

Solar Energy and the Role of Solar Cells in Providing Energy and Architectural Formation for Buildings in Syria

Mohamad Deab Aloosh

Abstract— Current advances in technology, especially those associated with environmental control systems, influence contemporary architecture. Solar systems are one of the environmental control systems. Such systems are used as sources of environmentally friendly energy and thus are often classified within the group of concepts associated with the mixing of buildings with the environment.

The research aims to spot methods utilized in integrating the solar panels with the architectural system and the way to use these panels to reinforce the sweetness of the ultimate architectural form. The possible locations of solar panels – by sort of a panel – are investigated to finally achieve a balance between the sweetness aspect of buildings and therefore the required energy saving of cells. The research also aims to research the acceptance of the people to the thought of using the solar panels in their buildings to partially solve the energy problem they suffer from.

Finally, the researcher concluded that using solar systems in buildings is one of the simplest methods to unravel the electricity problem in SYRIA thanks to functional and economical advantages. Functionally, a building system produces electricity without adversely affecting the environment. Economically, a building system – despite being costly at the start – saves money in the long term.

Index Terms— solar panels, solar energy .

I. INTRODUCTION

Highlight Current advances in technology, especially those related to environmental control systems, influence contemporary architecture. Solar systems are one of the environmental control systems. Such systems are used as sources of environmentally friendly energy, and therefore can be classified within the group of concepts related to the integration of buildings with the environment.

The research aims to identify methods used in integrating the solar panels with the architectural system and how to use these panels to enhance the beauty of the final architectural form.

The research also aims to investigate the acceptance of the people to the idea of using the solar panels in their buildings to partially solve the energy problem they suffer from.

Background of study

The solar panels are one of the new methods that an architect can use to induce a positive effect on the general building shape and both the inner and outer spaces.

The solar panels also change the color and texture of a building in a way that enhances the sense of modernity and stylishness. Therefore, the solar panels can be used as key architectural elements in a building to achieve the main architectural goals of functionality, beauty, sturdiness, and economy.

Energy is a basic human need. The growth and quality of life are determined by the abundance of resources, so there is no development without energy. Increased demand for energy and restrictions imposed on traditional energy sources, especially in Syria, due to problems and the inability to benefit from traditional energy sources. Therefore, you should go to renewables like solar cells as an aid to the electricity problem in Syria. Consequently, the architect had another task by creating a structure that would cover the building at the examination department to answer the following question: How can we changing the shape and design of the building we use solar energy technologies, especially solar cells to generate electrical energy while achieving the aesthetic aspect of the building and devising methods modern architectural design to connect solar cells to the building in Syria.

Problem statement

Solar systems, especially solar cells, can integrate with the building as materials essential within the building's exterior design. It also responds to external environmental impacts, from here, the research problem consisted of two main axes:

1 - We do not have comprehensive knowledge about ways that the designer can follow it when the solar cells are used as external materials at the building in Syria.

2- The extent people accept the installation of solar cells in Syria as an adjunct solution to the electricity problem because of the costs or usability of use.

Significance of study

The importance of the research comes from the fact that it is the first step to help solve the real energy problem in Syria and it is the beginning of energy self-sufficiency as it is one of the methods of self-reliance that reducing the need for traditional energy methods, and it is also important to show how contemporary architect can benefit from modern building techniques.

Research objectives

1 - Learn the methods of architectural integration with solar cells and the benefit from them in supporting beauty in the final architectural form.

2 - Study the place of installing solar cells according to

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their types in the architectural form of the building.

3 - Balancing of the formalism aspect of the beauty of buildings while providing the required energy from Cells.

4 - Determine the extent people accept the idea of solar cells and use it as an aid to the energy problem in Syria.

Research questions

1 - How can we learn the methods of architectural integration with solar cells and how to benefit from them in supporting beauty in the final architectural form?

2 - What is the impact of study the place of installing solar cells according to their types in the architectural form of the building?

3 - How do we benefit from balancing of the formalism aspect of the beauty of buildings while providing the required energy from Cells?

4 - How can we determine the extent people accept the idea of solar cells and use it as an aid to the energy problem in Syria?

Scope of study

With the increasing interest in renewable energies in general and solar energy in particular there are a lot of attempts to provide solar technologies to be equal to electric power that we use it now , that's why it is commonly used.

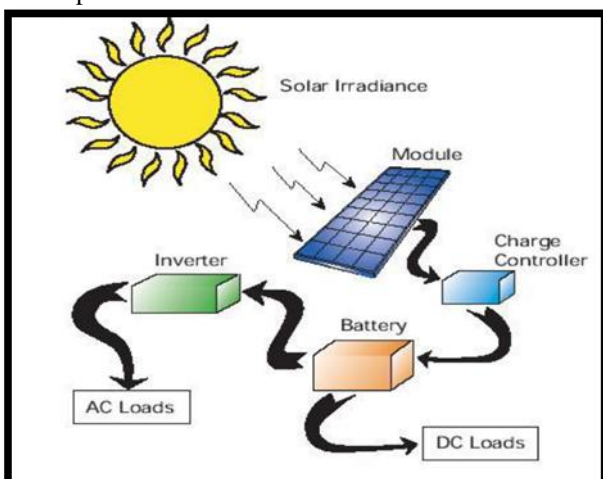
It transforms buildings from energy-consuming facilities into energy-producing buildings it depends on the sun.

Solar cells are a good way to produce electricity when placed in the right location and direct from the sun.

And that happens in cooperation between many different disciplines, such as architecture, Civil engineering, and solar systems designer.

Components of the solar system to produce electrical energy:

1 - PV photovoltaic



2 - Charger Controllers

3 - Batteries

4 - Power Inverters

II. LITERATURE REVIEW

Introduction

Energy can be defined by its ability to do something and the ability to relate matter to another matter (Efen, 2011). It is one of the properties the basic to expressing the state of the matter or the physical system.

All types of energy can be converted from one thing to another with some help of simple tools or sometimes it involves sophisticated techniques like chemical energy to electrical by batteries or thermal power to mechanical energy, or convert solar energy into electrical energy.

Energy resources

Energy sources and global consumption: The oil, Coal, Natural gas, Nuclear Energy and renewable energy sources (Efen, 2011).

