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## Solar Developing Egypt

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## Solar-Developing Egypt

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### Abstract

Harnessing the power of the sun through solar panels – a sustainable source of renewable energy – will lead to solving the issues of electrification and water supply in Egypt. I conducted individual interviews and a focus group with the solar energy specialists of the Research Institute for a Sustainable Environment and other experts. I also carried out a survey to evaluate the AUC community's acceptability to solar power in Egypt, and found out how much they know about the subject.

*“We are like tenant farmers chopping down the fend around our house for fuel when we should be using Nature's inexhaustible sources of energy – sun, wind and tide. [...] I'd put my money on the sun and solar energy. What a source of power! I hope we don't have to wait until oil and coal run out before we tackle that.”<sup>1</sup> Thomas Edison (1847-1931)*

Despite the ongoing debate on the usefulness of solar energy, it cannot be denied that Egypt has a high solar

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<sup>1</sup> Quoted in Newton 1987, p. 31.



Talaat: *Solar-Developing Egypt*

availability, and its energy can be used for water pumping, telecommunications, electrification, etc. Unfortunately, little has been done over the years to secure this sustainable type of energy. My paper will confirm my opinion of the importance and effectiveness of solar energy. It will also focus on how solar electricity will ensure electrification and the supply of safe drinking water. For millions around Egypt, electricity and safe drinking water are unavailable. Hence, harnessing the power of the sun through solar panels – a sustainable source of renewable energy – will lead to solving the issues of electrification and water supply in Egypt. I will conduct individual interviews and a focus group with the solar energy specialists of the Research Institute for a Sustainable Environment and other experts, since they have carried out projects pertaining to electrification and irrigation by way of solar panels. Moreover, a short survey of ten questions will be carried out where I will evaluate the AUC community's acceptability to solar power in Egypt, and find out how much they know about the subject.

The current crisis of fossil fuels in Egypt necessitates a change in fuel strategy. The limited resources and the huge demands make solar energy one of the best of the appropriate energy alternatives. The rising “transport expenses due to the fuel prices, the increasing restrictions of carbon dioxide and nitric oxide emissions due to new ecological policies (Wafiq & Walid, 2014) are more than enough reasons to encourage, and to propagate the dispersion of solar panels in order to reduce our dependability on fossil fuels. The great

*Talaat: Solar-Developing Egypt*

potential of solar energy technology makes it capable of covering several fields. Solar energy technologies are diverse: solar heating, solar photo-voltaics, solar thermal electricity, solar architecture and artificial photosynthesis (Wafiq & Walid 2014) and more.

In his study on solar energy, Professor and President of Egyptian Solar Energy Systems Company, Samer Ayad draws attention to this already existent solar installation company, which was established in 1989. It helped provide, on a small scale, “solar hot water systems for domestic users, for tourist villages, hotels and hospitals” (Ayad, 2013). Professor Ayad, in his study, provides a brief demonstration of the projects the company has undertaken in implementing solar energy and offers short and long term recommendations for propagating solar power systems. The most urgent of his recommendations focuses on the need to think of financial schemes to establish solar technology industries on larger scales, together with the training of technicians for the installation, and maintenance of the solar systems. Moreover, he stresses the need to promote community awareness of their benefits, to encourage the diversification of companies in charge of production, installation and maintenance, and for their regulation under quality measures.

The effectiveness of thermal solar power stations in solving problems of electricity and water shortages worldwide has been emphasized by another renowned expert in the field of solar energy: Dr. Engineer Hany El

Talaat: *Solar-Developing Egypt*

Nokraschy. He has worked on governmental projects in Germany, and declares that:

*“The analysis of renewable energy potentials around the Mediterranean, mainly Middle East and North Africa (MENA), showed that the solar energy potential is by far higher than any other renewable energy potential in the region. Beside its higher availability and reliability, it offers the option of hybrid operation and relatively economic thermal storage to bridge the nighttime and cloudy days.”* (El Nokraschy, 2006)

As Egypt is considered the largest in population in the Middle East and North African region, it also has the largest share of rural population. El Nokraschy also points to the potential of solar thermal plants for seawater desalination. This is particularly pertinent to the possible water shortage Egypt will consequently suffer if Ethiopia persists on building the Renaissance Dam, which would force the Egyptian government to look more closely at desalination. Moreover, President Sisi’s visit to Singapore, which is one of the pioneer countries in desalination, confirms Egypt’s inclination to find alternative resources.

