

A Study into the Acceptability of Alternative Energy Sources for Urdu Bazaar Karachi

By
Arif Hasan and Mansoor Raza
with **Hira Ilyas Bawahab**

(Author's Final Draft, January 26, 2011)

Arif Hasan, Architect and Planning Consultant, 37-D, Muhammad Ali Society, Karachi-75350, Pakistan; email: arifhasan@cyber.net.pk; tel: (9221) 3452 2361

Acknowledgements

Apart from the authors, a number of persons have worked on this study. Architect Furqan Khan along with Architect Hira Ilyas was responsible for carrying out the questionnaire survey and its tabulation. Varda Nisar helped in the tabulation and the preparation of the PowerPoint presentation. Israr Ahmad Rana has put the study together.

Shahid Bhai, our contact in Urdu Bazaar and Nasim Ahmad Sahib, the Urdu Bazaar Shopkeeper's Union leader gave a lot of time to the survey team, both during and after the survey. Nasim Ahmad Sahib subsequently arranged a well-attended meeting of the shopkeepers, authors of the study, and the solar energy supply company.

One of the important benefits of the Study is that the authors have learnt about the technical aspects of solar energy systems and are now in the position to promote them both in teaching institutions to which they are linked and within the communities they, and/or the organisations they work with.

This study has been supported by the International Institute for Environment and Development (IIED) England, UK.

ARIF HASAN
January 26, 2011

Executive Summary

Since the privatisation of the Karachi Electric Supply Company (KESC), three years ago, power outages (locally known as load-shedding), in Karachi, have increased causing immense loss to industry and commercial markets. This study seeks to understand the acceptability of alternative energy sources by commercial markets in Karachi. Urdu Bazaar, a commercial market for books in the centre of Karachi, was chosen for the study. The market consists of about 400 shops and retail storage spaces. The height of the buildings varies between one to four floors.

The market was chosen because it was not a high-end retail market and most of its shop owners belonged, both in monetary and cultural terms, to the middle-middle classes. Most of the markets in Karachi belong to this category.

A survey of the market was carried out through observations, detailed interviews with the markets' union leaders, and a questionnaire served to randomly chosen 100 shopkeepers. The survey revealed the following:

1. A three hour load-shedding during market hours was normal. Sometimes it could increase to six to seven hours. This load-shedding adversely affects businesses because fans cannot operate in summer, and lights after dark, or in shops that are not well lit.
2. The shopkeepers have opted for alternatives. These consist of generators and Uninterrupted Power Supply (UPS) units. The generators are expensive to buy (average cost Rs 37,500 or US\$ 436) and expensive to operate, at an average of Rs 5,882 (US\$ 69) per month. In addition, their noise and air pollution is damaging to health and visitors do not like coming into the shop when they are operative.
3. The UPS on the other hand is cheaper at Rs 20,000 (US\$ 233), with a running cost of Rs 1,000 (US\$ 11.6) per month. However, it does not store enough energy to meet the long hours of load-shedding and also consumes a considerable amount of energy from the grid. In addition, its acid batteries cause immense air pollution which is difficult to tolerate for a long period of time.
4. Ninety per cent of the shopkeepers surveyed are willing to adopt a solar energy option because they understand its environmental and sustainability advantages.
5. The shopkeepers identified four packages that could meet their needs. One of the packages consists of two energy saver bulbs and one fan. This was made the basis for a cost analysis by the authors.

Seven solar energy companies were then contacted and asked to provide the technical details of their product and its cost. Two well respected engineers were also contacted so that the authors could understand the technology and the details of what the companies were proposing.

On the basis of these discussions, a company called Wellbeinggreen was chosen for further negotiations. The reason for choosing it was that they were the most cooperative, had an association with a respectable foreign principal, and made the cheapest offer. For the preferred package, they have given an estimate of Rs 98,000 (US\$ 1,140). This is using the AC current option whereby the shopkeepers can use their existing fans and light fittings (for

details, see Section 3.5.1 of the study). The AC option, unlike the DC option, has less electric shock hazards related to it.

The findings of the study were presented to the Urdu Bazaar shopkeepers at a well-attended meeting at their union office. Representatives of Wellbeinggreen were also present and made a presentation. The issues that surfaced in the discussion are given below.