Renewable energy sources

It is the energy derived from natural resources it is renewed and cannot end.

It does not involve renewable energy remnants like Carbon Dioxide, harmful gases or Increase global warming such as when fuel is burning, also renewable energy is produced from wind, water, sun, sea waves (Tides).

Currently the most produced renewable energy from hydroelectric stations by dams on rivers and watersheds, and many countries have plans to increase their production of renewable energy to cover its energy needs by 20%.



Solar energy

Solar energy is the light and heat emitted from the sun and humanity mocked it to their advantage since ancient times, using a range of technology has developed continuously, solar energy technologies include the use the heat of the sun whether for direct heating or as part of a mechanical transformation for movement or electrical energy or to generate electricity through phenomena photoelectric by using photovoltaic panels and also to architectural designs that depend on the exploitation of solar energy they are technologies that can contribute in a good way in solving some of the world's problems today.

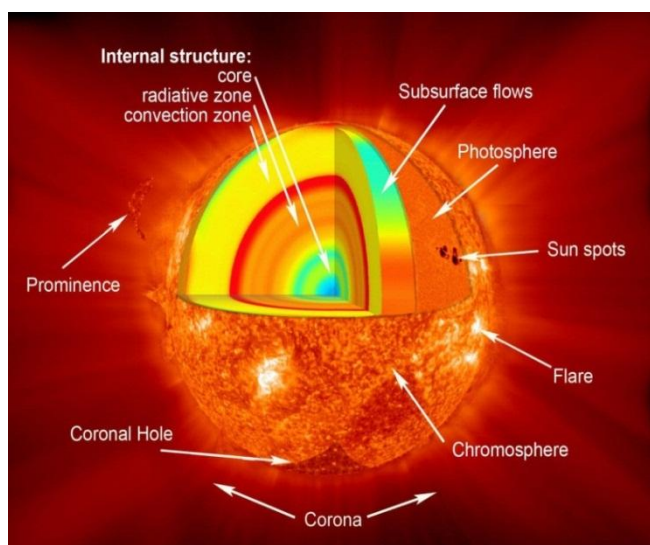
About the sun and its energy

The sun is the Earth's primary energy source, it has great importance and from it we get the warmth without it the ocean froze and the nitrogen and oxygen transform in the air into a liquid state, for the carbon dioxide it also freezes if not the Earth's climate resulting from the arrival of solar radiation, the sun provides the energy needed for photosynthesis.

The energy source is the interaction of the nuclear fusion that is constantly happen in the center of the sun, and that is 15000 times from what we need it.

The sun is made up of a group of elements:

- 1- Solar core: the fusion nuclear processes that produce energy.
- 2- Radiative zone: The shell that surrounds the nucleus.
- 3- Convection zone: Space for violent movement of free gases.
- 4- Photosphere: It is the outer layer of the sun (Its temperature 6000 Celsius) It is the visible part of the sun.
- 5- Aura: It covers the environment of the sun and extends this aura to more than 10000 km the aura is hidden from view due to the bright light from the illuminating ball, It can be seen when an eclipse occurs



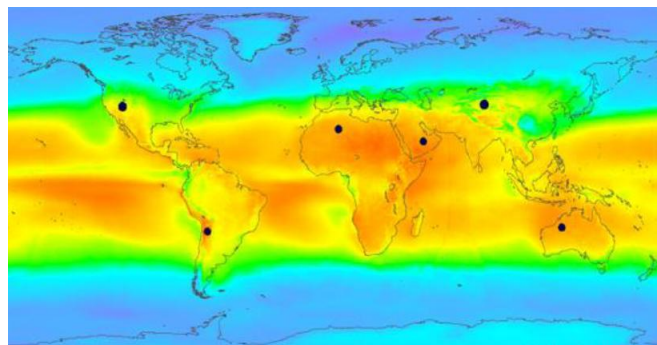
The sunlight is visible to us from the sun, it is a compound beam of seven colors, besides there is two other invisible

radiation: Infrared (thermal effect) and Ultraviolet radiation (Its effect on chemical biology) (sadafi,2014).

The solar radiation that reaches the Earth

Despite reflections, dispersion and absorption of Earth's atmosphere to solar radiation almost all UV rays fade and part of the infrared. However, solar energy that reaches to Earth within a year it is more than what we need 10000 times, These rays that reach to the earth called without any reflection Direct radiation, and the other part of the rays called Scattered radiation, and both of those two is called Total radiation.

The Middle East and Arab countries in general have a large share of daylight because of its geographical location, and of course Syria falls within this area (wikipedia,2016).



Solar energy is a source of other types of energy

The solar energy that Earth receives is the source of life on its surface and direct and indirect source types of energies available on it except for nuclear and tidal energy:

Wind Energy: resulted from the irregular distribution of solar energy in the atmosphere causing thermal differences and that produces air currents.

Hydropower: When evaporates some of the ocean water into the atmosphere rainfall is seen on earth and water returns to the ocean through rivers this generates kinetic energy (efen,2011).

Plant energy: Photosynthesis produces carbohydrates, and with fermentation, it gives alcohol, it can be used as a fuel.

Advantages of using solar energy:

- 1) Solar energy clean energy: Do not give secondary effects on environmental pollution.
- 2) The huge amount of energy carried by solar radiation.
- 3) The possibility of using this resource easily and in multiple life facilities.
- 4) The possibility to get electric energy by solar energy.

Disadvantages of using solar energy:

- 1- Dust and try to clean the solar energy devices: more than 50% of solar energy efficiency lost if the device is not cleaned for a month.
- 2- Store and use solar energy during the night, cloudy

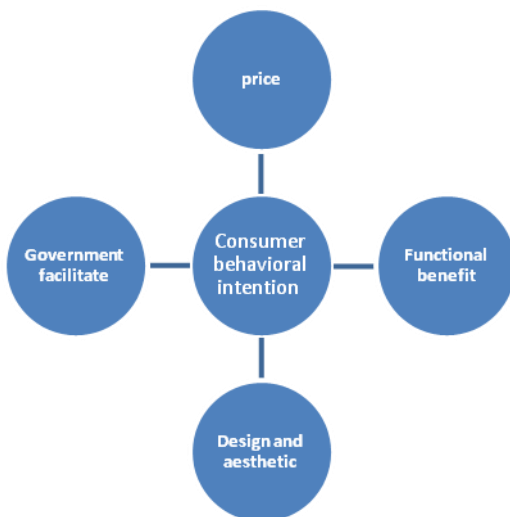
days, or dusty days: the storage of solar energy depends on the nature and amount of solar energy, and type of user and the period of using also the total cost of the storage way, Storage of heat by water and rocks is the best way available today, As for storing electrical energy, the common method is still the use of liquid and dry batteries. There are currently more than ten ways to store solar energy, such as melting metals, the phase conversion of matter, binary mixing methods, and others.

