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The Reduction Possibility Of The Emissions With Co_2 Burning Fossils Being Replaced By Solar Energy In The Republic Of Kosovo

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Abstact: Considering the opportunities for the use of solar energy in the Republic of Kosovo makes possible the reduction of emissions with organic burning fossils of CO_2, since over 92% of electricity consumption in Kosovo is involved by burning fossils. Fulfillment of standards according to European directives, care to the living environmentin case of global warmingare more reasonsto take into consideration the possibilities of putting in use the modern technologies with efficient exploitation system of natural resources by preserving underground wealth with burning fossils.Advanced technology on the use of solar energy has an unused potential of solar radiationwith optimal temperaturesmeasured by the Kosovo Meteorology Entity and German KFOR in Prizren, with sufficient number of days of annual solar radiation. Encouraging renewable energy investmentswhich include efficient technology of LED solar lighting systems, with solar panelsand photovoltaic system with well-controlled systemare the best indicators that the system is managed welland is the indicator of the living environment protection and reduction of the impacts by $CO_2$and greenhouse gases [1].

Keywords*: Reduction of CO_2 emissions, renewable energy, solar radiation, efficient system controlled by LED.*

I. Introduction

Even in the Republic of Kosovohas been started to think seriouslythat without time delay should be applied the use of modern technologieseither to promote the use of the equipment for environmental cleaningwhere electricity is produced by burning coal, or the possibility of using renewable resourcesfor productionof both the electricity or thermal energy, contributing to the efficient production of electricityas well as reducing the amount of CO_2 (carbon dioxide). Particularly this has increased the needfor exploitation of renewable energyeven from the Solar energy.Kosovo increasingly meets all conditionsto produce renewable energy from the sun,based on the measurements made by the Kosovo Hydro-Meteorological Institute for solar radiationas a source of inexhaustible energy production. Based on the surface of the Earth (510.1 $10^6 km^2$) we can conclude that we're dealingwith large amounts of Solar energy (about 10^9TWh/year). Due to the sunny days within the year in Kosovo (out of 365 days, 285 are available with the Sun). The amount of solar energythat penetrates to the Earth's surfacedepends on the locationoutside the terrestrial atmosphere where1.4kW energy falls per $1m^2$of the Earth's surface. Passing through the terrestrial atmosphere0.4kW (30%) of the Solar energyis absorbedand only1kW (70%) falls in $1km^2$of the Earth's surface. Solar energy is spread on the surface of the Earthdepending of geographic latitude, season of the yearand the length of the day. Even the generation of civilization that we live today is at a critical point, in terms of actual energy equilibrium, based almost entirelyon fossil fuelsincreasing care on the conservation of fossil fuels. We are at one of those critical points in history where we need to rethink of energy regime. We are in the final stages of the fossil-based fuel eraand change from current energy regime to a new energy regime will be an opportunity for civilization, in this case is the possibility of local application of solar energy for future generations. It is essential to clarify thatin this new shift of the global energy regime and technology there can be used amount of solar energy per m^2/year= 1000kWhm^2,so the countries which will implement the rules according to guidelines will survive contemporary technologies and will speedily adapt to the era that is under development [2].

II. Sunlight Energy

The Sun is an overheated ball in the form of a plasma with a continuous flow of its movement through the orbit that creates a strong magnetic field. With the passage of time the magnetic lines in the field can be obtained from the surface of the Sun in twisted rubber forms. These lines with magnetic field have a premature configuration with greater flow of energy in the form of fireworks that release radiation beams of X in nuclear form.

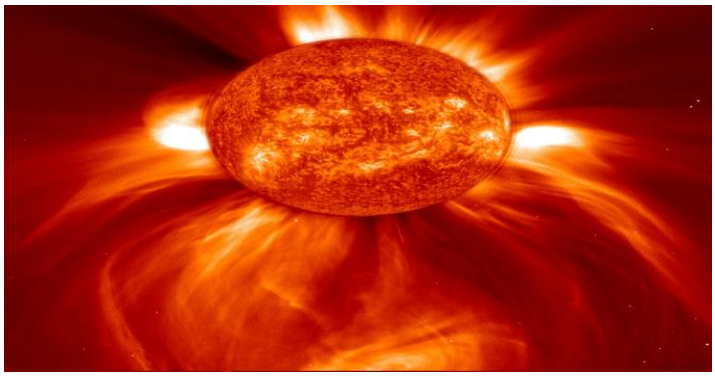

Figure: Radiation sun in nuclear form

The sun rays in the nuclear form are formed through the fusion of hydrogen atoms whose energy during the fusion of rays are passing through the process of helium.