1. The shopkeepers are afraid that the government might impose a tax on solar power and as such their investment will be compromised.
2. The KESC will lose revenue as a result of their adopting solar energy and as retaliation might disconnect them from the grid or bully them into paying additional charges illegally.
3. The solar panels will be placed on roofs that are accessible. There is no guarantee for their security.
4. They are afraid that the solar energy company might close down and as a result the warranty that they are offering would not be worth much.
5. There was much discussion on the advantages and disadvantages of having individual or collective solar panels.
6. The representatives of Wellbeinggreen also expressed the constraints they face in promoting their products. One, there is a 50 per cent duty on cadmium batteries and a 30 per cent tax on solar panels. If this is removed, a 30 per cent reduction in cost of the final product can be achieved. And two, given the advanced state of glass manufacturing in Pakistan, tempered glass sheets which cover Photo Voltaic cells can be manufactured in the country. This will further reduce costs. The government needs to offer incentives for producing them.
7. The representatives of Wellbeinggreen also displayed individual solar lanterns and fans that operate on a DC current. The solar lanterns cost about Rs 5,000 (US\$ 58) with a solar panel and the solar fan costs Rs 16,000 (US\$ 186). As such, one fan and two savers would cost Rs 26,000 (US\$ 302) as opposed to Rs 98,000 (US\$ 1,140) for the AC system that Wellbeinggreen has proposed.

As a result of the discussions, the following decisions were taken:

1. Arif Hasan (one of the authors), would write a letter to the Secretary of the Power Department, Government of Sindh explaining the governance related concerns of the shopkeepers and also the concerns of the Wellbeinggreen regarding duties on solar technology items. In the letter he will introduce the shopkeeper's union leader and the Wellbeinggreen Company who can then follow up things with the Secretary independently. The letter has been sent and a copy is attached as Appendix – 4.
2. The shopkeeper's union will share the presentation of the authors with other members and decide on a future course of action. They will keep in touch with Wellbeinggreen, and if necessary, with the authors.
3. The Wellbeinggreen Company has been introduced to the Orangi Pilot Project's Orangi Charitable Trust which has a major presence in the rural areas of Pakistan. It is felt that the OPP-OCT can introduce solar lanterns and fans to its partner organisations in the rural areas and small towns.

Contents

Acknowledgements **Executive Summary**

1. Introduction

- 1.1 Karachi Situation
- 1.2 The Current Condition of KESC
- 1.3 Alternative to KESC Supply Currently Adopted by the Shopkeepers
- 1.4 Project Description
- 1.5 Description of Urdu Bazaar
 - 1.5.1 Location
 - 1.5.2 Issues: Physical Conditions
 - 1.5.3 Issues: Traffic
 - 1.5.4 General Profile

2. Methodology Adopted for the Study

- 2.1 Research Tools
- 2.2 Reasons for Selection of Urdu Bazaar
- 2.3 Questionnaire Design
- 2.4 The Survey
- 2.5 Methodological Issues

3. Findings from the Research

- 3.1 On-site Observations
- 3.2 Findings and Conclusions from the Talks / Informal Interviews Conducted with the Shopkeepers of Urdu Bazaar
- 3.3 Interview of Urdu Bazaar Booksellers' Union Leader
- 3.4 Findings and Conclusions from the Survey Conducted with Shopkeepers of Urdu Bazaar
- 3.5 Findings from Solar Companies and Experts
 - 3.5.1 Technical Issues
 - 3.5.2 Financial Issues

4. Choice of Solar Company for Further Negotiations

5. Issues Identified at the Joint Meeting

6. Decisions Taken

Appendices

1. Survey Questionnaire
2. Cost Comparison Chart from Different Companies
3. News items, no let up in Karachi load-shedding
4. Letter to Secretary, Power Department, Government of Sindh
5. Letter to Secretary Power Development Department, Government of Sindh

Abbreviations and Local Terms

Abbreviations:

AEDB	Alternate Energy Development Board
CDM	Clean Development Mechanism
HFO	Heavy Fuel Oil
IPP	Independent Power Producer
KESC	Karachi Electric Supply Corporation
KWH	Kilo Watt Hour
M.A. Jinnah	Muhammad Ali Jinnah
MQM	Muttahida Quami Movement (Karachi based political party in control of the city government in Karachi)
NEC	National Engineering Corporation
UPS	Uninterrupted Power Supply
WAPDA	Water and Power Development Authority

Local Terms:

<i>Bazaar</i>	Market
<i>Kunda</i>	An illegal electric connection taken from the distribution poles

1. INTRODUCTION

This study has been undertaken for understanding the real reasons behind the hesitation that Karachi commercial markets have in adopting alternative sources of energy to overcome the long periods of power outages that plague their lives and adversely affect their businesses. As a result, a number of issues have been identified which are documented in the study.