The American University in Cairo is a pioneer when it comes to solar energy. It has launched this academic year of 2015 a specialization in Solar Energy for Physics majors – the first of its kind. The Chair of the Physics Department at AUC, Salah El Sheikh, enthusiastically declared that, “to find out that there are 184 new startup

*Talaat: Solar-Developing Egypt*

solar energy companies in Egypt just last year, it's a job opportunity that we cannot miss, and the decision to launch this new specialization was based on the study of the job market in Egypt (Ezzat, 2015)." In the long run, this specialization is the future, as El Sheikh asserts. In fact, Egypt enjoys an outstanding geographical location that qualifies it to be a producer as well as a user of solar energy. Nageh Allam, a Physics Professor at AUC, also points out Egypt's substantial potential since it lies in the global sunbelt; a group of 66 countries located within 35 degrees of the equator that have exceptional solar power (Ezzat, 2015).

Egypt's plans to slowly shift to solar power infrastructure seem to be building. Mohamed Farag reports, "the planned projects fall under the Ministry of Electricity's strategy to produce 20 percent of all energy from renewable energy by 2020 (Farag, 2015)." The energy sector in Egypt has undergone several crises due to the increase in demand for non-renewable sources, such as oil and natural gas. Hence, the Egyptian government started to consider the diversification of energy resources, notably the use of renewable energy starting with wind energy and solar energy. The latter – the main concern of this project – was decided to be "implemented in phases; the first one will be 150 Mega Watt hybrid solar thermal power plant in Kureimat then be increased to 750 Mega Watt by the end of year 2020 (El-Deken, Farag & Hamdy, 2010)." This project was funded, primarily by the World Bank, for the purpose of demonstrating the technical viability of solar energy.

Talaat: *Solar-Developing Egypt*

According to the official World Bank Kureimat project page:

*“The objective of the project was to increase the share of solar-based electricity in the Egyptian energy generation mix, thereby contributing to the government’s objective of diversifying electric power production. The global development objective of the project was to reduce greenhouse gas emissions... The Bank was also aware that the project would be useful in demonstrating the operational viability of hybrid solar thermal power generation technology in Egypt and elsewhere... It was part of a global effort to accelerate cost reduction and commercial adoption of large-scale, low greenhouse-gas emitting generation technologies through demonstration, learning and dissemination. Secondly, the project aimed to make a modest direct contribution to the reduction of greenhouse gas emissions.” (World Bank, 2013).*

Egypt’s current energy crisis necessitates the integration of renewable energy sources like solar energy into its energy sector. The government fuel subsidies have become a heavy burden on a debilitated economy. Therefore, President Sisi’s target is to gradually terminate the subsidies and to prompt the energy sector to be more innovative and environmentally friendly through transitioning to renewable energy technologies. If the high solar panel prices have earlier discouraged the

Talaat: *Solar-Developing Egypt*

government from adopting the solar option, the prices have surprisingly fallen over the past few years. As the manager of Regional Center for Renewable Energy and Energy Efficiency (RCREEE) Amr Bargouth proclaims: “solar cells are in part made of silicon, and that recent progress in the microprocessor industry has brought silicon’s price – and thus solar panels’ price – down (Sarant, L., 2015)” An impressive solar energy project has started three years ago in the Western Desert. It was undertaken by KarmSolar, an Egyptian company that embarked on introducing solar energy in rural areas:

*“KarmSolar designs and installs innovative solar systems, mostly solar-powered pumps that enable off-grid farming to tap fresh water resources from the vast Nubian sandstone aquifer beneath the ground. These systems have lowered farmers’ reliance on diesel generators, partly shielding them from the repercussions of Egypt’s ongoing energy crisis.” (Sarant, 2015).*

KarmSolar has gone on to develop rural areas and empower its peoples. This will be further expanded on later in the paper in my interview with the Technical Director of KarmSolar.

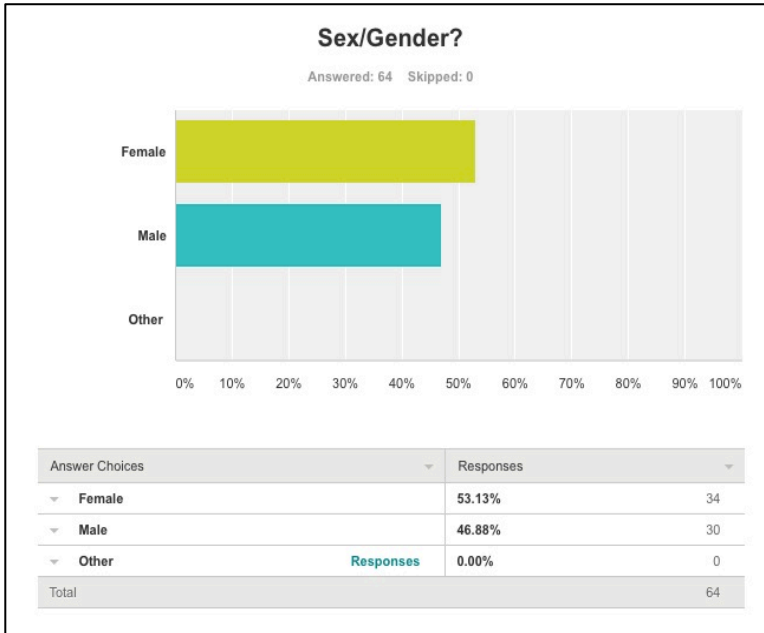
In order to ensure the success of solar energy projects in Egypt, the social acceptability of the concept must be considered. So I conducted a survey to ascertain the level of social acceptability and knowledge in regards to solar energy in Egypt. It is a general and small-scale survey of ten questions, which was concentrated on AUC students.