III. Solar Collectors

Concentrated solar collectors require large area of approximately 1 $km^2$for every 20-60 MW, as well as in case of surface miningof fossil fuels large areasare also required. In detail must be controlled panels and locations for accomodation of solar systems either for photovoltaic cells or when using solar thermal energy because solar thermal systems requiresignificant amount of water for cooling. Most economical is the use of solar collectors on the existing roofs of houses and industrial facilities for it does not require large areas. While passing through the atmospherea part of solar energy is absorbed by the gases (oxygen, water vapour, carbon dioxide), a part is reflected (in the molecules of gases, in particles of dust), and a part is re-emitted.

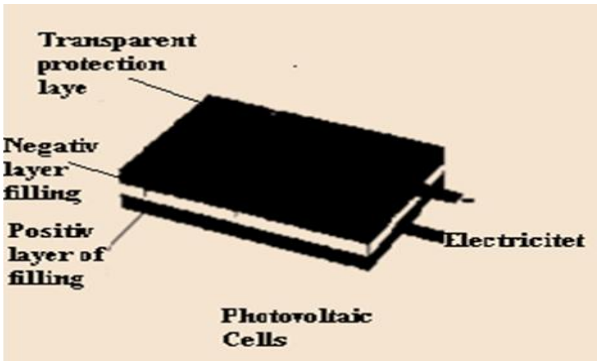

Figure: Collectors solar

Reduction of solar energy power during passage through the atmospheredepends on the weather coditions (cloudless, partly cloudy and cloudy), on the pollution of the atmosphereand altitude. The average value of the sun radiationwhich falls vertically to the surface is calledthe "solar constant" and has value:
$\bar{E}_0$=1.367 +_ 7 W/m^2

The intensity of radiation of the Sunvaries throughout the yeardue to the changes in the Earth's distance from the Sun. Value of radiation of the Sun which falls vertically to the surface at any distance of the Earth from the Suncan be obtained from equation:
$E_0=\bar{E}_0 (r/R)^2$
Where $\bar{E}_0$- is the solar constant, r-the average distanceof the Earth from the Sun, and R-the real distance of the Earth from the Sun.

In meteorology,the radiation of the Sun is measuredin horizontal plateand there are data for a number of countries.

Total radiation can be written in equation:
$E = E_i + E_d + E_r$
Where E_i-represents the direct radiation of the Sun, E_d–diffusive radiation, E_r-reflective radiation.

The power of the sun's rayswhich penetrate to the Earth's surface, which can be used, vary during the day and the year, depending on the position of the surfaceon which the Sun's rays penetrate.Potential energy of radiationis the maximum energythat reaches the Earth's surfece through the dry and clean atmosphere, it depends on the geographical latitude and altitude. It falls with decreasing altitude (the Sun's rays pass the longest way) and with increasing geographical latitude (decreasing angle of the rays become increasingly smaller).For the same altitude and the same meteorological conditions, conditions for potential energy radiationin geographical latitudein43^{0}are 2500 kWh/m^{2}during the year in 46^{0}about 2400 kWh/m^{2}during the year. If it is assumed that the maximum power radiation is 0.9 kWh/m^{2}if this power would be constant through the whole year could be obtained 7884 kWh/m^2 . Therefore, the use of the sun's potential energy in geographical latitude in 43^{0}would be 31.7 % while in geographical latitude in 46^{0}would be 30.4 %,[3].

IV. Global Solar Radiation

Solar radiation means: light, electromagnetic radiation that reaches the Earth's surfacewhich is partially absorbed on the surface, while the rest is reflected back into the atmosphere. Light is the direct componentthat originates from the sun (it means that light is not encountered with obstacles, so the running direct radiation can be determinedat any point of the Earth's surface), there is also a part of the lightwhich due to the particles in atmosphere (eg. clouds of dust, smog and other aerosols) is reflected and scattered which in this way affects the spectral distribution of light. In addition, the Earth itself radiates electromagnetic radiation. Overall radiation falling on a horizontal flat surface is called the global radiation [4].