1.1 Karachi Situation

Statistics show that Pakistan (defined as an energy deficient country) is one of the lowest in the world as far as consumption of energy is concerned. Its per capita energy consumption is less than half of the average for the developing countries, about 1/8th of the world average, 1/25th of developed nations and 1/60th when compared with the energy consumption level of an average American. According to figures taken in 2006, the per capita energy consumption of Pakistan is 430.183 kwh¹, while Iceland – ranking on top - has a consumption of 31,147.292 kwh per capita. The aforementioned figure show how devastating the energy crisis is for the 124.5 million people of Pakistan.²

This crisis is starting to take a serious toll on Pakistan's economy, as well as on the daily lives of its inhabitants. With the government sectors failing to provide solutions to an ever-growing problem, long hours of power outages, local communities will have to take the initiative to find a way out. Luckily, with the advancement in technology, we now have choices available to us in the form of alternative power sources. A study of the constraints for the implementation of alternative energy projects at the local level is necessary before it can actually become a feasible solution.

According to media reports, Karachi has at times faced a shortfall of 600 Mega Watts against the demand of 1,787 mega watts. Karachi being the business and commercial hub of Pakistan experiences no respite from frequent power outages. Residential areas, commercial areas and offices suffer great losses due to this situation. Massive electricity load outages has crippled economic activities throughout the country. Also the power cuts have hit both the medium and small scale industry, leading to a decline in jobs. Due to the prolonged hours of power losses, the city has also witnessed riots, in protest at what is known locally as "load-shedding". These riots – usually consisting of burning tyres, throwing stones, and in extreme situations, even torching the Karachi Electricity Supply Company's (KESC) offices - continue for many hours until electricity has been restored.

1.2 The current condition of KESC

At the moment the KESC, has an available capacity of 1,400 MW, rentals inclusive. This energy is being produced by gas and Heavy Fuel Oil (HFO). Externally, KESC is purchasing electricity from many Independent Power Producers³ (IPP's), which includes WAPDA⁴,

¹ http://www.nationmaster.com/graph/ene_ele_con_percap-energy-electricity-consumption-per-capita

² http://findarticles.com/p/articles/mi_hb092/is_n10_v25/ai_n28649731/

³ Independent Power Producers or IPP are those "private companies that develop, own, or operate electric power plants" and in many cases they sell it back to the National Grid. (Source: *esm.versar.com*) At the moment, there are almost 24 commissioned IPP's in the country.

⁴ Water and Power Development Authority is a semi autonomous body created in 1958. Its objective is to give a direction to the development of schemes in water and power sectors. Its charter of duties also includes the generation, transmission and distribution of power.

GulAhmed and Tapal, amounting up to 45 per cent of the electricity, while 55 per cent is being produced by KESC itself.⁵

KESC itself is under a lot of criticism, as it is unable to satisfy its consumers coming under its 6,000 square kilometres (sq.km.) spread jurisdiction. The old systems and machines are unable to meet the demands of the city, where 40 per cent of the electricity produced is being lost due to large scale theft⁶ and obsolete distribution lines.⁷



Lined up generators outside the shops in Urdu Bazaar

1.3 Alternatives to KESC Supply Currently Adopted by the Shopkeepers

In the absence of UPS, KESC resorts to load shedding and households, shopkeepers have alternate power arrangements such as generators and UPS. The use of generators has widely increased in the recent past due to the increasing incidence of power cuts. Although generators are a good backup unit that supplies uninterrupted power, and is also beneficial in emergency situations, its disadvantages outweigh its advantages. It contributes in a big way to noise and air pollution and also requires maintenance and a considerable amount of space for storing it. Similarly, a UPS backup power does not last for long and requires maintenance as well. Besides, it cannot be charged during hours of constant, uninterrupted load shedding. Hence, it fails to supply power in periods of long load shedding.

1.4 Project Description

The understanding of the existing and potential relationship between various actors in the provision of alternative energy is necessary. Such a study, according to academics and alternative power suppliers, has not been undertaken for urban commercial markets in Karachi.