Solar thermal uses

- 1) Solar water heating
- 2) Solar pool heating
- 3) Solar water desalination
- 4) Sewage treatment
- 5) Solar cooking
- 6) Use in agricultural activity

From the above, we find that energy has many forms including renewable and non-renewable energy, and transform from one form to another and that most of it is based on the sun, it can be used directly to generate heat for heating or to generate electricity by solar cells.

Framework



III. RESEARCH METHODOLOGY

Based on the research aim, research objectives, and research questions, this section critically discusses the available options, and provides adequate justification, for all methodological decisions taken, describing the research process in depth. Given that an understanding of the philosophy of research is considered as an essential

prerequisite in conducting research, starts with a discussion on research inquiry paradigms. Towards his effort to meet the requirements of this study's specific research problem, and provides adequate argumentation for the choice of a social constructionism perspective. The choice of the qualitative approach adopted in this study is then substantiated. Among the available qualitative data collection methods, a section on focus group design follows addressing discussion strategy and approach, design of questions and individual tasks, the choice of the sampling method, as well as the actual sampling process employed. Further on, the analysis of focus group data is described in-depth, along with the detailed process employed. Concludes with a discussion of issues related to the generalizability and transferability of findings, and with a discussion on the methodological limitations of this study.

Research paradigm/approach

An understanding of the philosophy of research is an essential prerequisite in conducting research: It provides awareness of the available philosophical alternatives but also assists the adoption of a philosophical stance that influences, or even determines, informed decisions about research strategy and methods to be adopted. In social sciences, and consumer research, in particular, the quest between the different paradigms "that guide disciplined inquiry" (Guba 1990, p.18), is evident during the last 30 years (Hudson and Ozanne 1988; Lutz 1989; Hunt 1991; Marsden and Littler 1996; Marsden and Littler 1998). A paradigm can also be seen as a "general orientation about the world and the nature of research that a researcher holds" (Creswell 2015, p.6), or even as a "net that contains the researcher's epistemological, ontological, and methodological premises" (Denzin and Lincoln 2019, p.22). Inquiry paradigms relate paradigms to research and researchers, defining what is there to be found, thus creating a research culture including, in addition to beliefs, "...values and assumptions that a community of researchers has in common regarding the nature and conduct of research" (Johnson and Onwuegbuzie 2018, p.24). From a more practical stance, Sarantakos (2019) perceives paradigms as "packages" of ontological, epistemological, and methodological prescriptions that guide research.

Research design

The choice of the qualitative approach in this study is also in agreement with Creswell's (1998) pragmatic view on the five compelling reasons for a researcher to undertake a qualitative study: (1) When the topic needs to be explored; (2) When the research questions relate to "how" or "what", rather than "why"; (3) When there is a need for a detailed view on the topic; (4) When there are sufficient time and resources; and (5) when the researcher considers him/her as an "active learner" rather than an expert into the field to be studied. The choice of a research approach, among quantitative, qualitative, and mixed methods, is not only a matter of epistemological and ontological orientation. Therefore, it

does not follow a deductive route that usually necessitates the adoption of a quantitative approach. The present study attempts to explore a phenomenon through a wide-angle lens, thus to provide an understanding and description of participants' experiences and life-world, to contribute towards the generation of theory.

Population

The target population for this study will be made up of people within Damascus city. The importance of selecting this population is that most of the city's residents suffer from problems of power outages.

Sampling

Sampling refers to the methods employed for the selection of the subset of individuals from which statistical data will be acquired. There are two types of sampling; probability and non-probability sampling. The present study will adopt probability sampling as it offers all the elements or individuals within the population equal chances of being selected as respondents in a study (Sekaran&Bougie, 2010).

Sample Technique

This research will adopt stratified random sampling technique. Stratified random sampling involves a process of stratification or segregation, followed by random selection of subjects from each stratum. This gives each strata equal chances of being selected with the least bias (Sekaran&Bougie, 2010).

Sample Size

Krejcie and Morgan (1970) suggested that sample size for a population 130 is at least 92. Therefore 130 questionnaires were administered, however the responses received were 109. Therefore the study was conducted with a sample of 109 data received.

Research Instrument

This study will be conducted by designing a questionnaire. A

questionnaire is a set of questions in written format requesting responses from respondents, where information obtained from respondents is used for data analyses for the intended study (Creswell, 1999). The questionnaire in the research instrument and will be designed using the Likert five-point scale. The study will also include demographic data to collect personal information from the respondents. The questionnaire will also be designed by using clear and concise language to facilitate easy understanding of the respondents (Hair et al. 2006).

Data Collection Method

The primary data will be collected by the personal administration of the research questionnaire. Dwivedi (2005) added that using a questionnaire approach for data collection is recommended due to convenience, cost, time, and accessibility constraints. The questionnaire will be distributed through personal and online mediums to respondents. This will also facilitate the timely reception of the questionnaire response.

Data Analysis Rate

Data was analyzed using descriptive analysis, regression, and correlation analysis. The demographic data was analyzed using descriptive statistics, while regression and correlation analysis was used to test the validity and reliability of the instruments and test hypotheses proposed for the study.

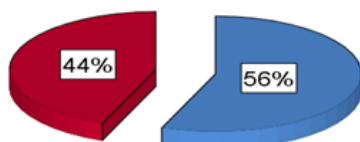
Reliability and Validity of Results

Reliability measures the ability of the research instrument to measure what it is supposed to measure with stable results. Internal consistency measures the reliability of survey instruments using Cronbach's alpha values. The good Cronbach's alpha values for all variables imply that they are internally consistent at measuring the same variable. Cronbach's alpha values of 0.7 and above are considered good and imply the variables are internally consistent (Hair, 2003). There is an inverse relationship between reliability and errors. The higher the reliability, the lesser the errors.