Talaat: *Solar-Developing Egypt*

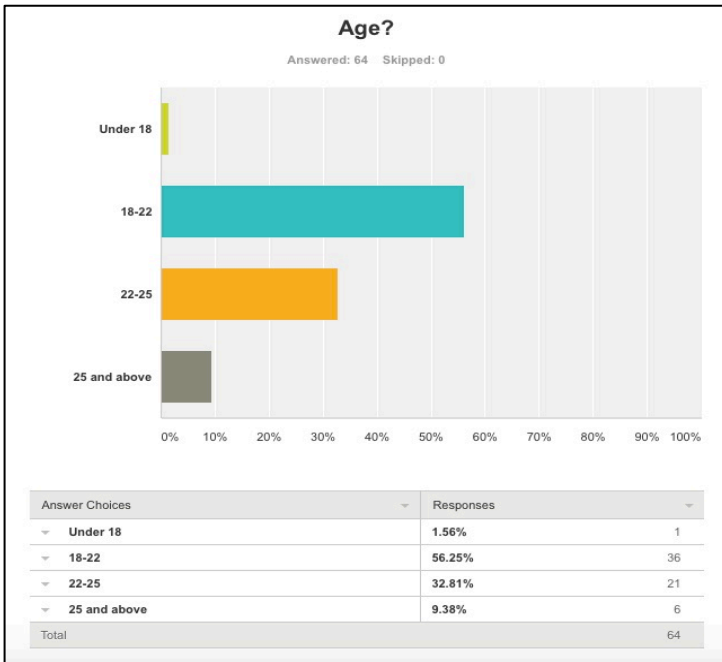
It was shared through the AUC Facebook group, and I also shared it on my profile.

**Question one:**



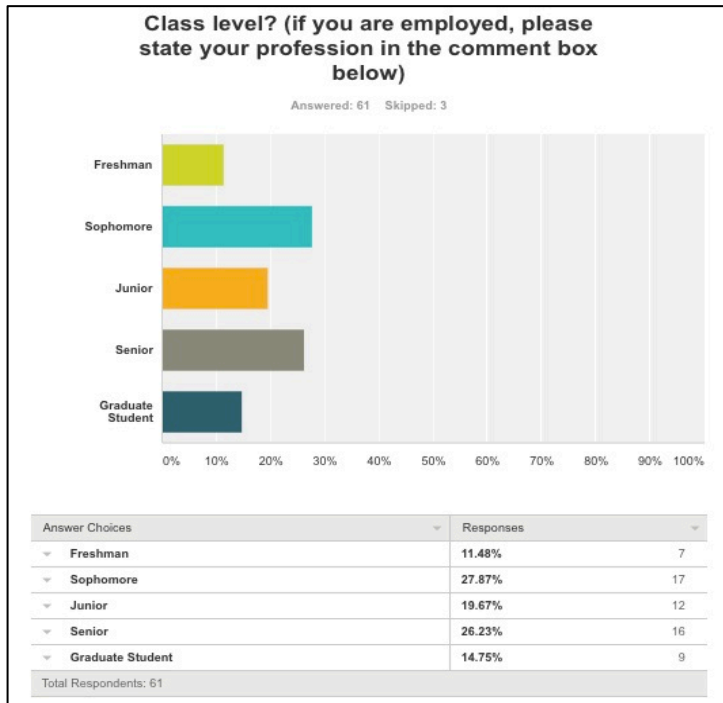
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### Question 2:



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**Question 3:**



**Question 4:**

**Respondents were required to select their majors from the following list:**

Accounting
Actuarial Science
Anthropology
Architectural Engineering

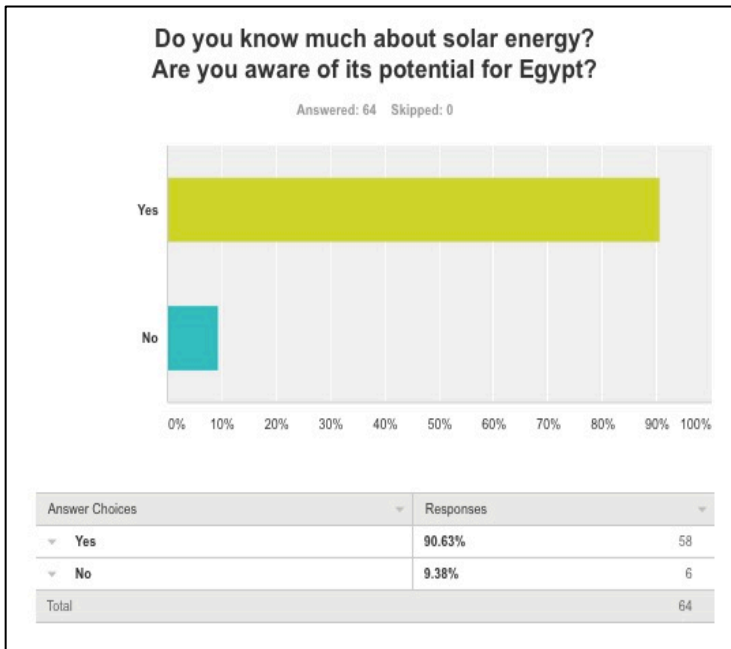
Talaat: *Solar-Developing Egypt*

Business Administration (Management)
Chemistry
Computer Science
Construction Engineering
Development Practice (MDP)
Electronics and Communication Engineering
Engineering
English and Comparative Literature
English Literature, Ain Shams Department of English Language and Literature
Environmental Science
Foreign Affairs/Commerce
Graphic Design
History and Political Science
Integrated Marketing Communication
Journalism and Mass Communication
Management of Information and Communication Technology
Masters in Sustainable Development
Mechanical Engineering
Middle East Studies
Petroleum and Energy Engineering
Physics
Political Science

Talaat: *Solar-Developing Egypt*

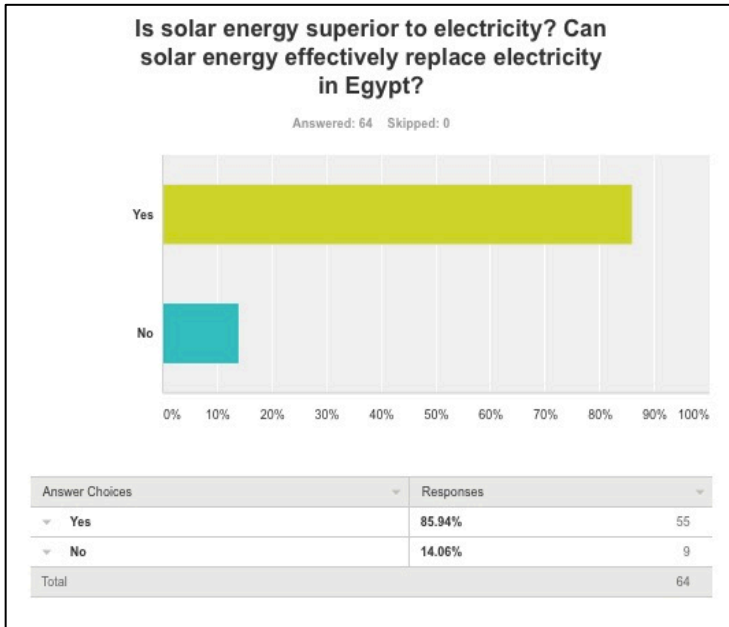
Political Science and Middle East Studies
Psychology
Sociology
Sustainable Development
Undeclared
Undeclared, intending to major in Economics

### Question 5:



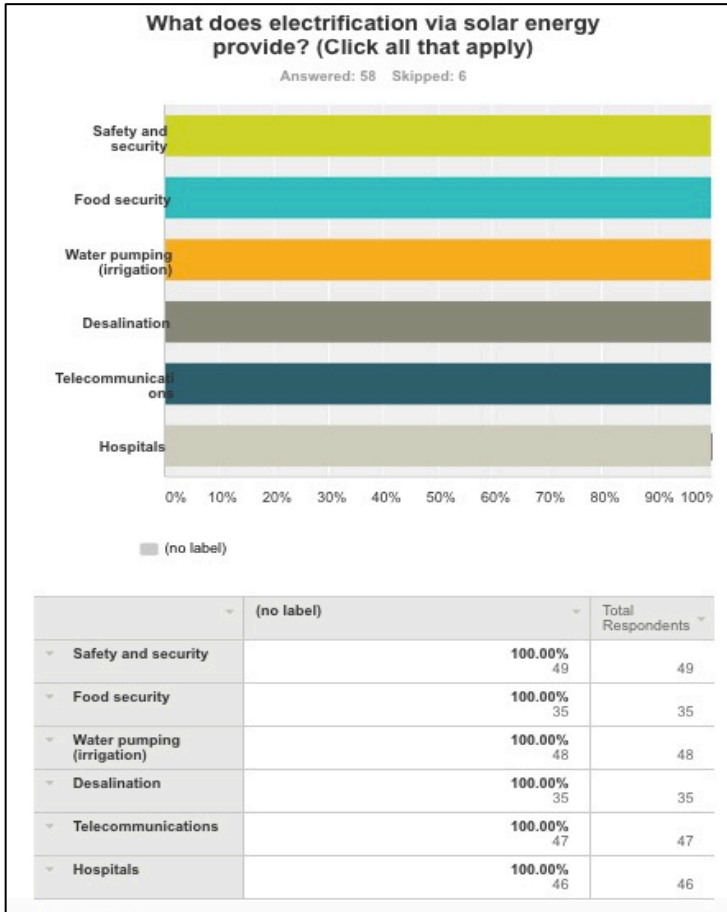
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**Question 6:**