Therefore, keeping the present electricity situation in view and the economic consequences of power breakdowns, the authors of the study decided to take one of the commercial areas of Karachi and study the possibility of solar energy as an option to generate electricity. For the study the area of Urdu Bazaar was selected, reasons for which have been discussed in detail in the section ahead. Surveys revealed that currently most of the shops in the market remain deprived of electricity for about three hours daily during work hours. The choice of Urdu Bazaar was determined by the fact that it was not an affluent bazaar like many other retail and wholesale bazaars in Karachi, and thus provided the researchers with conditions that can be compared with the majority of other markets in the city.

1.5 Description of Urdu Bazaar

1.5.1 Location

Surrounded by Radio Pakistan on its north, Jamia Cloth (market) on its South west, Government College for Women on its South East, Urdu Bazaar



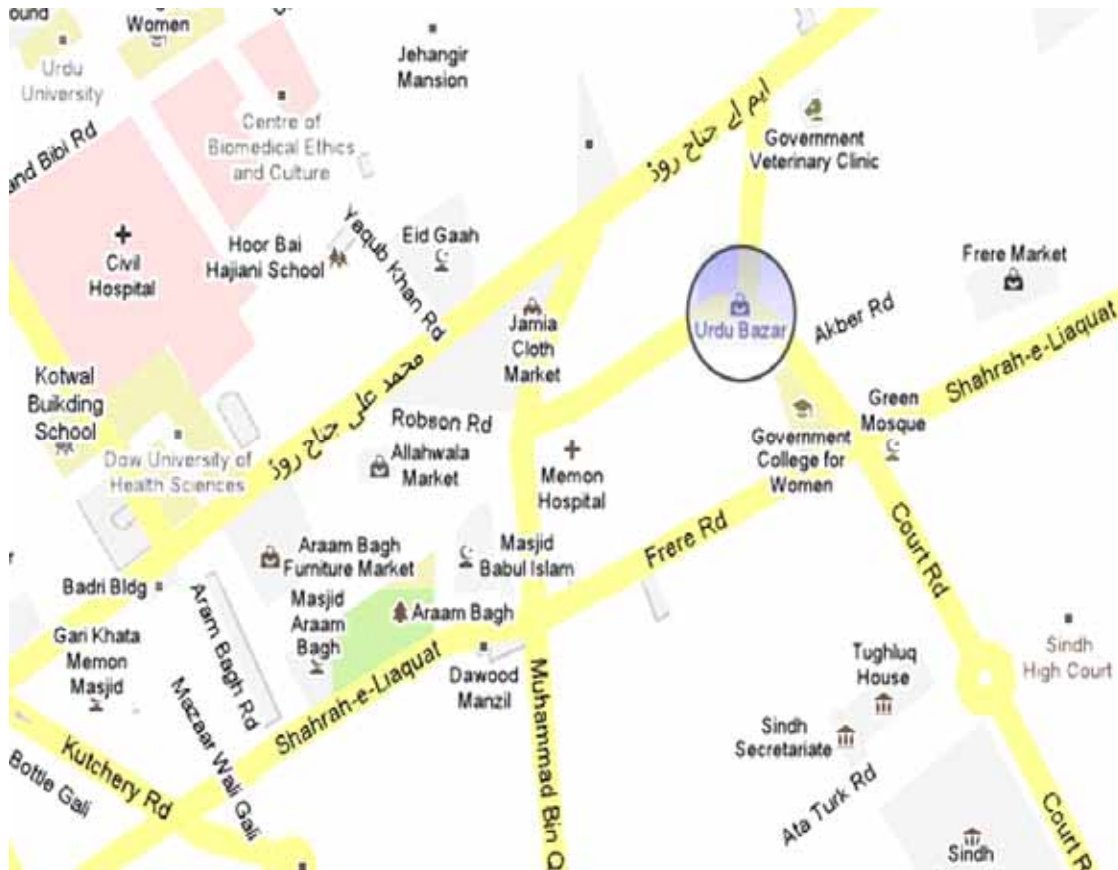
⁵ www.kesc.com.pk

⁶ <http://www.dawn.com/2005/09/26/eb2.htm>

⁷ (Hasan, 1999)

has a very central position in the city. Other important landmarks in the area include Green Mosque, Jamia Cloth market, Government veterinary clinic, Aram Bagh (garden), Sabiri Nihari House (a famous food outlet) all of which could benefit from alternative energy.