IV. ANALYSIS

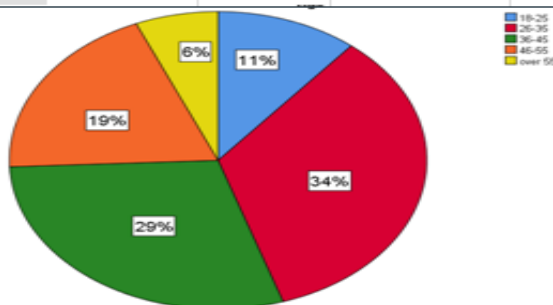
Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	61	56.0	56.0	56.0
	female	48	44.0	44.0	100.0
	Total	109	100.0	100.0	

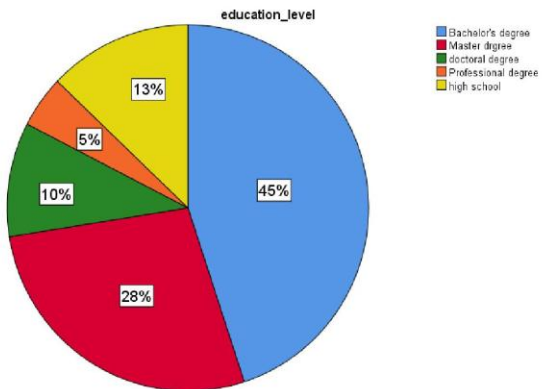


Age

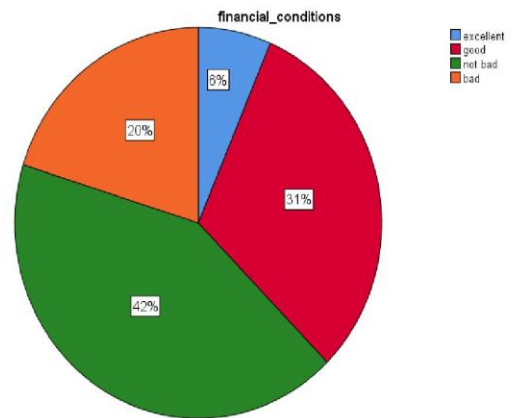
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-25	12	11.0	11.0	11.0
	26-35	37	33.9	33.9	45.0
	36-45	32	29.4	29.4	74.3
	46-55	21	19.3	19.3	93.6
	over 55	7	6.4	6.4	100.0
	Total	109	100.0	100.0	



		education_level			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bachelor's degree	49	45.0	45.0	45.0
	Master degree	30	27.5	27.5	72.5
	doctoral degree	11	10.1	10.1	82.6
	Professional degree	5	4.6	4.6	87.2
	high school	14	12.8	12.8	100.0
	Total	109	100.0	100.0	

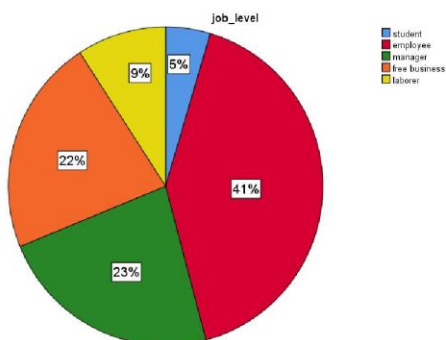


		financial_conditions			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	excellent	7	6.4	6.4	6.4
	good	34	31.2	31.2	37.6
	not bad	46	42.2	42.2	79.8
	bad	22	20.2	20.2	100.0
	Total	109	100.0	100.0	

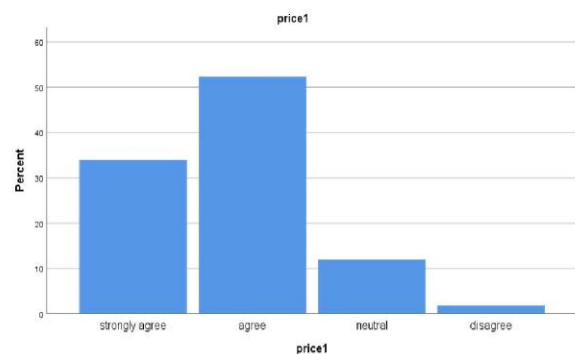


installing solar cells is expensive.

		job_level			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	student	5	4.6	4.6	4.6
	employee	45	41.3	41.3	45.9
	manager	25	22.9	22.9	68.8
	free business	24	22.0	22.0	90.8
	laborer	10	9.2	9.2	100.0
	Total	109	100.0	100.0	

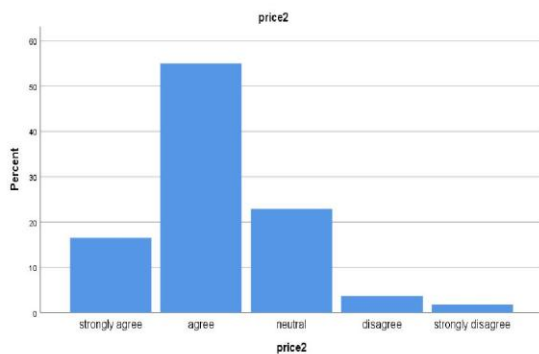


		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	37	33.9	33.9	33.9
	agree	57	52.3	52.3	86.2
	neutral	13	11.9	11.9	98.2
	disagree	2	1.8	1.8	100.0
	Total	109	100.0	100.0	



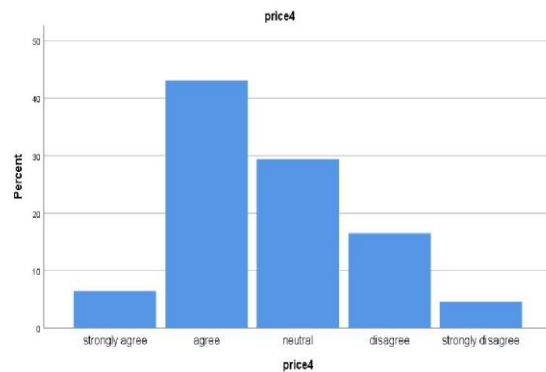
The maintenance of solar cells is bothersome and expensive.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	18	16.5	16.5	16.5
	agree	60	55.0	55.0	71.6
	neutral	25	22.9	22.9	94.5
	disagree	4	3.7	3.7	98.2
	strongly disagree	2	1.8	1.8	100.0
	Total	109	100.0	100.0	