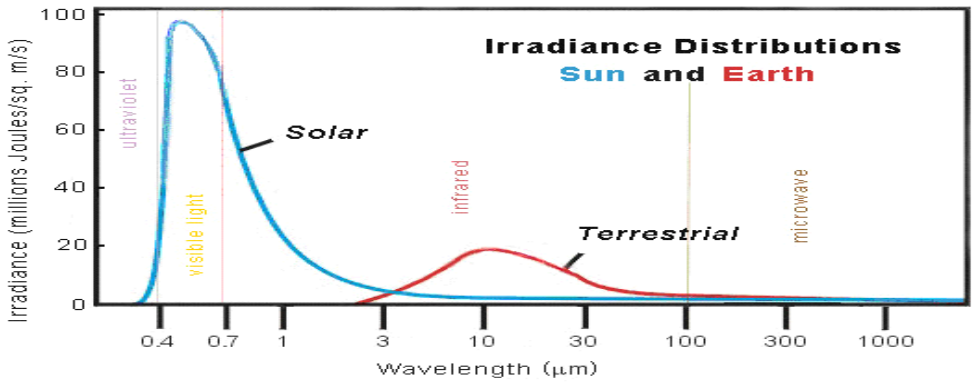

Figure: Irradiance Distributions sun and earth

The intensity of the quantity and quality (flat length distribution in the horizontal spectrum) impact on astronomy, physics, meteorology, geometry and geography. The diagram shows that the global radiationdepends on the quality, intensity and solar qualitytime (only a part of the spectrum is shown). The curve with interrupted line shows the light on the entry and exit of the sun.

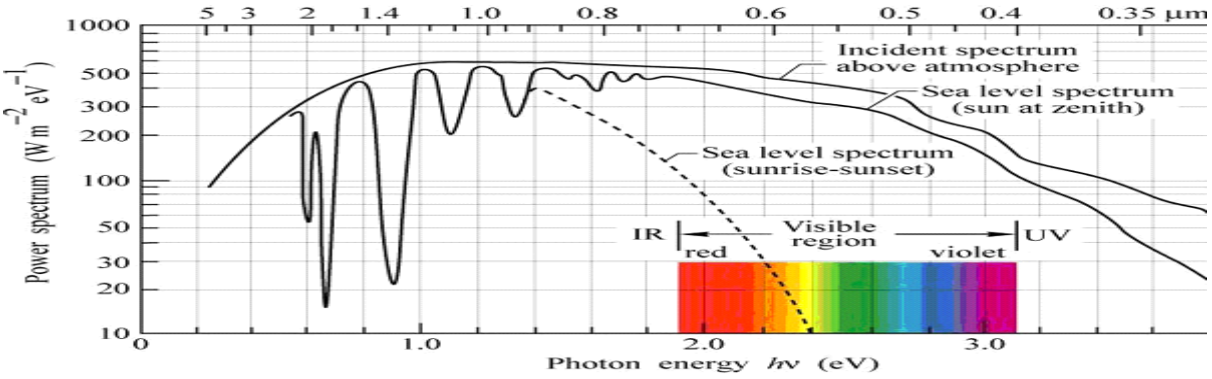

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Figure: Intensity distribution in the horizontal spectrum

The dependance of global variation during the day. Then, when the light directly falls at a different angle of 90^o, then the lighting flux of the light is reduced on a horizontal plate that reduces the light intensity.Diagram is the radiation flux according to angles [5].