Heaps of Garbage can be seen on the roads



Location of Urdu Bazaar

1.5.2 Issues: Physical Conditions

Jumbled up over head wires are an eye sore and unlimited number of illegal connections (*kunda* system) gives some clues about the informal arrangements for electric power supply. It's a highly dense locality with heaps of foul smelling garbage. Rains bring havoc to the market as the only system of drainage is the natural gradient on the paved metallic roads. Lots of shop-keepers have their shops on the ground floor and *godowns* (storage) at the first or at higher floors. It was also figured out that no proper ventilations system exists in the shops and this in the absence of electricity fired fans, creates heavy suffocation during peak business hours.



Jumbled up overhead wires and Kunda's can be seen all the market

1.5.3 Issues: Traffic

Karachi sees traffic jams regularly either due to rains or inefficient traffic management or most importantly due to political events like rallies or protests. Urdu Bazaar being in the vicinity of both the main arteries of movement and the locations where protests take place, is badly affected. Without electricity and with generator noise and air pollution, these disruptions and to the stress of the Urdu Bazaar shopkeepers.



Traffic Jams and Congestion is a common Phenomenon

1.5.4 General Profile

Urdu Bazaar is mainly a bazaar of both old and new books with shopkeepers involved in both wholesale and retail businesses. However, a minor percentage own publishing, stationery or auto parts business. As mentioned earlier, the area comprises of both commercial and residential blocks and the area most suitable for installing solar panels is the roof. Despite this ideal location, there are issues regarding the fact that most shops are located on the ground floor, below the residences on the floors above, thereby hindering the electricity transmission through solar energy (if introduced in future) and also the possibility of electricity theft during transmission from the floors above to the ground floor.



A minor percentage owns publishing, stationery or auto parts business

2. METHODOLOGY ADOPTED FOR THE STUDY

The methodology of the study was based on identifying the shopkeepers of Urdu Bazaar, mostly book vendors and related businesses, through a contact person, popularly known as Salam Bhai (brother Salam); a book vendor in Urdu Bazaar. The research team wanted to know the following.

1. What alternative sources of energy do the Urdu Bazaar shopkeepers use during periods of load-shedding?
2. What are the advantages and disadvantages of these alternatives in monetary and environmental terms?
3. Are they willing to invest in a solar energy option?
4. What are the psychological and financial constraints that the shopkeepers may face in making such an investment?
5. What services can the solar energy suppliers/companies provide to the Urdu Bazaar shopkeepers and at what cost?

2.1 Research Tools

The method of information gathering comprised of

1. Observations
2. Separate interviews and/or questionnaire surveys with respondents (100 shopkeepers, solar energy companies, professionals/experts)
3. Secondary data browsing.
4. Personal contacts and readily available information on web was used to identify the solar energy companies and individual experts.

MS Excel was then deployed to compute percentages accurately from the surveys. The software was also used to perform various combinations by employing data filter techniques.

2.2 Reason for selection of Urdu Bazaar

Urdu Bazaar was selected for the following reasons:

1. It is an important commercial hub facing the south-west and as such receives the Karachi sea breeze. As such, many of the shops facing west or south do not require energy for fans.
2. It contains narrow shops in a high-density area, which highlights the practical issues of space availability for solar installations, if agreed upon as an alternative by the vendors
3. Personal contacts, which have made the research process easier in the locality.

2.3 Questionnaire Design

A questionnaire was designed and administered to 100 respondents (shopkeepers) to figure out the frequency and duration of power outages, its impact on business and the acceptance of solar energy as an alternative for shopkeepers. Before the questionnaire was designed, a discussion was held amongst the researchers to discuss the initial observations on the use of generators and UPS by the vendors of Urdu Bazaar.

After the first round of survey, the questionnaire was modified for seeking more precise information. The questionnaire is attached as annexure 1 and the findings from the questionnaire are presented in the following sections

2.4 The Survey

A three member team was established to conduct the interviews. A supervisor was selected among the team for team coordination and management. The team was briefed about the objectives of the research, the ethical issues in conducting such surveys, and the possible problems that could hamper the survey. The Urdu Bazaar survey was conducted from July 29, 2010 and it continued till August 11, 2010

2.5 Methodological Issues

Though the access to the shopkeepers was made through an old acquaintance of one of the researchers, their availability was dependent on whether the customers were present or not in the shop at that time. Increased rush in the shop, usually resulted in a quality compromised response.