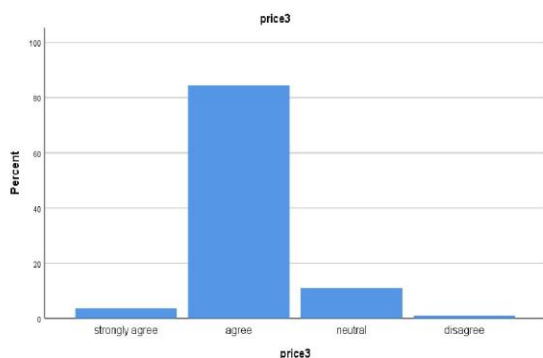
If a new generation of solar cells appears will the old cells be replaced?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	7	6.4	6.4	6.4
	agree	47	43.1	43.1	49.5
	neutral	32	29.4	29.4	78.9
	disagree	18	16.5	16.5	95.4
	strongly disagree	5	4.6	4.6	100.0
	Total	109	100.0	100.0	



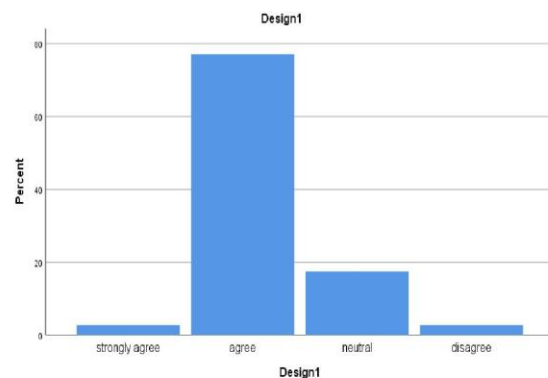
Adding solar cells increases the material value of the building.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	4	3.7	3.7	3.7
	agree	92	84.4	84.4	88.1
	neutral	12	11.0	11.0	99.1
	disagree	1	.9	.9	100.0
	Total	109	100.0	100.0	



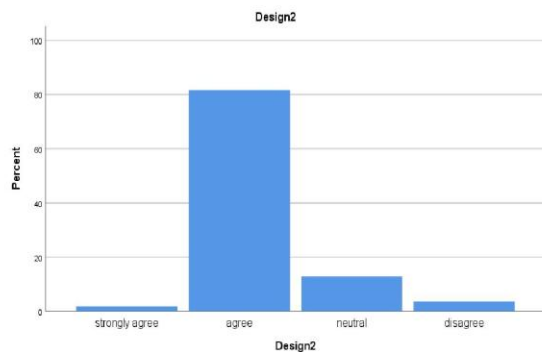
Installing solar cells for residential buildings is striking.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	3	2.8	2.8	2.8
	agree	84	77.1	77.1	79.8
	neutral	19	17.4	17.4	97.2
	disagree	3	2.8	2.8	100.0
	Total	109	100.0	100.0	



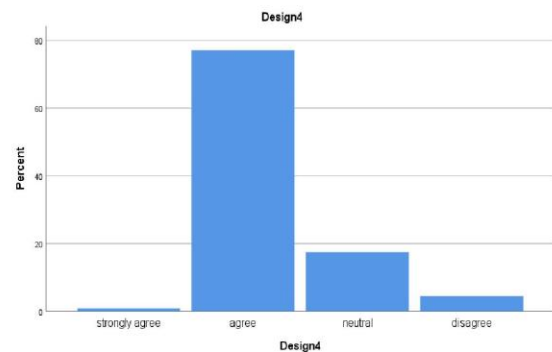
The use of solar cells is a civilized phenomenon.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	2	1.8	1.8	1.8
	agree	89	81.7	81.7	83.5
	neutral	14	12.8	12.8	96.3
	disagree	4	3.7	3.7	100.0
	Total	109	100.0	100.0	



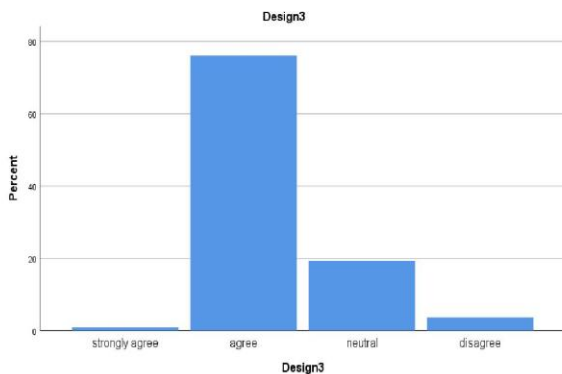
The installation of solar cells on facades influences the concept and character of the architecture building.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	1	.9	.9	.9
	agree	84	77.1	77.1	78.0
	neutral	19	17.4	17.4	95.4
	disagree	5	4.6	4.6	100.0
	Total	109	100.0	100.0	



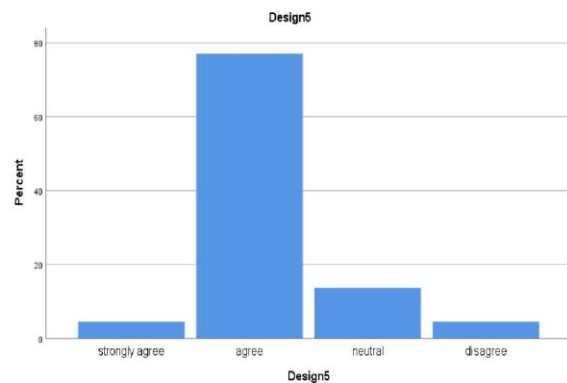
It is preferable to install solar cells in residential buildings on the roof so that they are hidden from view.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	1	.9	.9	.9
	agree	83	76.1	76.1	77.1
	neutral	21	19.3	19.3	96.3
	disagree	4	3.7	3.7	100.0
	Total	109	100.0	100.0	



