USING SOLAR ENERGY AND OPTIMIZING ENERGY CONSUMPTION IN COMMERCIAL BUILDINGS

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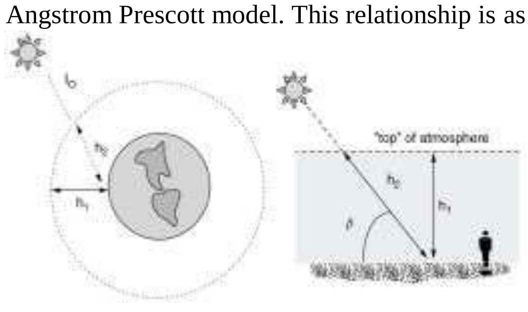
Abstract. Considering the energy issue is one of the main issues of recent decades, both in terms of contamination and in terms of resource constraints so, as much as possible, should prevent from energy loss. Solar power generation with photovoltaic is one of the clean energy methods that use of photovoltaic plates and dynamic forces such as wind are the right ways to achieve this goal. In these buildings, photovoltaic panels will be considered part of the outer shell of the building in the process of architectural design which in the back of these plates, dynamic structures will be placed in order to displacement of plates and Confronting with lateral forces such as wind. If this loading is affected by a non- uniform wind or earthquake dynamically, the structure begins to vibrate in various vibration modes. Hence, by expressing solar radiation calculation models, first, the selected model is fully introduced and then, using this model, a combination of photovoltaic and dynamic structures with a building in Tehran have been determined the amount of radiation received from the sun on different surfaces and wind speed. In the end it was concluded that a construction could be made to provide the largest amount of heating and cooling needs from the sun's energy a dynamic system can also help to maximize its efficiency.

Keywords: Solar Energy, photovoltaic, sustainable architecture, dynamic energy.

Introduction. The collapse of environmental equilibrium, air pollution, water and land and, on the other hand, the limitation of renewable energies and their rising prices are a serious issue. More than a third of all energy consumption is allocated to buildings and Buildings are the largest consumer energy sector in the world and as much an important source of carbon dioxide emissions. Clean energy such as solar energy, therefore, is considered an appropriate substitute for electricity generation and are easily accessible anywhere in the world.(Mostafa Nezhad 1388)Today, one of another the most common way of converting solar power into electricity is by using photovoltaic(solar cells)screens which have many uses in various fields, including the construction industry. At present, approach of the integration of photovoltaic shells with buildings is one of the major issues in building science and Photovoltaic are a part of the building's shell in the design process which are integrated with other components.(Alimorad Sharifi 2005)As photovoltaic panels integrated with buildings with different slopes on the front faces,or on the roof,equations required to cover all modes and can be used from those to estimate received radiation on different levels of photovoltaic to calculate the total radiation received from the sun on photovoltaic surfaces and by examining different slope angles to achieve optimal statue and proper design for their establishment suggested a range for combining in the facade or on the roof(Pour Deyhimi 2009).

Background research. Measuring solar radiation by using its associated equipment is one of the most reliable methods to achieve the actual rate of radiation in each location.But despite the importance of measuring this parameter are not available,proper tools and for measuring the incandescent radiation,weather parameters such as temperature and humidity in all locations due to high costs.On the other hand,access to weather information for any location and time is not possible.One of the empirical relationships that are widely used and popular among users worldwide is Angstrom linear relationship,which calculates the total daily radiation on the horizontal surface by that.The amount of solar radiation received on the horizontal surface is calculated by using the sunshine. This relationship was later corrected in 1940 by Prescott and renamed the Angstrom Prescott model. This relationship is as follows:



1) $$\frac{H}{H_0} = a + b\left(\frac{S}{S_0}\right)$$

Figure 1- The angles of sun radiation

The pyranometer is a tool that measures the sunlight from the 180 degree view and is used to measure overall and diffuse radiation.H:Daily total radiation on the horizontal surface of the earth(MJ/m²),HO:total daily radiation outside the atmosphere on the horizontal surface(MJ/m²),a and b:Regression coefficients:Daily sunny hours(h),Maximum number of sunshine hours (daytime)(h),S value by direct measurement and the value of s0 is obtained from spherical trigonometric relationships in terms of geographic he value of s0 is obtained from spherical trigonometric relationships in terms of geographic latitude and date.The disadvantages of these models are the dependence of the experimental coefficients of Angstrom on the basis of geographical and climatic parameters which requires to climactic factors such as sunny hours,temperature and humidity and in most of them,daily radioactive calculations are calculated on the horizontal surface(Kochak Zadeh,2010).Therefore(Sunny Day model)has been selected according to the existing conditions and facilities which is not for a specific climate or latitude and can be used in different places and,by using its results,it is possible to selected the suitable directions and optimal slope angles in designingthe integrated buildings with photovoltaic panels for combining panels with building.(Rahil Vafayi,2009).

