United Nations Development Programme

Conservation of Biodiversity and sustainable land use management in Municipality of Dragash

IDENTIFICATION OF POTENTIAL FOR APPLICATION OF SOLAR ENERGY TECHNOLOGY IN THE MUNICIPALITY OF DRAGASH

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Declaration

This analysis is based on the collected data by the "Study on preparation of design data for solar energy utilization systems in Kosovo" completed by "B2B & Energy" and funded by the Ministry of Energy and Mining of Kosovo (MEM) in 2010 and data from other relevant studies. Source of information is cited for each collected data.

Data in this analysis, taken from the MEM aforementioned study and other studies, were collected with a special focus on Dragash municipality. This analysis will serve as a guide for solar hot water energy application for the territory of municipality of Dragash.

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1 INTRODUCTION

Revised Energy Strategy of Kosovo (ESK) 2009-2018 sets out the medium and long term frame of energy sector development in Kosovo, and highlights the need for a more rational use of local energy sources, including renewable sources and increase of energy efficiency as a mean of considerable savings source that reduces demand for generation capacity.

Reliability of supply, promotion of investments in the sector, environmental preservation and further development of the energy market are the main strategic goals of the new European strategy for energy sector in the EU. A number of important objectives derive from these goals, including the so-called 20% - 20% - 20%. This means: (1) 20% reduction of gas emissions that create the 'greenhouse' effect, (2) 20% increase of the participation of renewable sources in energy consumption, and (3) 20% improvement of energy efficiency.

Kosovo is a signatory of the Energy Community Treaty for South Eastern Europe with equal rights and obligations. Under this treaty, Kosovo is obliged to increase the energy efficiency at 9% until 2018, based on consumption during 2006/2007. Achievements on this goal will be reported every three (3) years and increased efficiency should be 1% per year or 3% in 3 years. The first report will be done in 2012.

Based on indicative targets for increasing energy efficiency, which Kosovo has approved in line with the obligations under the Energy Community Treaty, a Kosovo Energy Efficiency Plan (KEEP) for the period 2010 - 2018 has been drafted.

Energy Community Secretariat has requested the signatories of the treaty to adopt the harmonized methodology of the European Commission (EC) for evaluation of the energy savings and use it for evaluation and verification of energy savings in their countries. The methodology adopted in 2011 by the signatories of the Energy Community Treaty, as part of measures to implement energy efficiency, provides for the installation of sanitary hot water solar systems.

To provide a more complete support for all those who want to design, finance, install and utilize solar energy for sanitary hot water or to produce electricity from solar energy, besides other things, are required to posses data with the following information:

Solar radiation on the optimum horizontal and sloping (tilt) plains for the specific area / location where solar panels will be installed;

Other climate conditions of the region / location, including average temperatures of air, water, etc..,

This analysis intends putting together all data relevant to **the territory of the municipality of Dragash** regarding the solar hot water energy potential obtained from other studies.

2 ENERGY POTENTIAL OF SOLAR ENERGY UTILIZATION IN DRAGASH

In order to design systems using solar energy, it is required to know a number of climate parameters (variables), including:

The average daily radiation in solar collector planes, which is used to calculate the collector efficiency and solar energy absorbed by it;

Sky temperature, which is used to calculate the energy, absorbed by collectors without cover, and radiation losses in the area surrounding the pools;

Cold water temperature that is used to determine the thermal load, which the system should cover / handle, and

Heating load (except for pools).

The amount of solar radiation that reaches each point of the Earth's surface varies depending on these factors:

(i) Geographical position;

(ii) The time during the day;

(iii) Season;

(iv) Geographical location and local climate conditions.

2.1 Horizontal solar energy radiation potential plane

Data of solar energy and the average monthly and annual temperatures for different Kosovo towns according to the European Commission database are given in Table 1.

(http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php#)

Table 1

Location		Calculated for locations:			Monthly and yearly solar irradiation in horizontal plate [kWh/m^2]												
Region	Municipality	Latitude	Longitude	Altitude	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Vjetore
Prizren	Prizren	N 42º 12' 44''	E 20º 43' 12''	395 m	46.8	63.28	108.5	146.1	181.7	201	218.2	190.0	123.3	92.1	54.6	36.3	1461.9
	Dragash	N 42º 3' 41''	E 20º 39' 20''	1054 m	48.1	64.96	110.9	144.3	177.3	198.6	217.9	187.6	121.5	92.7	56.7	40.9	1461.5
	Suharekë	N 42º 21' 41''	E 20º 48' 58''	387 m	46.5	65.24	110.9	145.5	180.7	203.4	217.6	190.9	123.6	93	54.9	36.9	1469.3
	Rahovec	N 42º 24' 7''	E 20º 39' 25''	424 m	45.0	64.4	111.6	145.5	180.1	203.4	215.1	189.1	122.7	92.1	54.9	35.0	1458.9
	Malishevë	N 42º 29' 3''	E 20º 44' 36''	523 m	47.1	64.4	112.5	146.7	181.4	204.6	216.7	189.7	123.3	93.3	53.7	36.9	1470.3