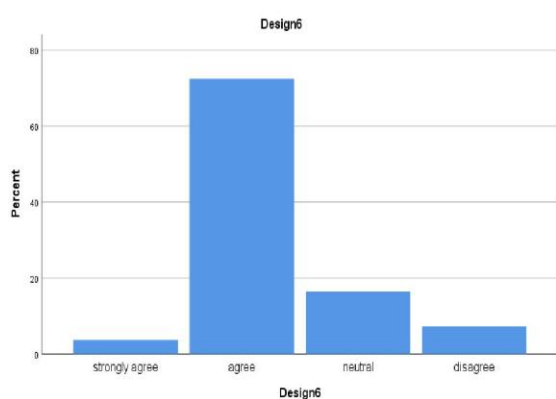
In monumental buildings, it is preferable to install solar cells invisibly.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	5	4.6	4.6	4.6
	agree	84	77.1	77.1	81.7
	neutral	15	13.8	13.8	95.4
	disagree	5	4.6	4.6	100.0
	Total	109	100.0	100.0	



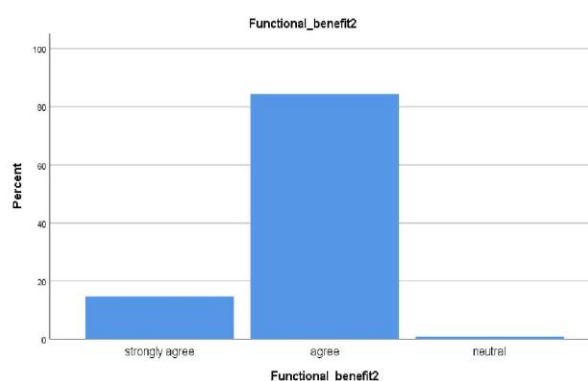
solar cells add a contemporary feel to buildings.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	4	3.7	3.7	3.7
	agree	79	72.5	72.5	76.1
	neutral	18	16.5	16.5	92.7
	disagree	8	7.3	7.3	100.0
	Total	109	100.0	100.0	



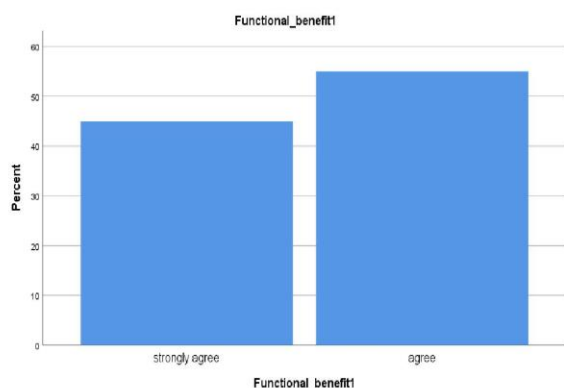
Solar cells help solve pollution and noise problems.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	16	14.7	14.7	14.7
	agree	92	84.4	84.4	99.1
	neutral	1	.9	.9	100.0
	Total	109	100.0	100.0	



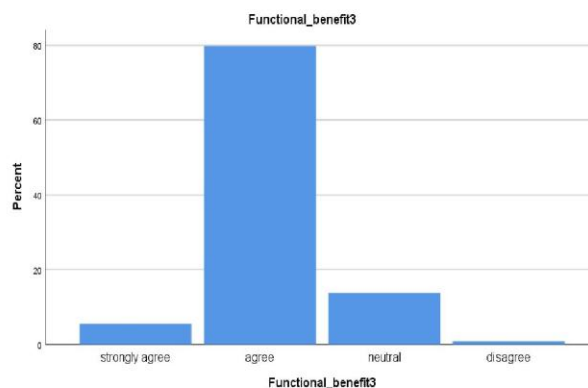
Solar cells represent a helpful solution to the electricity problem in Syria.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	49	45.0	45.0	45.0
	agree	60	55.0	55.0	100.0
	Total	109	100.0	100.0	



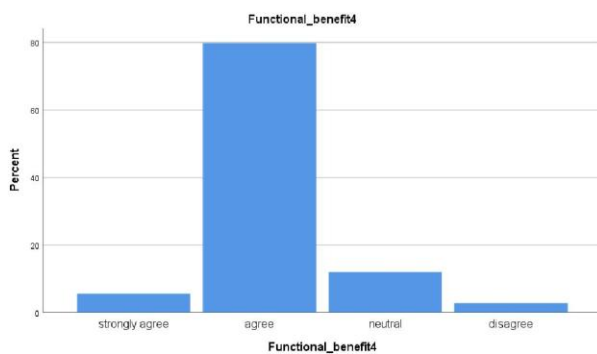
The solar cell may be used in place of tiles on inclined surfaces.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	6	5.5	5.5	5.5
	agree	87	79.8	79.8	85.3
	neutral	15	13.8	13.8	99.1
	disagree	1	.9	.9	100.0
	Total	109	100.0	100.0	



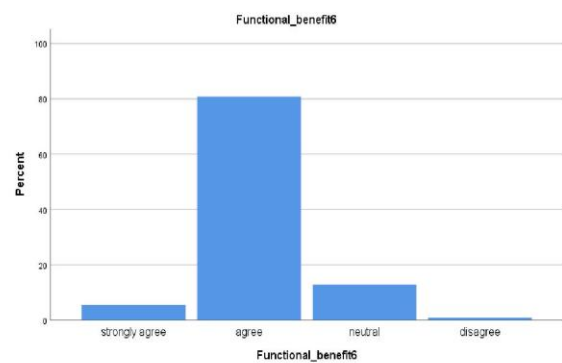
The use of colored solar cells gives a good look for the building.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	6	5.5	5.5	5.5
	agree	87	79.8	79.8	85.3
	neutral	13	11.9	11.9	97.2
	disagree	3	2.8	2.8	100.0
	Total	109	100.0	100.0	



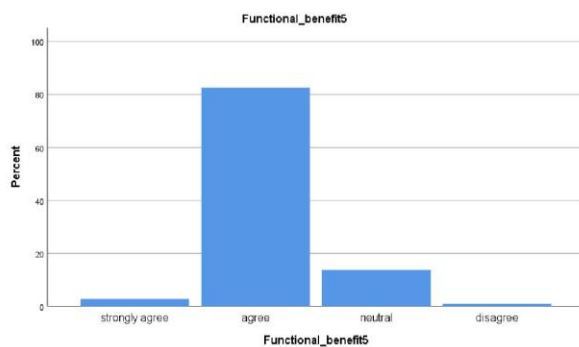
It is preferable to install solar cells on the front-facing of the sun.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	6	5.5	5.5	5.5
	agree	88	80.7	80.7	86.2
	neutral	14	12.8	12.8	99.1
	disagree	1	.9	.9	100.0
	Total	109	100.0	100.0	