Research method and discussion:

According to the library review and the implemented examples were introduced and checked out the equations for determining the position of the sun at a specified time than to the desired location. What is being considered here is how much diffuse radiation crashes to surface of the photovoltaic panel.

When angle of the slope of the panel is zero,panel sees the whole sky,so it receives the entire radiation of the sky.When the panel is vertical (a gradient angle of 90 degrees to the horizon),it sees half of the sky,so it receives half of the scattered radiation of the sky.

2) $I_{DP}, I_{DP} = I_{DH}\left(\frac{1+\cos\Sigma}{2}\right) = C\, I_B\left(\frac{1+\cos\Sigma}{2}\right)$ Another component of radiation,which is reflected from the surfaces of the photovoltaic panel,is reflective radiation.The amount of this component increases in bright and snowy days,but in other days it can be neglected from its small amount.In the simplest model,assume a large horizontal surface with a reflection ρ.That reflecting direct and diffuse radiation rays with equal intensity in all directions.

The values of reflections in the earth(Albeto)are varying between 154.0 and 220/0,which is the reflection range in the semi-urban environments. The range of the reflection of the Earth from about 0.8 for fresh snow to about 0.1 for a surface of asphalt and the default value of usual for the earth or grass is about 0.2. A portion of the reflected radiation energy that is received by the photovoltaic panel will depend on the slope of the panel.

3) $I_{RP} = \rho\, I_B(\sin\beta + C)\left(\frac{1-\cos\Sigma}{2}\right)$ is obtained from the direct and diffuse direct irradiation of the sun the total solar radiation on the photovoltaic surface.The total solar radiation on the photovoltaic surface in Tehran and the increase in the electric power by it will be considered as a single page,which its slope is change 10 degrees 10 degrees from horizontal(0 °)state to the vertical (90 degrees),Also,this page rotates with different azimuths from the south to the east and west.With considering different states for the azimuth angle and the slope of this page are calculated the parameters necessary for calculating direct,diffuse,and reflective radiation using the selected model and the corresponding equations in the Excel software at 365 days per year.The geographic latitude considered in the calculations is 35 degrees and 48 minutes north for Tehran. After obtaining the components of the solar radiation are plotted the daily,monthly,and annual charts for each angle of slope of 0 to 90 degree that is indicating the amount of radiation received by the entire sun on different levels. The amount of daily sunlight on the surface to the south and south-east or west (turning 30 degrees south)shows with different slopes in Tehran. Each month,a sample day(21st of the month) will be selected and the daily radiation will be calculated in KWh/m² unit.