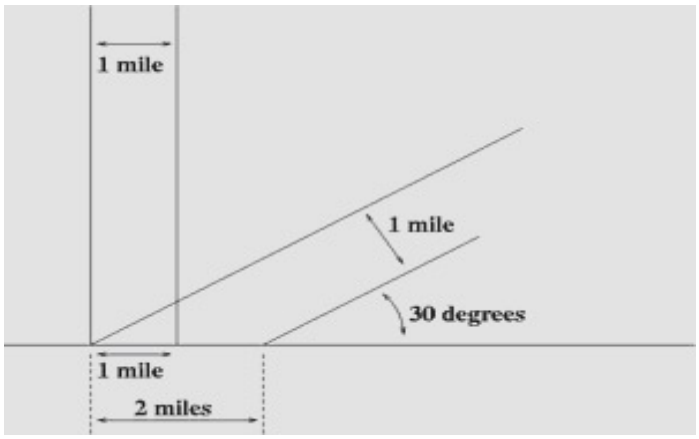


Figure: Diagram in radiation flux to angles

V. Solar Controlled And Managed Systems

- All measured systemsare subject to a strict controlof photovoltaic performance, brightness data of solar radiationmeasured by the Kosovo Meteorology Institute, and the measured values of solar radiation for the2011year in Kosovo range in average values of11.95 C°[6].

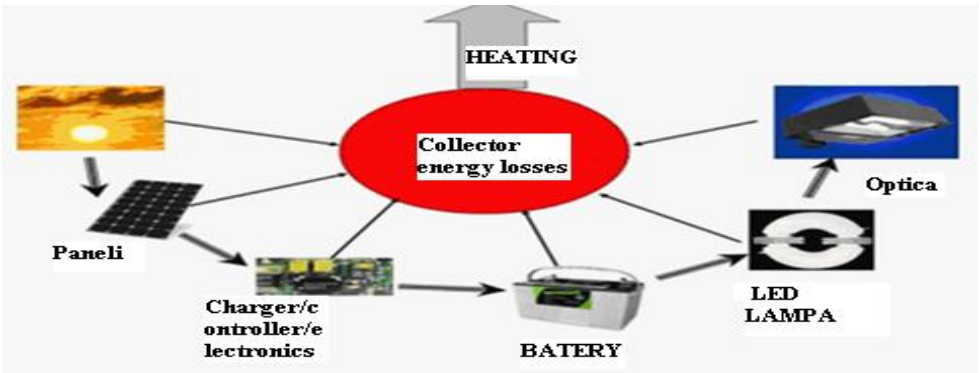
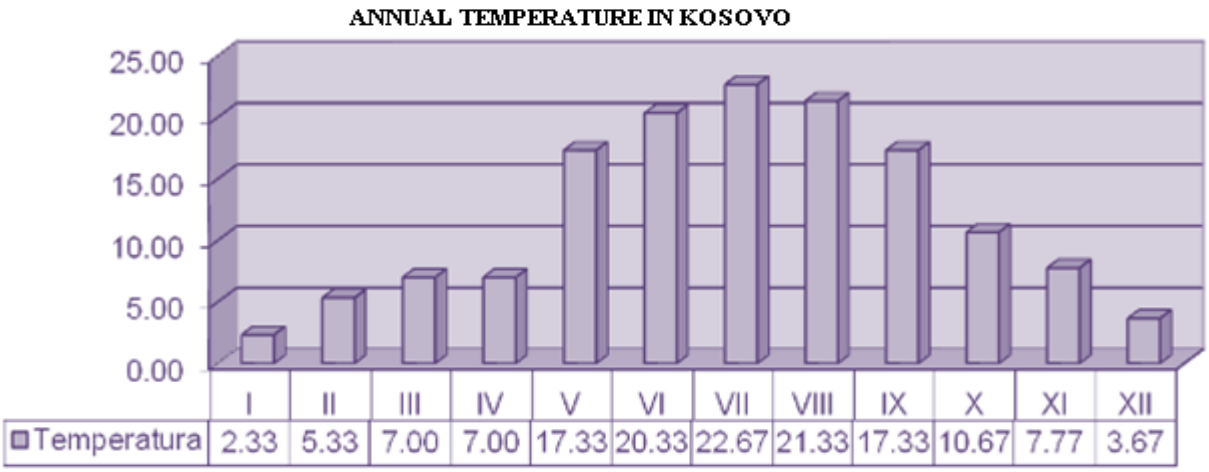
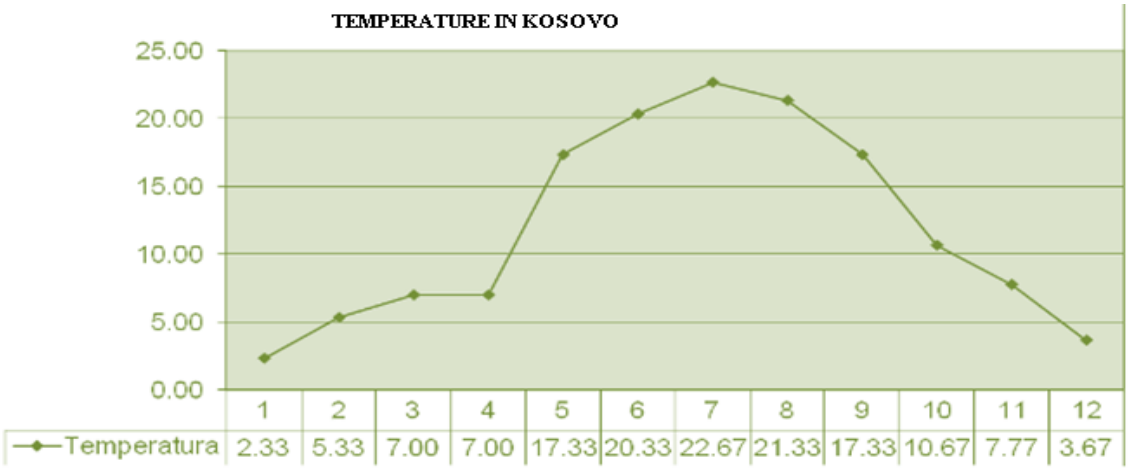