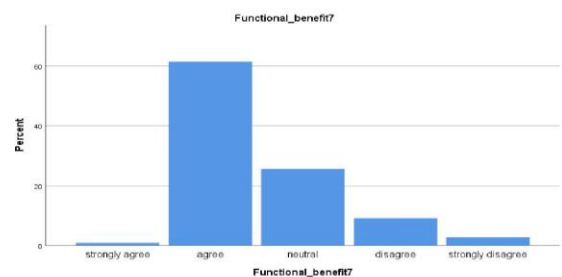
Solar cells can be used as a handrail to the balcony.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	3	2.8	2.8	2.8
	agree	90	82.6	82.6	85.3
	neutral	15	13.8	13.8	99.1
	disagree	1	.9	.9	100.0
	Total	109	100.0	100.0	



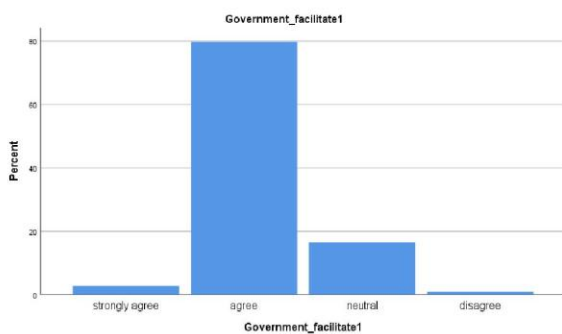
The installation of solar cells on windows does not affect the shape of the building.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	1	.9	.9	.9
	agree	67	61.5	61.5	62.4
	neutral	28	25.7	25.7	88.1
	disagree	10	9.2	9.2	97.2
	strongly disagree	3	2.8	2.8	100.0
	Total	109	100.0	100.0	



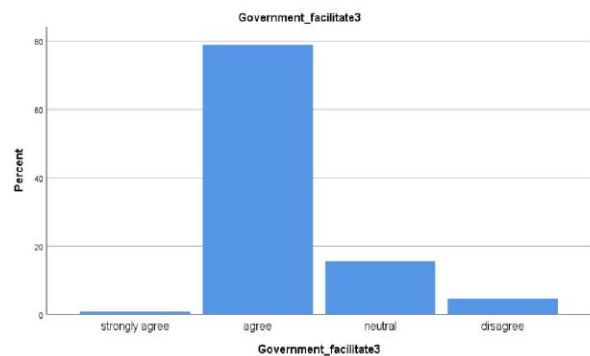
The government encourages the installation of solar cells.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	3	2.8	2.8	2.8
	agree	87	79.8	79.8	82.6
	neutral	18	16.5	16.5	99.1
	disagree	1	.9	.9	100.0
	Total	109	100.0	100.0	



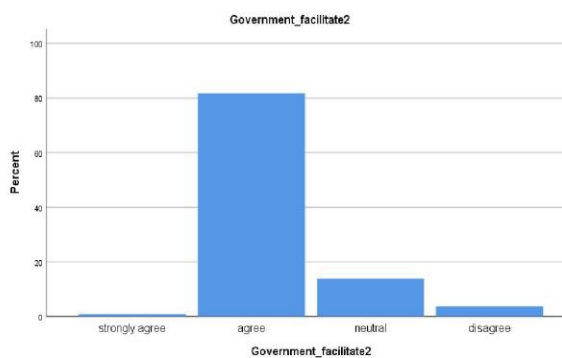
The government facilitates the import of solar cells.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	1	.9	.9	.9
	agree	86	78.9	78.9	79.8
	neutral	17	15.6	15.6	95.4
	disagree	5	4.6	4.6	100.0
	Total	109	100.0	100.0	



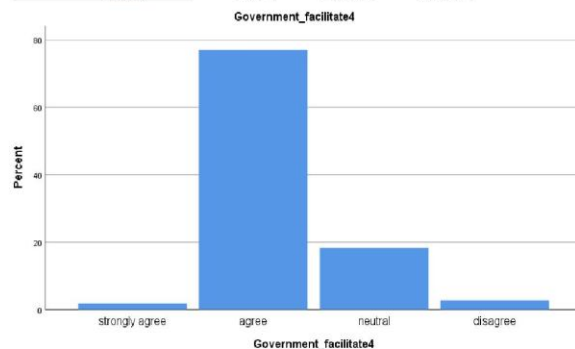
The government encourages the opening of solar panel agencies.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	1	.9	.9	.9
	agree	89	81.7	81.7	82.6
	neutral	15	13.8	13.8	96.3
	disagree	4	3.7	3.7	100.0
	Total	109	100.0	100.0	



Spreading awareness about solar energy through radio, TV, magazines, and newspapers.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	strongly agree	2	1.8	1.8	1.8
	agree	84	77.1	77.1	78.9
	neutral	20	18.3	18.3	97.2
	disagree	3	2.8	2.8	100.0
	Total	109	100.0	100.0	



Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Price	109	1.00	5.00	2.1995	.27592
Design	109	1.00	5.00	2.2263	.23188
Government	109	1.00	5.00	2.2041	.26824
Benefit	109	1.00	5.00	2.0524	.21792
CB	109	1.00	5.00	3.7394	.65856

Correlation test

This test used to investigate the relationship between four independent variables and the dependent variable. The correlation test showed that there is a negative and significant relationship between price and consumer behavior at ($r=-0.136$, $p=0.000$), there is a positive and significant relationship between design and consumer behavior at ($r=0.097$, $p=0.000$), there is a positive and significant relationship between government facilities and consumer behavior at ($r=0.084$, $p=0.003$), and there is a positive and significant relationship between functional benefit and consumer behavior at ($r=0.013$, $p=0.000$).