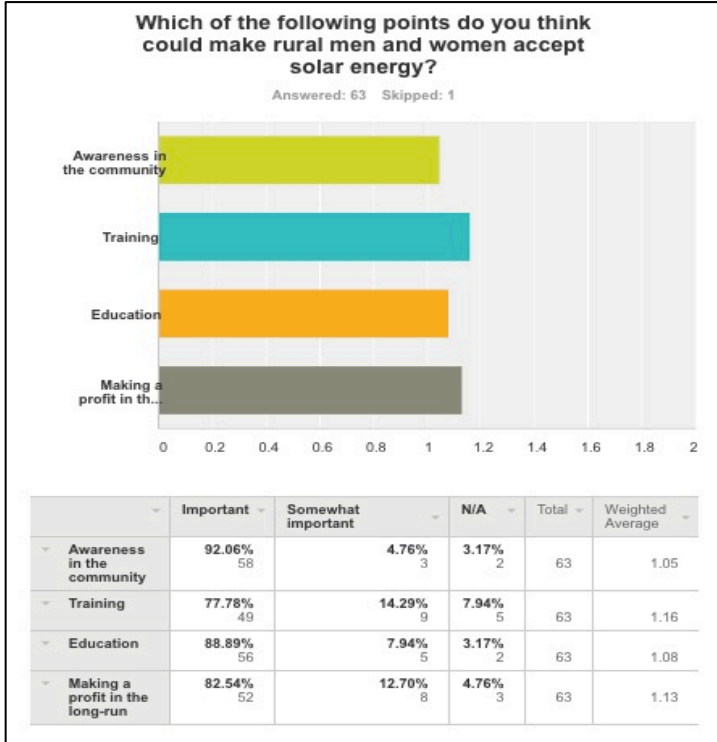
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**Question 7:**



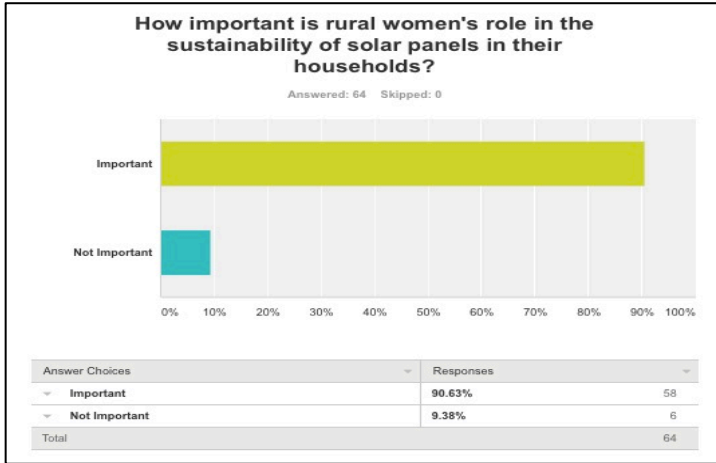
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**Question 8:**