Source: "Study on preparation of design data for solar energy utilization systems in Kosovo" completed by "B2B & Energy" and funded by the Ministry of Economic Development of Kosovo (MED), 2010

2.2 Optimum solar energy radiation potential plane

A. According COWI (Evaluation Study for Renewable Energy in Kosovo, COWI A / S, 2008) theoretical potential of solar energy in Kosovo is as follows (Table 2):

Table 2

Region	Municipality	Surface [km^2]	Solar irradiation	
			kWh/m^2/year	GWh/vit
			Average	
Prizren	Prizren	636	1600	1,017,600.00
	Dragash	435	1625	706,875.00
	Suharekë	357	1625	580,125.00
	Rahovec	268	1650	442,200.00
	Malishevë	311	1600	497,600.00

Source: "Study on preparation of design data for solar energy utilization systems in Kosovo" completed by "B2B & Energy" and funded by the Ministry of Economic Development of Kosovo (MED), 2010

B. According to the European Commission database[1], data for different cities of Kosovo for solar energy and average monthly temperatures is presented below (Table 3.)

Table 3

Lacation		Calculated for locations:			Monthly and yearly solar irradiation in in optimal angle plate with orientation to the South [kWh/m^2]												
Region	Municipality	Latitude	Longitude	Altitude	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yearly
Prizren	Prizren	N 42º 12' 44''	E 20º 43' 12''	395 m	69.4	86.8	133.6	159	180.1	190.5	212.0	201.8	146.1	127.1	82.5	53.0	1642.0
	Dragash	N 42º 3' 41''	E 20º 39' 20''	1054 m	68.8	81.5	132.1	155.4	176.4	189.3	213.4	199.6	142.8	125.2	83.1	57.9	1625.5
	Suharekë	N 42º 21' 41''	E 20º 48' 58''	387 m	69.4	91.3	137.3	158.4	179.2	192.6	211.4	202.7	146.4	129.3	85.2	54.6	1657.8
	Rahovec	N 42º 24' 7''	E 20º 39' 25''	424 m	66.0	89.3	137.9	158.4	179.5	193.2	209.6	200.6	145.2	127.4	82.2	51.5	1640.8
	Malishevë	N 42º 29' 3''	E 20º 44' 36''	523 m	71.9	89.9	139.8	159.6	179.2	192.6	209.9	200.9	146.1	130.8	84.3	56.7	1661.7

Source: "Study on preparation of design data for solar energy utilization systems in Kosovo" completed by "B2B & Energy" and funded by the Ministry of Economic Development of Kosovo (MED), 2010

[1] http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php#

The following solar energy potential utilization tables on heating and electricity production potentials in Prizren region, with a special focus on Municipality of Dragash, have been prepared based on the data obtained from European Commission database (Table 4 and Table 5)

Table 4

Potential for using the solar energy for heating sanitary water in Region of Prizren with focus in Kunicipality of Dragash

Location		Demographie				Solar irradiation potential		Potential for producing thermal energy (Solar collectors)					Potential application
								Efficiency sun-water =	0.7	Efficiency water-water =	0.7		Heating sanitary water
								Overall efficiency =	0.5				
Region	Muncipality	Zone	Popullation	Population density	Households	Irradiation in optimal angle	Theorical potential	Neto potential	Collector size	Number of households	Amount of collectors	Total potential for heating	
		km²	Inhabitants	Inhab./km²	Total	kWh/(m²*year)	GWh/year	kWh/(m²*year)	m²	% of total	m²	kWh/year	
Total for Kosovo		10910	1975000	181	295695	1611	17576010	805.5	4	10%	118278	95272929	Yes
Prizren Region	Prizren	636	177260	278.7	29215	1642	1044312	821	4	10%	11686	9594206	Yes
	Dragash	435	33584	77.2	6064	1625.5	707093	812.75	4	10%	2426	1971406	Yes
	Suharekë	357	59702	167.2	9132	1657.8	591835	828.9	4	10%	3653	3027806	Yes
	Rahovec	268	55053	205.4	8028	1640.8	439734	820.4	4	10%	3211	2634468	Yes
	Malishevë	311	54664	175.8	6887	1661.7	516789	830.85	4	10%	2755	2288826	Yes

Data for calculation:

Number of dwellings in Dragash:		9773
Inhabited dwellings:	60.90%	5952
Uninhabited dwelling	39.10%	3821
Households:		6094
Number of population:		33584

Data for inhabitants and households are taken from the preliminary results of the cenzus 2011 in Kosovo

Source: "Study on preparation of design data for solar energy utilization systems in Kosovo" completed by "B2B & Energy" and funded by the Ministry of Economic Development of Kosovo (MED), 2010

Table 5

Potential for using the solar energy for electricity production with PV panels in Region of Prizren with focus in Kunicipality of Dragash