It was also observed that shopkeepers were evasive of giving precise numeric information when it comes to expense on generators or electricity bills. The responses were usually full of ranges that researchers later averaged out for conclusiveness. Expenses are shown on the higher side, that reflects the typical paranoia of business communities towards strangers, as they may be undercover agents of tax authorities.

The research team was also under tremendous pressure to finish the survey-phase before the start of holy month of Ramzan. Experience being an authentic guide, it is difficult to break ice and ask questions with strangers, in Ramzan. Meanwhile, the high profile murder of one of the legislators of Muttahida Quami Movement, (one of the coalition parties of the current PPP-led regime) Raza Haider, on August 02, 2010, brought the city to a grinding halt. The ensuing violence, in the days to come, resulted in slower business activities and no-work days, making survey conditions difficult.

The survey questionnaire has its pros and cons. The questionnaire served as an excellent reminder for what needs to be asked in a systematic manner. It kept research team on the track and saved time as well. However, it proved to be too much of a mechanical tool with little ability to capture the nuances of the entire issue. As the survey progressed, lots of issues not covered by the questionnaire were observed. These are discussed in the next section.

3. FINDINGS FROM THE RESEARCH

After the data had been collected, it was analyzed in the frame work of understanding the capacity of the shopkeepers to establish trade-offs between electricity from the national grid and the solar power in the light of the difficulties they are facing with already established alternatives.

The findings of the research can be divided into:

1. On-site observations made during the entire research period.
2. Findings and conclusions from the talks/informal interviews conducted with shopkeepers of Urdu *Bazaar*,
3. Findings and conclusions from the questionnaire survey conducted with shopkeepers of Urdu *Bazaar*, and
4. Findings and conclusions from interviews and discussions with suppliers and experts of the solar energy discipline.

The findings are used to identify the gap between reality and the proposed solar energy ideal and to identify ways to bridge this gap.

3.1 On-site Observations

The peak business hours in Urdu Bazaar are from 10 am to 10 pm, and it is during these hours that the market faces a minimum of 3 hours load shedding, that can extend up to six to eight hours in case of a KESC related fault. This crisis then results in not only an unsuitable environment with regards to noise and air pollution because of the use of generators, but also results in a loss of clientele.

The following issues emerged as a result of the survey team observations:

1. To fill the gap of power outage, the shopkeepers resorted to two back up options a) generators b) UPS. Generators are deployed collectively by a group of shopkeepers or on individual basis.
2. Besides problems of noise pollution and health related issues, use of generators affects the quality of personal and telephone communication.
3. Use of UPS has generated a number of operational issues and charging of batteries is one of those. For example, the whole market is switched off at night time and because of that and of load-shedding, batteries are not charged properly.
4. Because of perpetual emission of acidic fumes from lead acid batteries used in the UPS, there are health problems. Also the batteries are expensive to maintain. Maximum life of a battery with such frequent charge-discharge cycles is one year and the cost ranges from Rs 10,000 (US\$ 116) to Rs 12,000 (US\$ 140) per battery.

5. The shopkeepers are irritated by the fact that they are billed on average tariff⁸ rule by the KESC, which from their accounts, is higher and does not match national level practices.
6. It was suggested by some of the respondents that awareness about alternative source of power should be developed through media.
7. From conversations with the shopkeepers it seems that they can go for an undefined “reasonable” initial investment for a solar set-up. They said that people invested in UPS but it proved to be of little help because of the above-mentioned issues. Then came investments in generators but their daily fuel expense and maintenance, is an unbearable burden for most of them. So, they first wish to test out a solar energy proto-type in one shop before making a full scale investment.

3.2 Findings and Conclusions from the Interviews Conducted with Shopkeepers of Urdu Bazaar

During interviews with the survey team the shopkeepers of Urdu Bazaar raised a number of questions and issues. Some of these are listed below:

1. It was asked as to what will happen to the already-in-use alternatives’ such as UPS’s and generators if they opt for a solar energy option?
2. Apprehensions of conflict were expressed if the solar panels are installed for collective usage, as some shopkeeper’s may consume more electricity than other partners.
3. Mistrust on the solar energy suppliers was expressed by asking what will happen if the company runs away.
4. Theft of solar panels and accompanied wires is also feared. Some shops have floors above them and the solar panels will be placed on their roofs. There is no security of solar panels on these roof tops.
5. It was asked if the solar option will work for heavy loads such as photocopy machines, computers and printers and at what cost.
6. There was also a fear that power generating ability of solar cells will be compromised in cloudy weather and after dusk.
7. It was emphasized that the KESC management needs to be taken into confidence for it might disconnect connections of those who opt for solar power. Also, could the KESC carry out its load-shedding during sunlight hours only, thus no storage would be required with the solar option?
8. After-sales features like maintenance and warranty of solar systems were also discussed.
9. Discussions were also held on the mode of payment for solar system. The possibility of availability of the system on instalments, loan or on monthly-payment basis was suggested.