Table 1: Daily Radiation in the Southwest and West

Radiation intensity (clear sky) daily (KW / m²)											Latitude 35 ° North								
Azimuth		South									South east / west (°30)								
Slope(degree)	0	10		30	40	50	60	70	80	90	10	20	30	40	50	60	70	80	90
January(jan)	3/59	4/48	5/24	5/84	6/28	6/53	6/59	6/45	6/13	5/62	4/35	4/99	5/48	5/81	5/97	5/96	5/77	5/41	4/90
February(feb)	4/82	5/63	6/28	6/74	7/01	7/07	6/93	6/59	6/05	5/34	5/51	6/04	6/41	6/59	6/58	6/38	5/99	5/43	4/74
March(mar)	6/20	6/80	7/20	7/40	7/38	7/16	6/72	6/09	5/29	4/34	6/71	7/02	7/14	7/08	6/82	6/37	5/75	5/01	4/13
April(apr	7/25	7/73	7/78	7/62	7/25	6/68	5/92	5/00	3/94	2/80	7/68	7/71	7/52	7/17	6/63	5/93	5/13	4/30	3/25
May(may)	8/13	8/15	7/95	7/52	6/90	6/12	5/16	4/08	2/97	1/80	8/14	7/93	7/54	6/98	6/26	5/41	4/47	3/51	2/54
June(jun)	8/29	8/21	7/90	7/37	6/67	5/81	4/80	3/70	2/58	1/49	8/20	7/91	7/43	6/79	6/01	5/13	4/16	3/19	2/23
july(jul)	8/04	8/05	7/83	7/40	6/78	6/00	5/06	3/99	2/91	1/77	8/03	7/82	7/42	6/86	6/14	5/32	4/39	3/44	2/49
Agust (aug)	7/28	7/54	7/59	7/43	7/06	6/50	5/77	4/87	3/85	2/75	7/50	7/52	7/33	6/98	6/45	5/76	4/98	4/08	3/16
September(sep)	6/06	6/61	6/98	7/16	7/12	6/89	6/46	5/85	5/07	4/16	6/53	6/81	6/91	6/84	6/57	6/13	5/53	4/81	3/96
October(oct)	4/64	5/40	6/01	6/45	6/70	6/76	6/62	6/30	5/79	5/12	5/29	5/79	6/13	6/30	6/29	6/09	5/72	5/19	4/53
Novamber(nov)	3/50	4/36	5/09	5/67	6/09	6/33	6/38	6/25	5/93	5/45	4/24	4/85	5/32	5/64	5/79	5/78	5/59	5/25	4/75
December(des)	3/11	4/00	4/77	5/40	5/87	6/18	6/29	6/23	5/98	5/56	'87	4/52	5/04	5/41	5/63	5/67	5/56	5/27	4/84

(www.cleanenergydream.com)

The amount of radiation received from the sun on the surface to the south with different slope angles in 72% of the year is greater than radiation on the south-east or west levels with different slope angles. In the warmer months and cold months of November,December and January,whatever the slope of the panel is higher,the daytime sun exposure to the south-east or west(60 degrees to the south) and to the east or west with a slope Different shows in Tehran. By comparing the results of the tables it is determined that the radiation received on the surface of the south is much higher than the east or west surface in 80% of the year which this difference of radiation in the autumn and winter is very significant and up to KWh/m² 4 per day for surfaces with a slope of 70 degrees from the horizon.Therefore,in the cold seasons whatever the slope of the surface is higher and azymoth is lower(the tendency toward the south)will get better radiation.But in the spring and summer seasons the levels with a higher slope than the horizon(closer to the vertical)whatever the east or west more,will have better radiation.

Table 2: Daily Radiation in the East and West

Radiation intensity (clear sky) daily (KW / m2)										Latitude 35 ° North									
Azimuth		South east / west (°60)									East/weast								
Slope (degree)	0	10		30	40	50	60	70	80	90	10	20	30	40	50	60	70	80	90
Jan(January)	3/59	4/01	4/31	4/52	4/61	4/57	4/43	4/19	4/83	3/38	3/54	3/45	3/31	3/15	2/96	2/74	2/48	2/21	1/87
February(feb)	4/82	5/20	5/45	5/55	5/55	5/40	5/13	4/76	4/25	3/71	4/77	4/62	4/44	4/21	3/91	3/62	3/24	2/87	2/43
March(mar)	6/20	6/45	6/56	6/52	6/35	6/04	5/61	5/07	4/45	3/76	6/11	5/92	5/65	5/29	4/92	4/48	3/98	3/48	2/91
April(apr)	7/45	7/55	7/46	7/24	6/87	6/39	5/80	5/10	4/37	3/58	7/36	7/10	6/74	6/31	5/80	5/22	4/62	3/99	3/31
May(may)	8/13	8/09	7/87	7/50	6/98	6/29	5/69	4/90	4/12	3/31	8/02	7/73	7/32	6/80	6/30	5/55	4/88	4/17	3/43
June(jun)	8/29	8/19	7/91	7/48	6/92	6/28	5/55	4/74	3/93	3/13	8/17	7/87	7/43	6/88	6/25	5/59	4/89	4/15	3/40
July(jul)	8/04	7/98	7/76	7/39	6/87	6/28	5/59	4/81	4/03	3/24	7/92	7/64	7/23	6/71	6/12	5/47	4/80	4/10	3/37
Agust (aug)	7/28	7/37	7/28	7/06	6/66	6/21	5/62	4/94	4/23	3/46	7/19	6/94	6/58	6/15	5/65	5/07	4/49	3/86	3/20
September(sep)	6/06	6/29	6/38	6/33	6/15	5/83	5/41	4/88	4/27	3/60	5/97	5/78	5/51	5/16	4/78	4/34	3/85	3/36	2/81
October(oct)	4/64	4/99	5/22	5/31	5/30	5/15	4/89	4/53	4/04	3/52	4/59	4/44	4/25	4/03	3/73	3/44	3/07	2/72	2/29
Novamber(nov)	3/50	3/90	4/20	4/40	4/48	4/44	4/30	4/07	3/71	3/28	3/45	3/36	3/23	3/07	2/89	2/66	2/41	2/14	1/82
December(des)	3/11	3/53	3/85	4/09	4/22	4/22	4/13	3/93	3/63	3/23	3/07	3/00	2/90	2/76	2/62	2/42	2/21	1/98	1/69