Location		Demographie				Solar irradiation potential		Potential for electricity production (Photovoltaics modules - PV)					Electricity production
								Efiqienca e pergjithshme =		0.15			
Region	Municipality	Zone	Popullation	Population density	Households	Irradiation in optimal angle	Theorical potential	Netto potential	Size of PV module	Number of households	Amount of PV panels	Total potential for electric energy	Electricity production from PV modules
		km²	Inhabitants	Inhab./km²	Total	kWh/(m²*year)	GWh/year	kWh/(m²*year)	m²	% of total	m²	kWh/year	
Total for Kosovo		10910	1975000	181	295695	1611	17576010	242	4	10%	118278	28581879	Yes
Region Prizren	Prizren	636	177260	278.7	29215	1642	1044312	246	4	10%	11686	2878262	Yes
	Dragash	435	33584	77.2	6064	1625.5	707093	244	4	10%	2426	591422	Yes
	Suharekë	357	59702	167.2	9132	1657.8	591835	249	4	10%	3653	908342	Yes
	Rahovec	268	55053	205.4	8028	1640.8	439734	246	4	10%	3211	790341	Yes
	Malishevë	311	54664	175.8	6887	1661.7	516789	249	4	10%	2755	686648	Yes

Data for calculation:

Number of dwellings in Dragash:		9773
Inhabited dwellings:	60.90%	5952
Uninhabited dwellin	39.10%	3821
Households:		6094
Number of population:		33584

Data for inhabitants and households are taken from the preliminary results of the cenzus 2011 in Kosovo

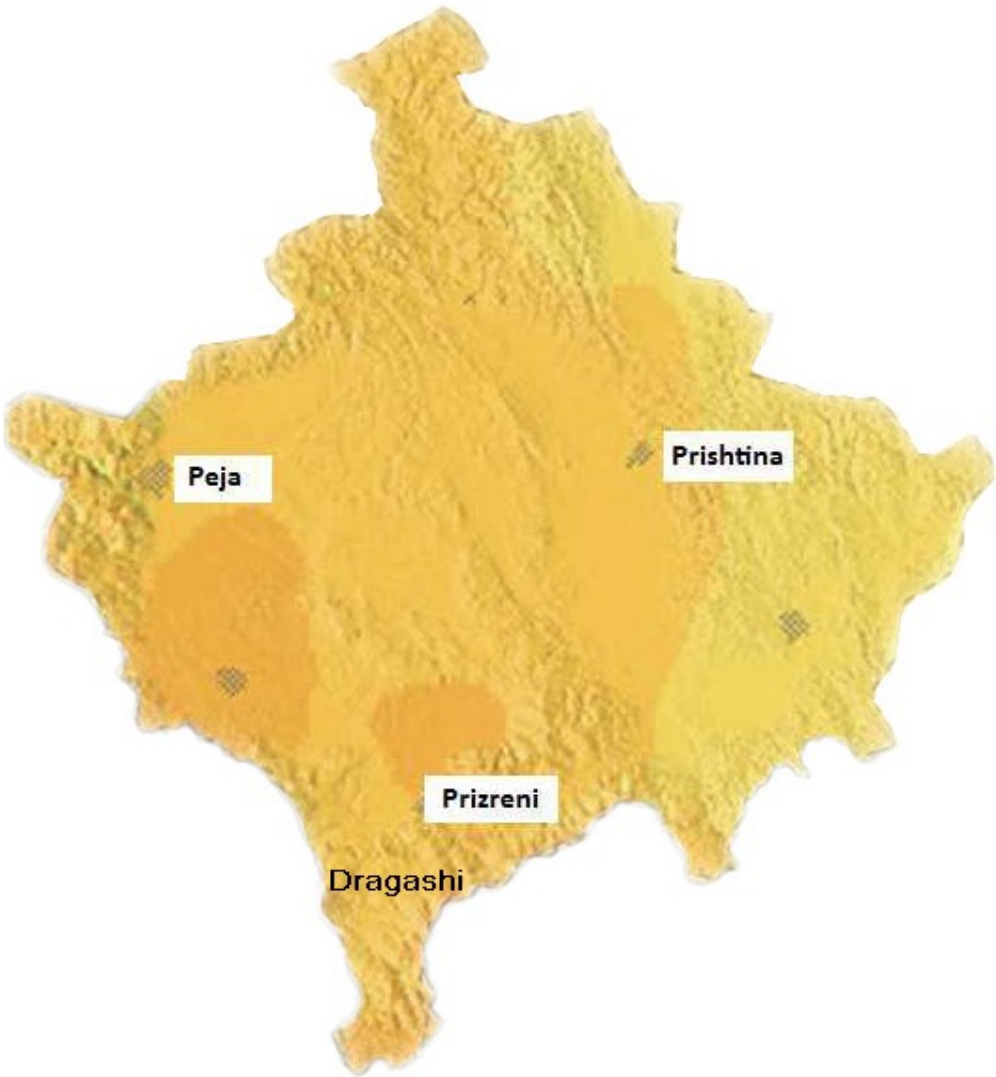
Source: "Study on preparation of design data for solar energy utilization systems in Kosovo" completed by "B2B & Energy" and funded by the Ministry of Economic Development of Kosovo (MED), 2010