⁸ At times Karachi Electric Supply Corporation resorts to average billing rather monthly billing. In average billing it takes the average usage of last couple of months of the customer, instead of actual consumption of the preceding month.

10. The resale value of the solar panels was raised as a point of discussion.
11. It was asked as to what are the advantages for those people who will buy this expensive system and after few years its market value will go down.
12. What happens if the government puts a tax on renewable energy?
13. Choice in selecting any mode of power or in combination was also desired by the respondents. They should have the flexibility to use either KESC or solar system or both together.
14. The electricity supply to the main market is from more than one distribution zone, as configured by KESC, for its power distribution system. As power outages from those two zones differ in timings, some of the shopkeepers have developed an indigenous mechanism to swap their incoming supply lines from one source to another, thus maintaining a continuous availability of power for their business.
15. Those vendors who have their shops outside the main buildings have enough sunlight and they do not need energy savers. On the other hand, some shops which are located towards the main road, get plenty of light and air, and as such do not even need a fan during the day. Their only requirement is 2 energy savers at night time. This group is not interested as in solar power options as those who have shops deep inside the market.
16. Collective use of power generated by petrol fired generators, though not very common, was also observed. Four to five shopkeepers contribute Rs 25 per day each and get power for two savers and one fan from generators.

3.3 Interview of Urdu *Bazaar* Booksellers' Union Leader

On July 29, the research team met with Mr. Naseem Ahmed popularly known as Naseem *Bhai*, and had a thorough and wide ranging discussion on the power outages, impact on business and the existing coping mechanisms.

Explaining the power related difficulties, Naseem Bhai said that in the absence of electric power the market gets suffocated and in such cases people usually avoid the shops that are situated further inside. He mentioned that some of the shopkeepers have started keeping glucose with them, as last summer a few customers fainted due to suffocation. He mentioned that the average duration of power outage from the national grid is three to four hours daily and in worst cases the shops remain without power for 9 to 11 hours a day. This happens about twice a year. He said that the average electricity bill of the shops is Rs 1,800 (US\$ 21) per month⁹.

According to him, the use of generators is a cause for asthma, allergies, sinus, headaches and short tempers of the shopkeepers. In the same breadth he mentioned that most of the people do not have generators and this is because of the space limitations in their shops and issues of affordability. The absence or presence of generators affected business as some customers do not want to enter into a noisy dialogue (they have to compete with the sound of the generator), while others need artificial light to be able to see.

⁹ It is difficult to ascertain the exact amount, as contradictory figures are given. Couple of shopkeepers said that they get quarterly bill of Rs 3000, each. Similarly, the survey shows a broad range of expenditure on power utility bills.

In his opinion, the permutations of bare minimum requirements varies from shop to shop. However, the normal requirement is for a) four energy savers and two fans (it is assumed by the researchers that since most of the shops are not very spacious therefore ceiling fans may not be of more than 48 inches; b) two energy savers, one fan; and c) two savers and two fans.

During the course of discussion three important points were also raised by Naseem Bhai. One, when the option of solar power is put to shopkeepers they will establish a trade off between KESC supply and the various proposed combinations of solar power. Weight-age will be given to the maintenance free aspect of solar power set up, the running cost of it and other maintenance cost related factors. Two, that there should be a formal agreement with KESC, as switching to solar power for six to eight hours a day by 400 shopkeepers will result in a substantial drop of revenues to the company. The company might retaliate against this. Three, since the electric jumpers of the commercial area is shared with nearby residential areas so the possibility of having load-shedding through an arrangement with the KESC, only during sunlight hours is not really an option. However, if that could be arranged, it would really boost the solar option as no storage batteries (and their maintenance) would be required with the solar panels. It would also reduce costs substantially.