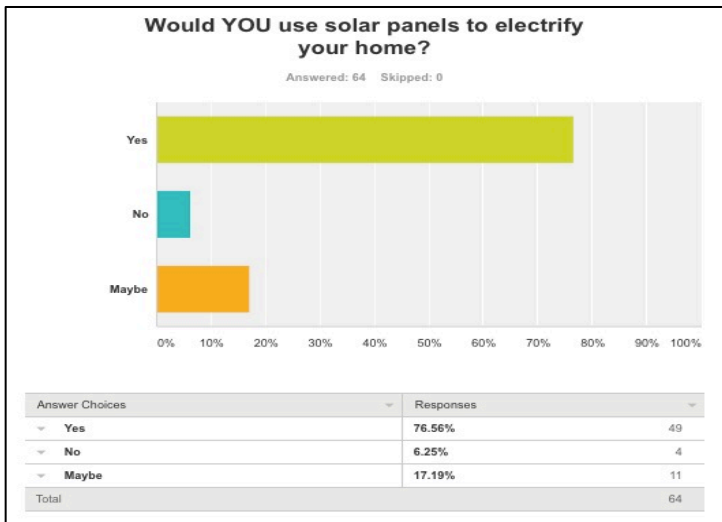




**Question 9:**



**Question 10:**



*Talaat: Solar-Developing Egypt*

This survey received 64 responses. While it is not a large number, the results still showed a positive view towards solar energy. The overwhelming majority of respondents were aware that Egypt has a high solar availability and that it could be used in the electrification of any sort of project. In order to guarantee its sustainability in rural areas and make sure the people accept solar energy, there should be awareness in the community, education, making a profit in the long-run and training. The respondents marked all of the options as important, with some more important than other: 1- awareness in the community, 2- education, 3- making a profit in the long-run and 4- training.

The focus group I interviewed also discuss the previous questions in further detail; they consider the steps that need to be undertaken to improve access to solar energy in rural areas. While attending the “First International Conference on Solar Energy Solutions for Electricity and Water Supply in Rural Areas” at AUC, I took advantage of the attendance of individuals who are knowledgeable in solar energy; and thus conducted my focus group. The conference was organized by RISE, Autarcon, SolarInput and Sustainable Concepts.

**Focus Group participants:** Dr. Tina Jaskolski (Senior Researcher and Research Coordinator at the Desert Development Center/Research Institute for a Sustainable Environment), Hend Ishmail (Development Program Specialist at Misr El Kheir Foundation and student at the Masters in Sustainable Development Program at AUC),

Talaat: *Solar-Developing Egypt*

Chelsea Estevez (Office of Sustainability Intern), Hana Zayed (Economics Major) and Hassan Husseiny (RISE Senior Trainer and Water Management Specialist). They were asked to comment on the following points:

- 1- Targets to improve access to solar energy and water supply in remote/rural regions
- 2- Challenges and obstacles that need to be overcome
- 3- Resources and experiences available that can be built upon
- 4- Solutions on how to achieve the targets

There was a general consensus that there should be a coverage of basic needs – like electricity and water. Dr. Jaskolski also thought it important that project managers do not force the community into it. Hassan Husseiny confirmed the importance of this; the people should be engaged from the beginning, and have to help in the process. The community must be engaged in all stages, and for that to happen there should be profit generation for motivation. Rural areas are in desperate need of simple electrification for hospitals, asserted Hend Ishmail; from what she had seen and heard of in Sinai, Halayeb and Shalateen. All participants stressed the necessity for a needs or priority assessment first. Following the assessment, awareness in the community should be introduced, after that comes training, and finally education – since they do not have any knowledge about it. These steps will ensure that they accept and use it. Maintenance is also an important component and must take place regularly. However, for all this to take place, not only men but women as well

*Talaat: Solar-Developing Egypt*

have to be trained and educated to learn how to sustain the machines. They are the ones who handle the household after all.

Regarding the obstacles RISE and other organizations/institutions may face, finances are always an arduous challenge with these type of projects. Finding ways to facilitate the technology for proper cost and financing the projects will, hence, be a big part of the endeavor. Moreover, long-term maintenance is of great significance. For the projects to be sustainable, RISE would need to train the people of the villages to ensure everything keeps working. Gaining the trust of the leaders who take initiative to preserve things in their community is important; as without them the people will not listen. If financing the projects from outside sources – donors and banks – fails, the natural, human and physical resources that the villages have can be used for capital to fund the projects. This way, they would be involved in every step of the electrification of their village and they would own it entirely.

For RISE to achieve the targets they set out, they would utilize local communities through mosques, community centers, etc. Finding different ways to fund the projects is a key factor. This will build on what the people, and the village, already have through community engagement. There should also be effective coordination between companies and the government, and cost sharing between them, as well. The focus group responses ended with a comment on what Dr. Jaskolski wants to do at RISE, which is learning from other

Talaat: *Solar-Developing Egypt*

projects' past experiences – research what didn't work so as not to do it, or to do it better and more successfully.