3 SOLAR RADIATION AND TEMPERATURE MAPS

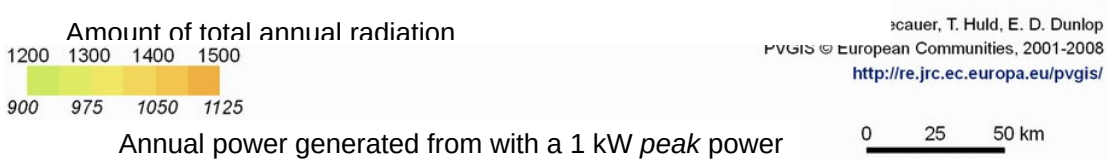
3.1 Solar radiation map

3.1.1 Kosovo Solar Map – horizontal radiation plane

According to satellite data, the intensity of solar radiation on the territory of Kosovo is shown on the solar mapping presented in the following figures.
Total solar radiation and the electricity production potentials
Photovoltaic modules mounted horizontally



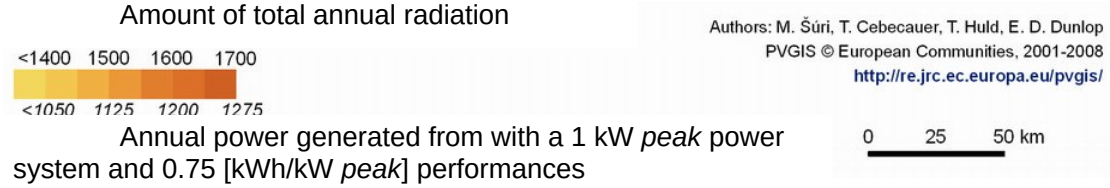
Source: *http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php#*
Image 1.Kosovo solar radiation map - horizontal inclined plane



Annual power generated from with a 1 kW *peak* power system and 0.75 [kWh/kW *peak*] performances

3.1.2 Optimum Kosovo Solar Map – Optimally radiation incline plane

Total solar radiation and the power production potential
Photovoltaic modules mounted at optimally inclined slope



Annual power generated from with a 1 kW *peak* power system and 0.75 [kWh/kW *peak*] performances

Image 2. Kosovo solar radiation map – optimally inclined plane

3.1.3 European Continent solar radiation map

European Continent solar radiation maps are shown in the following:

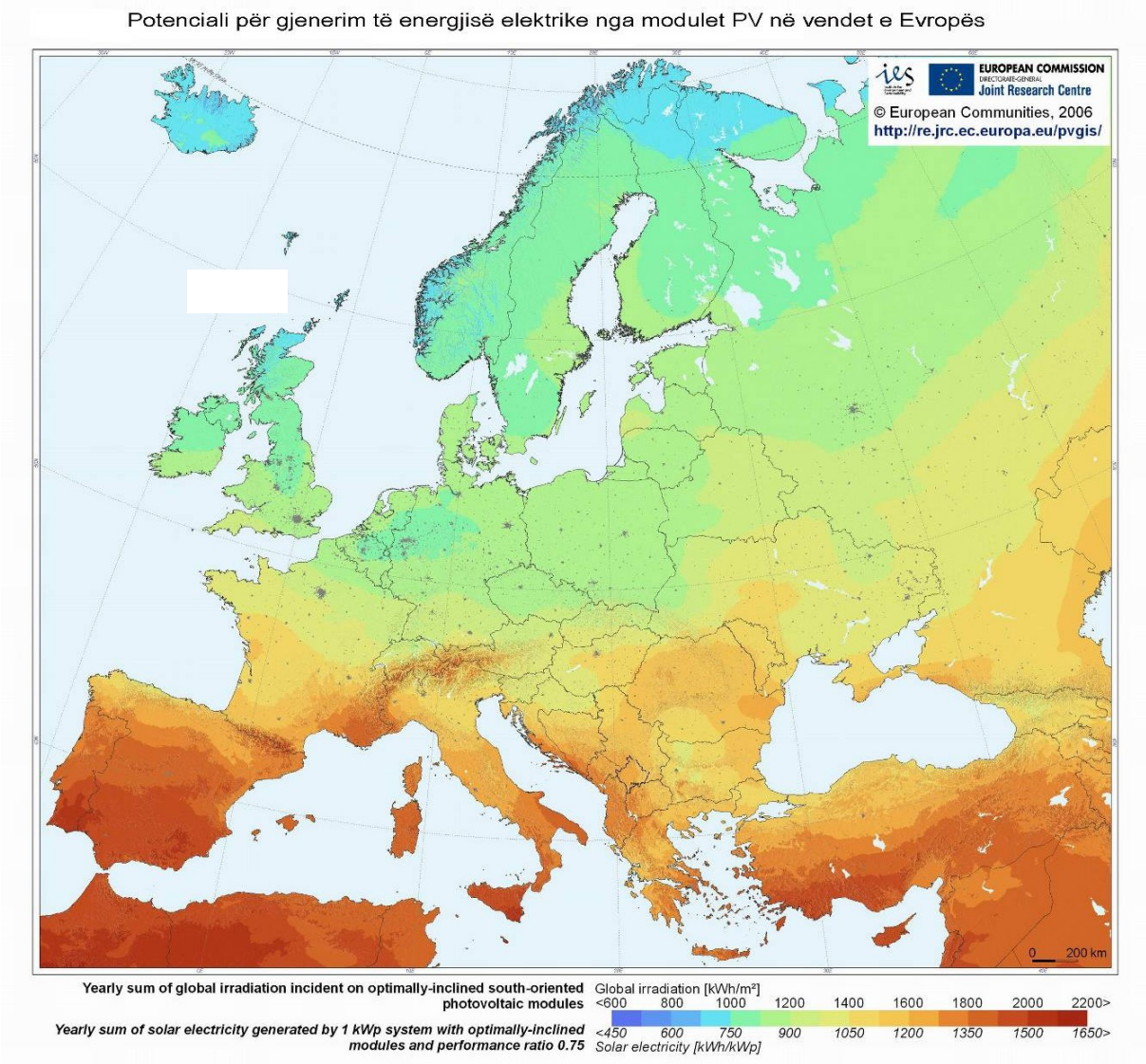


Image 3. Kosovo solar radiation map – optimally inclined angle

4 DIRECTION AND OPTIMUM SOLAR COLLECTORS' ANGLE

4.1 Collectors' direction and azimuth angle

The direction (orientation) of the collector must be such as to enable it absorbing sunlight as long as possible during the day. In the northern hemisphere, in which Kosovo belongs, collectors should be directed towards the south - in azimuth.

Azimuth angle, Figure 4, is the collector's deviation from the southern plane; with the collector plane angle oriented south, azimuth angle is 0 °. Since solar radiation is most intense at midday, the collector plane should be directed as close as possible to the south. However, the deviation from the south to 45 ° to the southeast or southwest is acceptable. In this case, collectors' surface should increase in order to compensate losses arising from deviation of the azimuth angle.

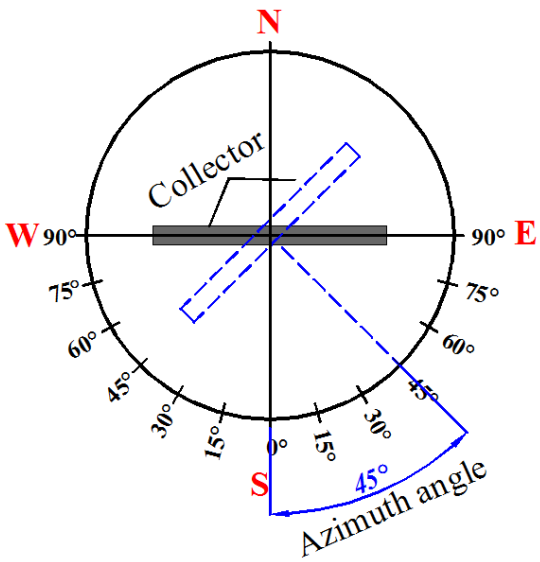


Image 4. Example – azimuth angle at 45º from east

4.2 The collector's inclined (tilt) angle

Inclined angle β is the angle between the horizontal plane and the solar collector (see Figure 4). For collectors integrated in the roof, the angle β is the angle of the roof which in this case is the angle of the collector. The highest amount of energy that the collector's absorber receives from the Sun happens when the collector is at the right angle with the sunlight.

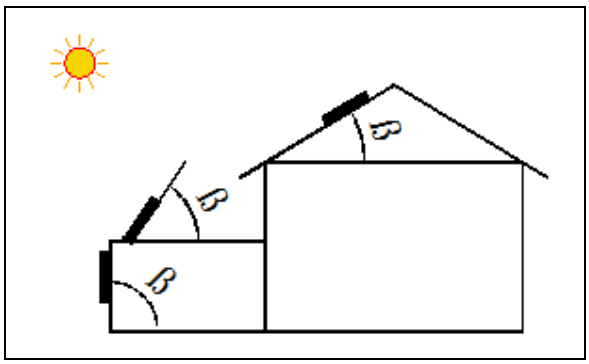


Image 5. Collector's position in its inclined angle

At different periods of the year, sun's irradiance on earth attenuates as it moves through different angles as shown in Image 6

