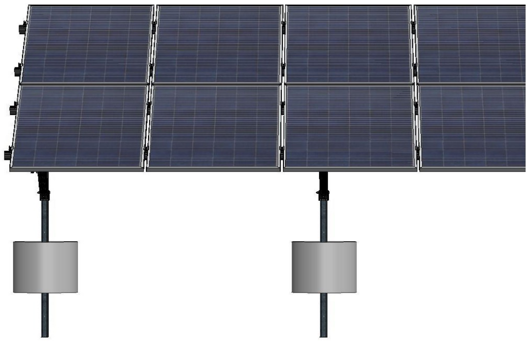

Figure 4. Structure metal panels fixation

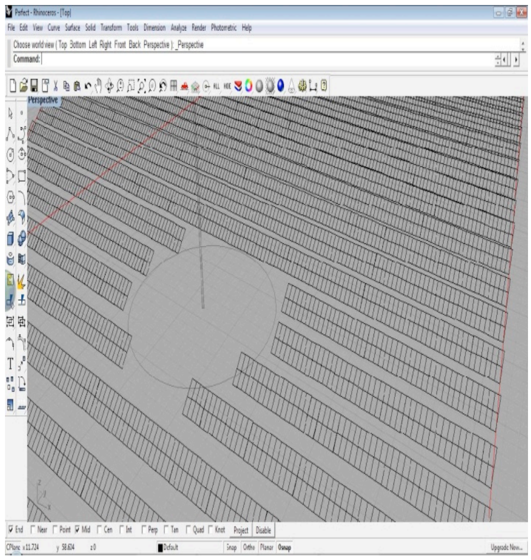

Figure 5. Orientation of photovoltaic panels

How do annual energy production taper is 1608 kWh / m^2 for the conventional 365.25 days of the year, the annual output of radiation will be given yearly total area, yield and system losses.

$$W_{out} = 1.608 \cdot 1628 \cdot 0{,}1535 \cdot 0{,}8 = 321.468\ [\text{kWh}] \quad (5)$$

So we have the following parameters: installed capacity 900 kWp panels 250W polycrystalline inverters 20kW, the power plant transformer of 1,000 kVA and metallic structures for mount the panels and so we can move on to actual calculation of the energy and an estimate for a period of 15 when electrical has an obligation to reward manufacturing company the green certify per MW injected into the network, price is indexed regularly to take account of inflation and that has an obligation them to redeem of the price range of 30-60 EUR / MW, at the end.

The prices can be different more or less depending the command and producer of table data are taken from the [9].

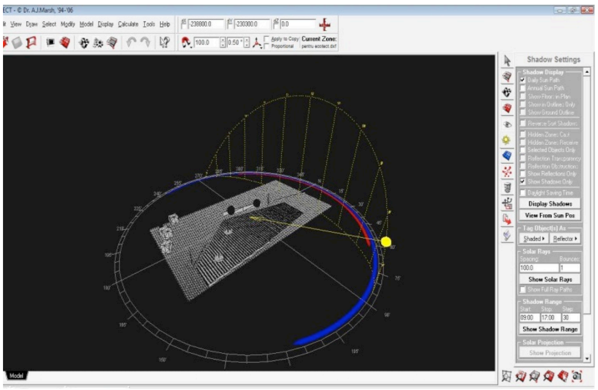

Figure 6 Simulation at shadow effect in the open field

This economical analysis has been designed to provide information regarding inflows and outflows of energy, and some expenditures regarding project implementation and payback period and its durability, and creation of new jobs for local people, as can be seen by the appearance of such parks in the country as can be see in rest of the park by BIHOR.

5. CONCLUSIONS

There are no polluting emissions thermal and acoustic the time utilization is expected to be 30 years in which case the their performance does not fall below 80%, economically speaking the investment represent 30% of the lifetime, but the by changing the inclination angle summer - winter production can to increase further

How to a product MW photovoltaic plant 6 certificates are received more quickly green investment is recovered, leading it to be written off in 2.2 years and 4.4 years for worst advantage in and the rest is profit at least 10.6 years as receive green certificates (2.8 to 5.6 mil. Euro), taking into account our lifetime panels which may reach 25 years

Table 1. The Estimative General Bill of Quantities of photovoltaic installation

No.	Name of the product	Units	No. of units [pcs]	Total [EURO/pcs]	Total [EURO] WITHOUT WATT	Total [EURO] WITH VAT
1	Panel cristaline de 250W	buc	4080	166,38	678.830,40	841.749,696
2	Inverter of 20 KW	pcs	35	3.180,00	111.300,00	138.012,00
3	Fixed metal structure	kW	900	198,00	178.200,00	220.968,00
4	Cables, connection boxes, energy counter, etc.	kW	900	166,048	149.443,2	185.309,56
5	Shipping panels, inverters and structure	kW	900	30,13	27.117,00	33.625,08
6	Subtotal photovoltaic			**1.05 euro/Wp**	**1.009.890,6**	**1.060.385.13**
7	Labor	kW	900	104,47	94023	116588,52
8	GENERAL TOTAL			**1.15 euro/Wp**	**1.103.913,6**	**1.176.973,65**

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