Also, while at the “First International Conference on Solar Energy Solutions for Electricity and Water Supply in Rural Areas”, I managed to individually interview several key experts in solar power approaches and applications, and those who are in the field of sustainability. KarmSolar's Chief Technical Officer, Eng. Omar Hosny, spoke to me about KarmSolar's project in the Tanweer El Heiz village, which was funded by the Rotaract Club. KarmSolar succeeded in electrifying all 60 houses for the residents with the help of the residents, which is what Dr. Tina Jaskolski and Hassan Husseiny stressed upon in the focus group. Hosny stated, “residents' active involvement is crucial to the success of any project.” He also emphasized that, “project ownership is incredibly important... Paying for it – no matter how little – gives them a sense of purpose and ownership... They need to feel and know that they have helped build the project.” Another vital point he made was that, “we need to always listen to their needs... We can't just go to their village and assume we know what is best for them... That is never the way to go in development.” Project sustainability, according to Hosny, includes three fundamental factors: “the locals' participation, the local's technical training of the photo-voltaic technology [solar panels] and the local's ownership through maintenace funds.”

Technical Director and Co-founder of SolarizEgypt, Rana Alaa Abbass, was also kind enough to answer

*Talaat: Solar-Developing Egypt*

some of my questions. SolarizEgypt was established in 2013 and pioneered the introduction of grid-tie Photo Voltaic (PV) technology in Egypt. When asked about their targets to improving access to solar energy, she said “SolarizEgypt aims at changing people’s mindsets and facilitating technical procedures to connect solar to the grid, and simplify and tailor policies to the public.” She calls for “customs and taxes for clean technologies to be mitigated, procedures to tie-in a solar plant to the grid to be expedited, a national project to manufacture solar panels in Egypt should be studied, more awareness spread by government entities and finally, the banking sector should offer green loans for renewables.” Abbass maintains that SolarizEgypt’s “focus was initially on grid-connected technologies, which rely on the presence of a national electricity grid to work. Grid connections are more prevalent in urban areas in Egypt.” But to accommodate the rural areas, they expanded their focus to include “off-grid and PV hybrid solutions”. Abbass also informed me that SolarizEgypt “partners with NGOsto apply for grants needed to install solar panels in rural and slum areas to help overcome the high initial cost obstacle.” While I was under the impression that the government constitutes a hindrance to the process of substituting fossil fuels for solar energy, Abbass proved me wrong. In fact, “the government has actually enacted an incentive program to encourage people to adopt solar energy. It is known as Feed-In-Tariff program, where anyone can build and own a solar plant to sell electricity to the government in return for revenue. This is a huge leap on the government’s side to support renewable

Talaat: *Solar-Developing Egypt*

energy in Egypt. We actually lobby a lot with the government to try and make such processes smoother.”

To promote solar energy, the SolarizeEgypt team “attend all green events at AUC, including: earth week, environmental conferences, session series... [they] took conference attendees on field trips and [they] gave the practical component of a Freshman course that focuses on solar energy in Egypt... As a matter of fact, [their] first project was implemented at AUC, and [they] are currently working closely with the Sustainability Office to convince them to build a large-scale solar plant at AUC to make it pioneer in its field.” RISE/the Sustainability Office has already gone to great strides in getting involved with solar energy projects. According to Adam Ezroua, RISE Research Associate, “we have implemented projects in rural communities; including, for example the installation of a solar-powered egg incubator system in Abu Minqar, and the installation of a solar-powered sheep shearing system at Bir Wahid. We also led a project on the installation of drinking water filtering stations in many remote communities in the Western Desert with German company AUTARCON, which can also be powered by solar panels.” He highlights the challenges, which are: “ensuring the communities can financially sustain the operational costs of these systems – like getting money for maintenance and getting new parts – and maybe other more community-related issues as in ensuring the projects benefit the entire community and not a select few.” To promote and popularize the idea of solar energy, Ezroua says that “RISE regularly holds trainings on the topic

*Talaat: Solar-Developing Egypt*

that are open to both AUCians and non-AUCians, and we also run educational programs in coordination with some AUC professors on solar energy applications. Universities, I guess, should try to integrate the topic in more courses, build solar systems as a showcase for students, give them more practical experience within the field, and connect to the solar energy industry through organizing on-campus events, conferences and job fairs on the topic.”

Hence, Hend Ishmail, Development Program Specialist at Misr El Kheir Foundation and graduate student at the Masters in Sustainable Development Program at AUC, has RISE to thank for her interest in solar energy. She believes that it is of the utmost importance and it is one of, if not, the most efficient and clean sources of energy Egypt has. The solar panels could be used to fulfill any number of purposes, “first you have security needs; for example lighting the dark streets.. then there’s food security, like refrigeration so the food doesn’t go bad... water pumping and irrigation... electrification of hospitals, which in Sinai is a huge problem because their electricity is always getting cut off.” Therefore, the focus now should be moving away to renewable sources of energy, specifically solar energy. Also at the conference, Hubert Aulich, Chairman of SolarInput, Chairman of SolarValley Mitteldeutschland and President of Sustainable Concepts, said that “removing subsidies on fossil fuels could force people to resort to solar or other sustainable energy resources.” He believes that “there needs to an incentive to use clean energies... if it’s attractive, you’ll get investors... The switch from fossil



Talaat: *Solar-Developing Egypt*

fuels to renewables without incentive and reliability will not be able to be put into action... It wont work without trust and reliance on the system.” He could not provide a comparison between Germany and Egypt, because “there is no difference between rural and urban areas in Germany; it is almost 100 percent electrified.”