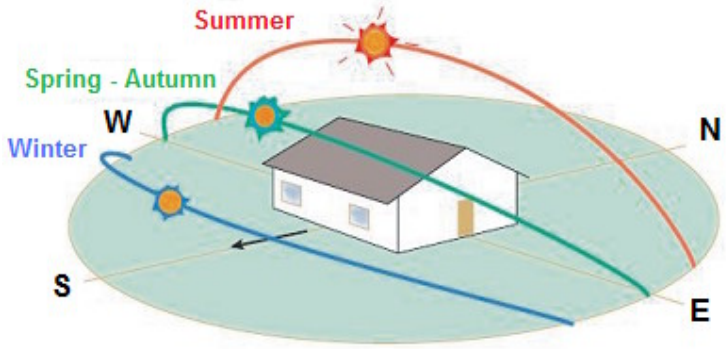


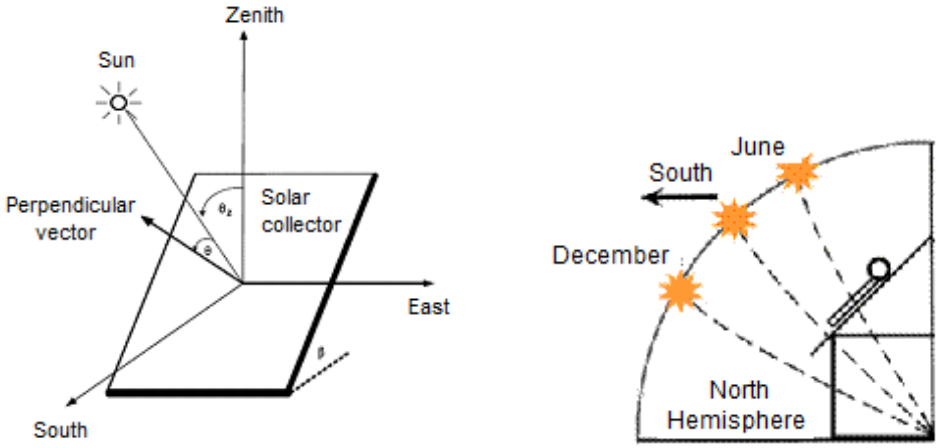
Image 6. Sun’s positions during the seasons.

It is important to note that the angle of the collector compared to the horizontal plane can not be less than 20 ° because the collector is likely to be covered with dirt, due to the small slope angle, and rain cannot clean it.

So, choosing the direction and tilt (slope) angle of solar collectors or photovoltaic modules is the most important issue in order to improve the efficiency of these collectors and modules.

Optimum direction of the solar collectors for the Northern Hemisphere is the one to the South. Meantime, the angle against the horizontal plane, in which the average monthly total solar radiation is at maximum is called optimum angle.

Figure 6.a, shows the geometry of the solar collector oriented south. In Figure 6.b, the orientation of the solar collector is presented in the Northern Hemisphere



b)

Image 7. a) The geometry of the solar collector oriented south; b) Orientation of the solar collector in the Northern Hemisphere

4.3 Annual solar energy optimal angle (β) developed for Prizren region, with focus on Dragash, according the European Commission database

Tables 6 and 7 show the optimum angles for placing solar collectors and solar panels

Table 6. Shows optimum angle for solar collectors and solar panels according to the European Commission database

Location		Calculated for locations:			Optimal angle [Degree]
Region	Municipality	Latitude	Longitude	Altitude	
Prizren	Prizren	N 42º 12’ 44’’	E 20º 43’ 12’’	395 m	32
	Dragash	N 42º 3’ 41’’	E 20º 39’ 20’’	1054 m	31
	Suharekë	N 42º 21’ 41’’	E 20º 48’ 58’’	387 m	32
	Rahovec	N 42º 24’ 7’’	E 20º 39’ 25’’	424 m	32
	Malishevë	N 42º 29’ 3’’	E 20º 44’ 36’’	523 m	33

Source: http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php#

Table 7. Comparison of optimum angles according to different sources

City	Latitude [º, ‘, ‘’]	Longitude [º, ‘, ‘’]	Optimal angle * [Degree]	Optimal angle ** [Degree]	Optimal angle *** [Degree]	Optimal angle **** [Degree]
Prizren	N 42º 12’ 44’’	E 20º 43’ 12’’	32	36	32	34
Dragash	N 42º 3’ 41’’	E 20º 39’ 20’’	31		32	34

* Annual optimum angle (rounded to nearest integer) according to the European Commission database
Source: http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php#

**Annual optimum angle (rounded to nearest integer), developed for some of Kosovo's main cities, according to NASA.
Source: http://eosweb.larc.nasa.gov/cgi-bin/sse/grid.cgi?