Figure: Solar control and ménage system

Solar radiation temperature in Kosovo, according to the measurements of the Kosovo Hydro-Meteorological Office,have optimal valuecompared even by the developed countriesof the European Union, in this case it is concerned to Germany.





I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Midle/Year
-0.9	6.48	11.3	11.7	17.6	22.2	17.8	24.0	16.0	11.7	8.5	2.8	12.4

VI. Modules Of PV System

Some solar programsin order to be qualified to PV systemsshould reach maximum generationthatis usually distinguished by the level of consumersin what disposalyou havepurchasing electricity on an annual basis (see section on net metering). Finally, the privileged consumersfor net meteringvary from the level of annual categoryin net metering unit.Një tipar opsional për t'u marrë me kete system bateri per te siguruar ruajtjen e energjise ose duke ruajtur fuqi reserve me rastin e nderprerjes se energjise lidhur me sistemin e shperndarjes nga PV. Per sistemet deri në 5 kilovat me PV edhe inverter po me te njejten madhesi dhe kostet e punes per nje system te vogel prej 2 kW mund te jen te njejta sikurse per nje system madhe[8].

PV Module	PV Capacity Rating (Watts)						
	100	250	500	1,000	2,000	4,000	10,000
4	**30**	**75**	**150**	**300**	**600**	**1,200**	**3,000**
8	**15**	**38**	**75**	**150**	**300**	**600**	**1,500**
12	**10**	**25**	**50**	**100**	**200**	**400**	**1,000**
16	**8**	**20**	**40**	**80**	**160**	**320**	**800**
For example, to generate 2,000 watts from a 12%-efficient system, you need 200 square feet of roof area							

Calculation of electricity bill savingsfor a unified system with PV

• Determining the size of the system in kilowatts (kW) is a reasonable range of calculationfrom 1 up to 5 kW. This value "kW PV" is for the bellow highlighted equations. Based on your geographical locationwe will choose a power generation factor from the map below to "kWh / kW-yearly" to the following equations:

Energy from the system:

PV = (kW i PV) x (kWh / kW-yearly) = kWh / year

If we want to share in the months and divide by 12 in order to find out the determination of the reduced energy.

Energy bill savings = (kWh / year) x (occupancy rate) /100 = € / yearly saved.

(Occupancy rate in the above equation should be in euros per kWh,

For example, a rate of 10 cents per kWh is input as€ 0.10/kWh.)

For example, a 2-kW systemon CO_2 emissions, in a residential energy rate of€ 0.07/kWh will save around € 266days per year: 1,900 kWh / kW-yearly x € 0.07/kWh x 2 kW = € 266/yearly [9].