AUTARCON Project Coordinator Eng. Philip Otter has hopes for Egypt’s potential to thrive in the future. He said, “it is going slowly in the right direction.” After AUTARCON’s successful joint projects with RISE of suppling water to rural communities El Heiz and Abu Minqar, Otter said that “we plan to supply more communities around Egypt with the same.” He confirmed my beliefs of the solar powered technologies by asserting that it is indeed, “a durable system without major repair or maintenance requirements; this can make a difference and we are keen to extend its capabilities not just here in Egypt, but worldwide... And it is up to this new generation to undertake this and ensure its expansion.” Yaseen Abd El-Gaffar also expressed hope in the solar powered projects: “There have 600 new solar energy companies founded in the past six months alone, which is an incredibly positive indicator of the future of solar energy in Egypt.”

Egypt has incredibly high solar energy at its disposal, and it can harness this extraordinary power of the sun through panels throughout the country. I believe that now is the ideal time to propogate the implementation of solar powered electrification, especially since global solar module prices are at an all time low. The prices of

Talaat: *Solar-Developing Egypt*

solar modules – packaged collection of solar cells – have dropped to 63 cents per watt (Spross 2014). This factor, along with the feed-in-tariff program and a gradual removal of subsidies off of fossil fuels will ultimately lead to a concentrated effort towards solar energy electrification of the entirety of Egypt.

Talaat: *Solar-Developing Egypt*

## **Appendix I: Focus Group Transcript**

### ***I- Targets to improve access to solar energy and water supply in remote/rural regions:***

*Chelsea Estevez:* There should be a coverage of basic needs, like electricity and water. Solar is just a sustainable way to go about it.

*Dr. Tina Jaskolski:* It is also important that we not force the community into it.

*Hend Ishmail:* These rural areas need simple electrification for hospitals – like in Sinai – and refrigeration – like in Halayeb and Shalateen.

*Dr. Tina Jaskolski:* Needs assessment... priority assessment comes first. Then awareness in the community, then training and then education; because they don't have any knowledge about it. If they don't know anything about it, how will they accept it and use it?

*Hassan Hussein:* The people should be engaged from the beginning, and have to help in the process. The community must be engaged in all stages. Profit generation will motivate them for sure.

*Dr. Tina Jaskolski:* For them to have a sense of ownership; perhaps a small fee for maintenance costs to make them persevere it. So we need a mechanism in place from the beginning to ensure maintenance takes place.

Talaat: *Solar-Developing Egypt*

Hana Zayed: If projects are to be successful, approaching the people is an important factor – a priority. Gaining their trust to gain their engagement.

*Hend Ishmail*: Women, as well, has to be trained and educated to learn how to sustain the machines. They're the ones who handle the household after all.

## **2- Challenges and obstacles that need to be overcome:**

Dr. *Tina Jaskolski*: The cost of technology and financing the projects. Finding ways to facilitate the technology for a proper cost.

*Hassan Hussein*y: Long-term maintenance is so important. For the projects to be sustainable, we need to train them to ensure everything keeps working. We have to find out who are the leaders who take initiative to preserve things in their community; without them the people won't listen.

## **3- Resources and experiences available that can be built upon:**

Dr. *Tina Jaskolski*: We should keep in mind what the natural, human and physical resources they have that can be used for capital in case financing the project from outside sources – donors – doesn't work.

*Hassan Hussein*y: Family ties in the community! They control the communities – clans, leaders will make sure the system works.

## **4- Solutions on how to achieve the targets:**

Talaat: *Solar-Developing Egypt*

*Hana Zayed*: Utilizing local communities through mosques, community centers and stuff like that.

*Chelsea Estevez*: Finding different ways of representing the community and for financing.

*Hend Ishmail*: Trying to build on what is already there; selling their dates or homemade goods for example.

Dr. *Tina Jaskolski*: Community engagement is key.

*Hassan Hussein*: Cost-sharing. The government should make a contribution.

*Hana Zayed*: Yes, the government should contribute 50 percent and the investors the other 50 percent. There should be good coordination between companies and the government to prevent hindrances.

Dr. *Tina Jaskolski*: Learning from other projects' past experiences; research what didn't work so as not to do it, or to do it better and more successfully.

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Talaat: *Solar-Developing Egypt*

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