***Annual optimum angle (rounded to nearest integer) according to a scientific work model "The position of the sun and the optimum angle of solar collectors in the northern hemisphere", $I_{opt} = 0.76 \Phi$

**** Annual optimum angle (rounded to nearest integer) according to a scientific work model "The position of the sun and the optimum angle of solar collectors in the northern hemisphere", $I_{opt} = 0.764 \Phi + 2.14$

4.4 Kosovo climatic sub-zones

According to the intensity of solar radiation, Kosovo can be divided into three or four generations or areas of rough solar radiation. See Image 8

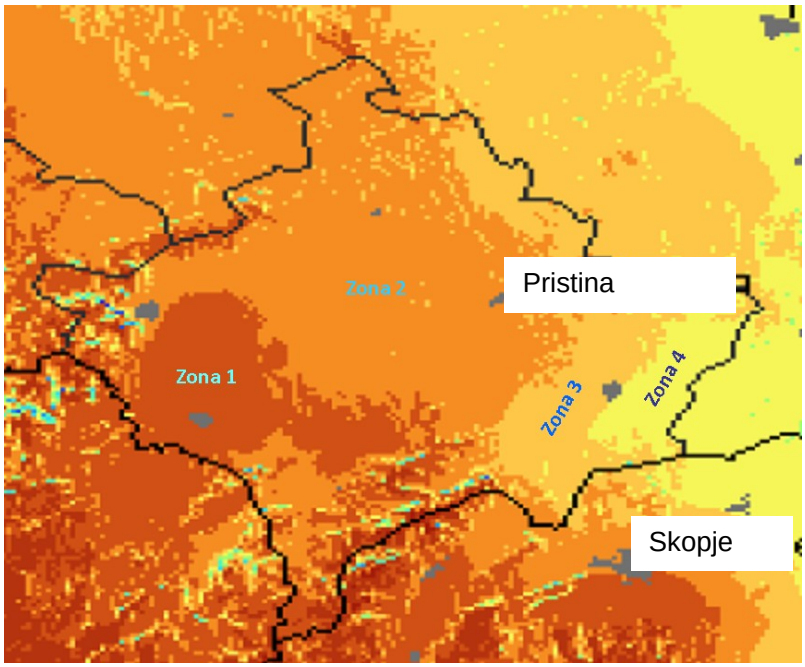


Image 8. Solar radiation in Kosovo according to climate sub-zones

It should be noted beforehand that Kosovo is small in terms of size of the territory. The distribution of population density is greater in central and western parts compared to eastern Kosovo. Hence the division into three zones is an acceptable approximation, since the solar radiation in Zone 3 and Zone 4 does not change much, as well as that opportunities to widely use solar energy in Zone 4 (which is smaller in terms of surface area) are practically not that big.

Division of municipalities by area of solar radiation intensity is presented in Table 8.

Table 8. Division of Kosovo municipalities according to climate sub-zones

Nr	Zone 1	Zone 2	Zone 3	Zone 4
1	Pejë	Prizren	Podujevë	Gjilan
2	Deçan	Dragash	Novobërdë	Viti
3	Gjakove	Mitrovicë	Kamenicë	Kaçanik
4	Klinë	Skenderaj	Istog	Shtërpcë
5	Rahovec	Gllogovc	Zubin Potok	
6	Suharekë	Obiliq	Leposaviq	
7	Malishevë	Fushe Kosove	Zveçan	
8		Lipjan	Vushtrri	
9		Shtime		
10		Prishtinë		
11		Ferizaj		

Source: "Study on preparation of design data for solar energy utilization systems in Kosovo" completed by "B2B & Energy" and funded by the Ministry of Economic Development of Kosovo (MED), 2010

4.5 Average air temperatures

For the final calculation and accurate dimension of the solar energy systems (especially for those of medium and larger sizes), data from meteorological stations closest to the location of planned construction / installation of the specific solar energy systems are required. The size of the system (i.e. depending on the planned investment) depends on the required degree of data accuracy.

Tables 9 and 10 provide information on the average air temperatures

Comparison between calculated and average temperatures measured in the field

1. The average temperature measured from 12 stations in Kosovo during 1949-1978 is 10.43^{o} C, while the temperature calculated from the database is 11.07^{o} C. The difference between them is 5.8%. This difference is well acceptable for the dimensions of systems using solar energy.

2. The difference exists because: (i) Calculated temperatures have the accepted margin of error rate, (ii) measurement stations and the coordinates of locations of which average temperatures are calculated do not fully comply.

Note:

The table of calculated temperatures was prepared based on data taken from the database of the new version of PVGIS (autumn 2010). These data are based on calculations made from satellite images of CM-SAF. Database represents data of a total of 12 years. Spatial resolution is 1 '30" (about 2.5 km).

Source: "Study on preparation of design data for solar energy utilization systems in Kosovo" completed by "B2B & Energy" and funded by the Ministry of Economic Development of Kosovo (MED), 2010

Table 9. Average monthly and annual air temperature (^{o}C) during the period 1949-1978, (according to Kosovo Hydro - Meteorological Institute)