Correlations

		Price	Design	Government	Benefit	CB
Price	Pearson Correlation	1				
	Sig. (2-tailed)					
Design	Pearson Correlation	.162	1			
	Sig. (2-tailed)	.092				
Government	Pearson Correlation	.148**	.137	1		
	Sig. (2-tailed)	.124	.154			
Benefit	Pearson Correlation	.077**	.073	-.072**	1	
	Sig. (2-tailed)	.424	.452	.459		
CB	Pearson Correlation	-.136**	.097**	.084*	.013**	1
	Sig. (2-tailed)	.000	.000	.003	.000	

This test is used to examine the constructed hypotheses of this study. Based on the obtained result, the adjusted R-square equal to 38.1%, which confirms that this model explains the consumer behavior at 38.1%, the result obtained from regression test is shown in table below, which found that there is a significant and negative impact of price on consumer behavior at ($\beta=-0.333$, $t=-2.416$, $p=0.001$), there is a significant and positive impact of product design on consumer behavior at ($\beta=0.259$, $t=2.201$, $p=0.002$), there is a significant and positive impact of government facilities on consumer behavior at ($\beta=0.290$, $t=2.201$, $p=0.002$), and there is a significant and positive impact of functional benefit on consumer behavior at ($\beta=0.039$, $t=4.132$, $p=0.000$).

Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
	(Constant)	3.149	1.009		3.122	.002		
	Price	-.333	.235	-.140	-2.416	.01	.952	1.051
	Design	.259	.279	.091	9.926	.000	.956	1.046

	Governm ent	.290	.241	.118	2.2 01	.0 02	.957	1.045
	Benefit	.039	.293	.013	4.1 32	.0 00	.982	1.018
	Adjusted R ²	38.1%						
a. Dependent Variable: CB								

Hypotheses testing

No	Hypotheses	Beta	P-value	Decision
H1	There is a negative and significant impact of price on consumer behavior	-.333	.001	Accepted
H2	There is a positive and significant impact of price on consumer behavior	.259	.000	Accepted
H3	There is a positive and significant impact of price on consumer behavior	.290	.002	Accepted
H4	There is a positive and significant impact of price on consumer behavior	.039	.000	Accepted

IV. CONCLUSION

Energy has many forms, including renewable and non-renewable energy, and it transforms from one way to another, and that most of it are based on the sun which in turn can be used directly to generate heat for heating or to generate electricity by solar cells.

Solar cell systems are just a simple brick of clean energy technologies that can no longer be overlooked, Because although it costs a lot of money in the beginning, its long-term returns give a good return either in terms of savings or in terms of reducing environmental pollution, as an ideal environment friend, and it is very successful in the Middle East because, regardless of being the most abundant place in the world in solar energy, it will save a lot of money wasted on other energy sources, the most important of which are oil and natural gas. Therefore, it is one of the simplest solutions that can help solve the energy problem in Syria.

In Syria, there seemed to be a clear interest in using solar cells as an auxiliary solution to the problem of power outages, but it was not clearly spread, but it began to draw attention to its presence in the simplest buildings, albeit in a little way.

The architect's category is convinced of the solar cell system and connecting it with the building to create a new character and style with functional goals in terms of power generation and aesthetics in terms of formation.

The design of a building based on clean energy needs to be comprehensive in thinking, because the ideas put forward must be familiar with the overall design considerations by creating general coordination.

Technology today is trying to provide the architectural design required to achieve this, However, this depends on

how the designer uses these techniques to give the building the aesthetic character that the designer had prepared for him in advance as a mental image of what the building body wants to look like.

The designer's choice of how he wishes to employ solar systems will depend primarily on the characteristics of the solar system, his tools in this is the capabilities provided by the technology through the diversity in the shape, size, color and visual effects it gives to the facade of the building, which is important for the architect.

The place of solar cells in buildings are installed and categorized on the horizontal and oblique naves, as well as on the vertical and oblique facades with architectural details.

Solar cells (as a new integral component) must do their job to produce the energy needed to power the building and this is what the designer tries to obtain when searching for the optimal orientation, however, the design process is a flexible process that in turn depends on the ability of the designer, it is possible, as an alternative, at times to accept a little loss in the amount of energy produced if this positively improves the integration process to increase the aesthetic and economic value of the building.

That is, the multifunctional number of cells will help compensate for the reduced efficiency.

Suggestion and recommendation for future studies

The research has discussed the issue of using the solar cell system and how to direct conversion through which solar energy is converted into electrical energy and how to benefit in architectural formation

For the residential building, to contribute to solving the energy problem in Syria with the highlight of a modern architectural character:

a) Governmental aspects

- Work to spread the culture of alternative energy, especially the solar cell system, and clarify its importance, role, and benefits for citizens.
- Supporting and activating associations that help citizens use solar cells, whether in terms of money or awareness, and demonstrate the efficiency and benefits of this system.
- Establish laws that contribute to the use of alternative energy, and urge municipalities to do that, with facilities to ensure that citizens respond to the idea of using solar cells.
- Urging the Electricity and Energy Authority to activate the system for buying excess electricity from residential homes if they are installed for solar cells, as do the rest of the world, which helps people save electricity and helps them to be convinced of their economic viability.
- Make facilities to import components of the solar cell system so that they become less expensive so that all citizens can install them and not think about their expensive costs.

b) Education aspects

- Guidance through educational processes, whether at the school level or at the higher levels, by introducing solar energy systems in general and solar cell systems in particular.
- As for the level of architectural study, the minds of students must be directed to these attempts to apply Systems with the creation of architectural solutions that integrate form and content with the thought of cell systems Solar` and take into account the environmental design and planning considerations of using these cells with appropriate design.
- Activating the role of the Engineers Syndicate to conduct training courses and workshops to educate engineers to make the necessary designs to support the use of solar cells.

c) Aspects related to the designer engineer

- Dealing with the building as an integrated building system, selecting the project idea and its internal elements, and treating it to the outer covering (facades and surfaces) in an integrated way.
- Work to benefit not only in energy and beauty but also in material terms by utilizing them as termination materials that are alternative to traditional materials as well as employing other jobs Such as thermal insulation and used as umbrellas or solar mains for entrances and openings and windows..... etc.
- At the planning level, the necessity of setting environmental planning is one of the planning priorities, so that the plans are based on preserving

the environment while reducing dependence on traditional energy sources because of its negative impact on the environment.

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