VII. Benefits Of Solar Energy From Solar Panels In The Republic Of Kosovo

- Sollar energy emits no pollution, the only pollution produced as a result of solar panel is the manufacture of solar panels in factories, transportation of goods and installation.
- Secondly, solar energy is not specific locationunlike some other forms of energy.Regardles of the factwhether a person is in a city with density population, in a remote village, in dry desert or in a healthy green forest, at sea, or high in the mountains and so on, solar energy is available to everyone.
- Solar radiation is free.
- One of the major advantages of solar energyis the ability to use electricity in remote locations that are not connected to the national network [10].

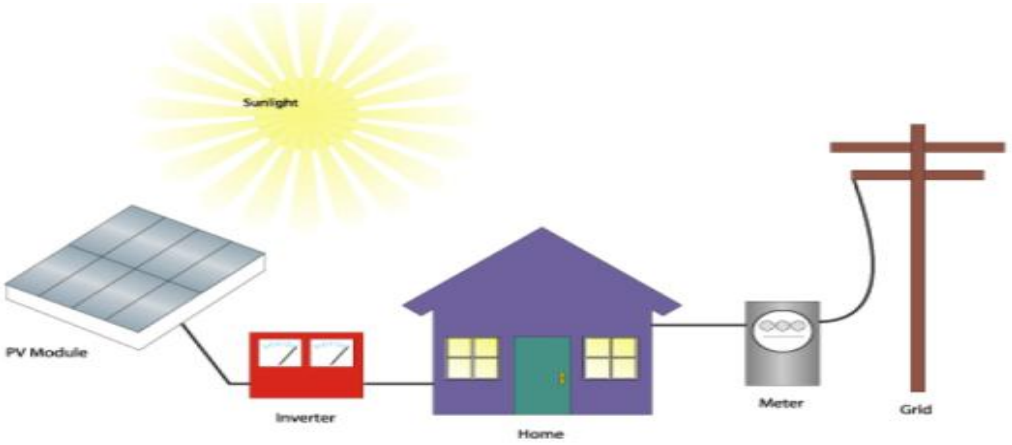


Figura: Benefits of solar energyfrom solar panels conect to networc

The prime example of this is in space, where satellites receive electricityfrom high efficiency of solar cells.

- Prices of fossil fuelsfluctuate constantlyas they depend on several global factors- demand for supply. Solar energy is completely free of any such complexity, simply because it is cheap (free).
- Small systems of solar energy are installed easily.
- Solar panels can be installed on the top of many roofs, which eliminates the problem of finding the necessary place for placing of solar panels.

The possibilities of using Solar Energy and sun radiation during the year in Kosovo, [7].
The global radiation in Kosovo is about 1400 kWh/m^2
Geographical latitude: from 41°52´ to 43°16´ (N)
Geographical length: from 19°59´ to 21°16´ (E)

a) The data for solar radiationin three cities of Kosovo, the average radiation of which can be taken as an average at the level of the country. Cities in question are Prishtina, Prizrenand Peja as shown in tables.

Cities	Hours of sunshine per year
Prishtina	2153.2
Prizren	2131.8
Peja	1974

Their average is: 2086.3 hours of sunshine per year.

a. The average number of sunny hoursin several cities of the Republic of Kosov, të calculated for one day is shown as in table.

Cities	Hours of sunshine per day
Prishtina	5.9
Prizren	5.8
Peja	5.4

Their average is: 5.7 hours of sunshine per day [11].

Solae energy resources in Kosovo

The Republic of Kosovois relatively wealthywith natural resourcesof renewable energyas well as including solar energy as shown in table 7, [12].

Kosovo	
Total area in km²	10789
Urban area in km²	142

Annual radiation varies depending on geographic location,weather and air pollution.Solar radiation in Europe is shown in table 7, which is calculated by thejoint study centerof the European Commission,based on records and dataprovided by the Bureau of Meteorology in all over of Europe.According to this reference,the global average of radiation in Kosovo is 1622km/m² per year [7].According to the Kosovo Bureau of Meterorology,the global radiation is 1400km/m² per year, while in the Republic of Germany radiation ranges between 850 up to 1100km/m²,[13].The average annual solar radiation depends on the geographical location**,**

RADATION GLOBAL IN YEAR (kWh/m2)

RADIATION GLOBAL IN YEAR (kWh/m2)	horizontal	vertikal	optimal
Minimumi	1356	997	1535
Mesatarja	1421	1067	1622
Maksimumi	1465	1125	1680

Angle of radiation - South

Angle of installation –optimum angle of solar cell assemblyfor the whole yearranges from33° to 36°.Annual photovoltaic energy is shown in table.