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As a result,the best choice for the combination of photovoltaic in the roof is a slope of 70 degrees and a canopy in the slope of the 30-degree slope south.According to Table 2,the 90 to 96 percent range will receive good radiation and will have more options for direction and the slope angle also suggests panels.As shown in the diagram,surfaces with a slope of 50 and 60 degrees to the south receive more radiation than horizontals during one year,and on the other hand,no have the horizontal plane problems such as snow gathering,More dust,and so on,so these levels will also be a good option for use in the building's view."(Dr. Ali Khorshidi, 2006).

Figure 2:The combination of photovoltaics in the vertical view Figure 3:The combination of photovoltaics in a steep view

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In direct sunlight use, for example,if it is placed in sun glasses of sun energy,so that when sunlight hits to the plates,it will absorb light. In the dark hours (night),light will be provided.If for absorb the energy all of the glasses,fittings are operated as a cable tension system,can withstand the tension and the pressure of the wind can withstand its own weight,as well as the natural lighting of buildings,with the continuous movement of people,especially in Inputs or lobbies make bulking through the kinetic force base isolate systems and pistols on the particles(sand and glass)The strain moves and generates heat(Jahanbakhsh,2008).The dynamic structure behind the photovoltaic panels should be placed in a functional form,for example,in the administrative building of the Salehin Bank (pic.4)located at Motahari St.Tehran along the Tehran Tower Northeastern)in style,single-hull(the display of the structure is as beautiful as the dynamic use of solar energy).

Figure 4:The Southern View of the Salehin Bank (Motahari, Tehran) Figure5:Dynamic structure of flange and bushne (Motahari, Tehran)

As seen in screenshots (6-7-8),the building's facade resists the dominant winds to maintain its standing,in the event of high winds and heat,a dynamic system in place of a knot in the shape of a bean in its place and the maximum tension goes after movement.In the first stage,the building's profile is dynamically designed,compression,flange and bush structures are designed and in some places the damper is designed.Because the structure is dynamic and the static and transversal structure is the main construct.

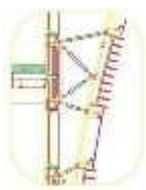

Figure 6: Metacarpetting of dynamic structures Figure7: Dynamic, static cross section view

Figure8: Cross section of the roof protector structure
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This project,while estimating the need of residents of the region,improves and improves the texture quality.Due to the high cost of infrastructure technology,as a statistical sample has been made a set of basal isolates with an energy absorption structure in kinetic conversion kits and Roller transforms into a stored energy in a capacitor (Jalali, 2011).

Conclusion:

According to the calculation of total solar radiation in Tehran, the optimum slope direction and angle for combining photovoltaic with the building,the azimuth angle is from 30 to 30+ from the south and the slope angle is 20 to 40 degrees from the horizon.In this azimuth range,the levels with slopes of 60,50,10 degrees also receive more radiation than to the horizon during the year than horizontally. If photovoltaic is combined with a suitable slope of the canopy or Louvre (in the form of a dynamic system) in the building's view,during the production of electricity,in the heating season reduce the cooling loads and allow the sun to enter the building during the cold season,and Daylight is also provided and as well as the kinetic energy of the view,it will be dynamically visible. In this case, photovoltaic will be multifunctional, but should be positioned in such a way that the lower panels are not shaded by the top.Therefore,the use of photovoltaic in the view of such buildings,either vertically or slopping, in combination with a second shell(dynamic structure)with canopy function can, in addition to power generation, help to improve the indoor condition and photovoltaic plates with displacements are made by dynamic structures to adapt and adapt to the environment provide some changes in its, for example, For example, they change their position to absorb sunlight or wind energy.

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