Nr	Station	Month												Yearly average
		1	2	3	4	5	6	7	8	9	10	11	12	
1	Prizren	0.18	2.89	6.46	11.87	16.67	20.23	22.27	22.09	17.99	12.08	7.36	2.46	11.87
2	Ferizaj	-1.39	1.02	4.40	10.01	14.66	18.05	19.96	19.82	15.81	10.33	5.57	0.72	9.91
3	Suhareke	-0.16	2.75	5.89	11.28	15.97	19.44	21.58	21.38	17.33	11.52	6.78	2.11	11.33
4	Gjakove	-0.56	1.77	5.40	10.70	15.40	18.77	20.54	20.40	16.48	10.63	6.41	1.72	10.64
5	Dragash	-1.63	0.17	3.09	7.71	12.44	15.73	17.71	17.87	14.06	8.78	4.70	0.69	8.48
6	Gjilan	-0.94	1.35	4.67	10.21	14.71	18.04	20.04	19.14	15.77	10.69	5.87	1.126	10.14
7	Peje	-0.33	2.05	5.93	11.32	15.85	19.12	21.16	21.37	17.19	11.69	6.60	1.91	11.14
8	Prishtine	-1.11	1.20	4.56	10.03	14.58	17.98	19.92	19.92	15.96	10.52	6.16	0.95	10.03
9	Kline	-0.56	1.91	5.95	11.18	15.72	19.03	20.82	20.26	16.56	11.1	6.57	0.19	10.87
10	Podujeve	-1.84	0.60	3.88	9.43	14.00	17.48	19.45	19.22	15.39	10.10	5.39	0.60	9.48
11	Mitrovice	-0.87	1.48	4.85	10.14	44.78	18.06	20.13	19.87	15.81	10.37	5.90	0.31	10.16
12	Istog	0.3	2.5	6.2	11.3	15.6	18.7	20.5	20.8	16.8	11.6	6.8	2.4	11.1
Average for Kosovo		-1.3	0.8	4.1	9.3	14.0	17.3	19.2	19.1	15.3	9.9	5.3	1.0	9.5

Table 10. Table 10 shows comparison of average monthly and annual temperatures according to estimates from the European Commission database and those measured by meteorological stations in Kosovo during the period 1949 – 1978.

Nr	Location	Calculated for locations:			Average 24-hours daily temperatures for every month [^{o}C]												
		Latitude	Longitude	Altitude	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Yearly
1	Peja	N 42° 39' 0"	E 20° 18' 9"	499 m	1.0	2.3	6.0	10.4	15.6	9.4	21.6	21.4	16.5	12.5	6.9	2.2	11.3
2	Istogu	N 42° 46' 59"	E 20° 29' 32"	481 m	0.7	2.2	5.9	10.5	5.7	9.4	21.5	21.3	16.4	12.4	6.7	1.9	11.2
3	Gjakova	N 42° 22' 58"	E 20° 25' 44"	360 m	1.8	3.2	7	11.4	16.5	0.5	22.7	22.6	17.7	13.5	7.8	3	12.3
4	Klina	N 42° 37' 18"	E 20° 34' 38"	393 m	1.1	2.6	6.5	11	16.2	20	22.1	21.9	17	12.9	7.2	2.3	11.7
5	Mitrovica	N 42° 52' 33"	E 20° 52' 6"	515 m	-0.1	1.5	5.4	10.1	15.2	18.8	20.8	20.7	15.8	11.8	6.2	1.1	10.6
6	Prishtina	N 42^{0} 39’ 28”	E 21^{0} 9’ 12”	579 m	-0.2	1.3	5.3	10.0	15.1	18.7	20.7	20.7	15.8	11.8	6.2	1.0	10.5
7	Podujeva	N 42° 54' 14"	E 21° 11' 33"	608 m	-0.5	1.1	4.9	9.7	14.9	18.4	20.3	20.3	15.4	11.4	5.8	0.7	10.2
8	Gjilani	N 42° 27' 50"	E 21° 27' 42"	528 m	0.0	1.6	5.7	10.4	15.5	19.1	21.2	21.2	16.4	12.3	6.4	1.2	10.9
9	Ferizaj	N 42° 22' 43"	E 21° 8' 55"	581 m	0.1	1.6	5.7	10.2	15.3	19.0	21.1	21.1	16.3	12.3	6.5	1.3	10.9
10	Prizreni	N 42° 12' 44"	E 20° 43' 12"	395 m	1.4	2.9	7.0	11.3	16.4	20.4	22.6	22.5	17.7	13.4	7.6	2.2	12.2
11	Dragashi	N 42° 3' 41"	E 20° 39' 20"	1054 m	-0.5	0	3.4	7.8	12.8	16.5	18.6	18.8	14.2	10.7	5.5	0.8	9.1
12	Suhareka	N 42° 21' 41"	E 20° 48' 58"	387 m	1.1	2.7	6.8	11.2	6.3	20.2	22.4	22.3	17.4	13.2	7.3	2.4	11.9

Source: (*http://re.jrc.ec.europa.eu/pvgis/apps4/pvest.php#*)

5 CONCLUSION

Solar radiation potential in Dragash provides good opportunities for introducing solar technologies, mainly for water heating (and space heating?), but also for generating electricity for small and isolated systems where electrical grid is missing. A further analysis and assessment will be elaborated to identify the technical opportunities in order that utilisation of the sun's radiation in Dragash be economically feasible and to define the right technology and the market for those technologies.