PHOTOVOLTAIC ENERGY (PV) FOR YEAR *(kWh/1kWp)*

Energjia PV vjetore (kWh/1kWp)	horizontal	vertikal	optimal
Minimumi	1013	752	1140
Mesatarja	1062	805	1205
Maksimumi	1091	863	1254

If we consider as a basisthe average of annual photovoltaic energy (PV) of 1205 kmh/1kWp then we will have reduced environmental benefitsas shown in table:

SO_2/year	38,15 kg
NOx/year	43,25 kg
CO_2/year	1566 kg
Dust/year	43,3 kg

Monthly changes of solar radiation in Kosovoare assessedon the basis of solar radiationin the region, records which are taken from the monitoring stations of the regionare presented in the diagram.

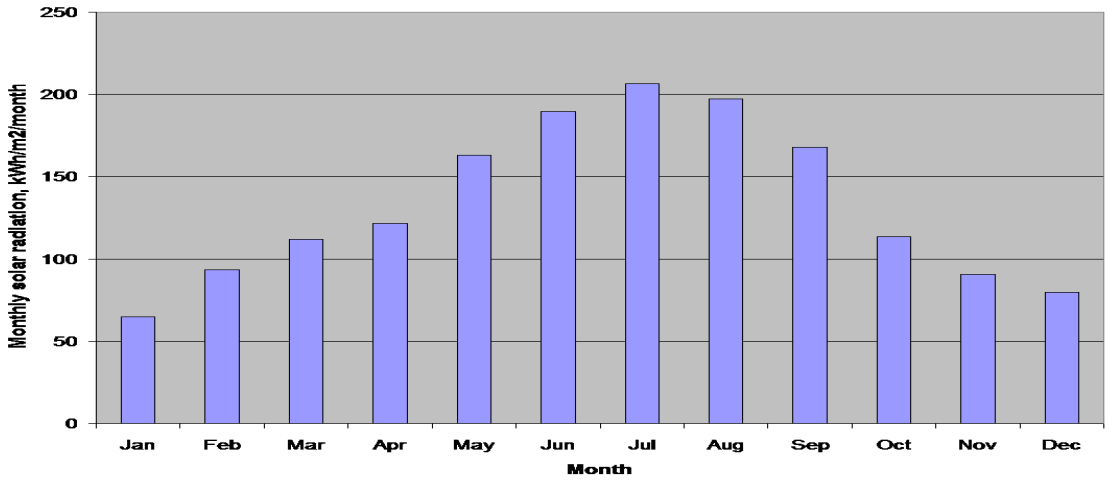


Diagram: Monthly solar radiation in % of annual radiation.

VIII. Conclusion

Daily trends are increasingly in function of putting in usethe clean and efficient technology, reduction of energy consumption with CO_2, creation of functional and reliable operation over the time. The Republic of Kosovomeets all conditionsof solar radiationbased on measured temperaturesby the Kosovo Bureau of Hydro-Meteorologyand has an appropriate geographical positionfor the implementation of solar panelsaccording to the angle of radiation-south. As a solution andwell opportunity benefit isthe type of LED lamp which is called by the name „Light Emitting Diode“, based on LED technology,where the last layer with the white colour is covered with one or two coats of yellow phosphorus where the source of blue light gets green light. Today the world needs more renewable energythan ever beforeand in spite of the use of solar resource energy, it is believed that there is about 86000 TW of unused energy. The modern sciense is looking for other sourcesin order to meet the needs of humanity and technology. Today, the most ponounced and concerned effect is the global warming, which is created from fossil fuels, and, at the same time is the biggest challenge of the mankind in its history [17]. In the Republic of Kosovo,the legal base infrastructureand regulatory for renewable energysources is being completed and unifiedas that of the European Union,in compliance with appropriate directivesand energy efficiency lawsthat has been introduced by the European Union for BER and their further institutional developmentup to 2020 [14].

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