3.4 Findings and Conclusions from the Questionnaire Survey Conducted with Shopkeepers of Urdu Bazaar

This section represents findings of 100 questionnaires, in percentages and/or in numbers. These are presented in the order of the questions in the questionnaire:

1. 100 per cent of the all of the respondents are male.
2. Age of respondents was categorised into three age brackets; 15 to 24 years, 25 to 50 years and 50 years and above. Fourteen per cent of the respondents fall between 15-24 years of age, 64 per cent between 25 to 50 years and 21 per cent are above 50 years of age.
3. Eighty per cent are either in wholesale or retail business. Out of these 80 per cent, 38 per cent are wholesalers, 21 per cent are retailers and 21 per cent are the combination of the two. The remaining 20 per cent are publishers, stationers and automobile parts dealers.
4. Sixty-seven per cent have established business in the last 25 years. The antiquity of the market is established by the fact that that some of the people are in business since independence.
5. Usual business hours are between 10 am till 9 pm. Seasonal variations aside, 26 per cent of the shops operate for 9 hours a day, 25 per cent for 10 hours per day, and 18 per cent for 11 hours a day. Conclusively, 85 per cent of the shops operate between 9 to 11 hours daily.
6. Out of the total respondents, 51 per cent of the shopkeepers remain without KESC provided power for a minimum of three hours in a day.
7. Sixty-five per cent of the total shops, surveyed, do not have generators.
8. The 65 per cent who do not have generators gave multiple responses (reasons) for it. Eighty-five per cent of them said that they cannot afford the monthly expenditure of a generator; 16 per cent think it creates noise pollution; and 14 per cent do not have

enough space for storing them. Hence, the reason why most of the respondents do not have a generator is mainly because of the affordability factor. The rest believe that it requires maintenance and is not environmental friendly. Some of the shops receive constant natural daylight throughout the day. Therefore during daylight hours of load shedding, they do not feel the need for having a generator.

9. Twenty-eight out of 35 people who do have generators in the market purchased them in the last five years (from 2006 to 2010).
10. There is much variation in the per month expense for the maintenance of a generator. The maintenance cost ranges from Rs 2,000 (US\$ 23) to Rs 80,000 (US\$ 930) per month.
11. The average number of fans calculated per shop were 2.5 (mode = 2), average number of energy savers per shop 7.31 (mode = 6). These are bare minimum requirements and that too are bookshop specific only, as photocopier operators have huge power requirements. Also, the extracted data reveals that there are an average of 6.5 tube lights of 40 watts per shop.
12. Ninety per cent of the respondents would prefer solar energy as a means of acquiring electricity instead of KESC. 20 out of 25 who work for 10 hours daily said YES when asked about their preference for solar option. Similar results were observed for those who operate for 11 hours a day. 16 of 18 of these agreed to switch to the solar option. All those who work daily for 10.5 to 12 hours also gave similar answers.
13. Of the 35 respondents (who have generators), 32 said Yes when asked for their preference for the solar option. Similarly, 58 of 65 without generators also gave the same answer.
14. All those who said yes, to solar power as an alternate source, said that their per month electricity bill ranges between Rs 275 (US\$ 3) to Rs 13,500 (US\$ 157).
15. Of the respondents 90 per cent are interested in the solar option. Fifty-three per cent are willing to have solar as an option for obtaining electricity only if it's economical as compared to their present arrangements.

3.5 Findings from solar companies and experts

Six companies that are involved in either manufacturing or indenting of solar equipment, and two expert individuals were interviewed. The meetings were held between August 16, 2010 and September 07, 2010. Average duration of a meeting/interviews is 45 minutes approximately. The name and brief profile of the companies are given below:

1. National Engineering Corporation (NEC) is currently working in almost all development sectors in Pakistan related to irrigation, energy, ground water resources, agriculture, public health, industry, urban development, rural development, education, environmental management, highways and transportation as well as renewable energy. Founded in 1976, NEC is currently working in all the four provinces of Pakistan.
2. Hi-Tech Alternate Energy Systems (Pvt.) Ltd., besides winning the "Achievement of Award" by Alternate Energy Development Board (AEDB), government of Pakistan, is also an ISO 9001 (QMS) and ISO 14001 (EMS) certified company, working in the alternate energy sector, providing solar, wind and hybrid power solutions.

3. Fusion Group is a proprietorship based company, headquartered in Karachi. It carries out research and development to popularise product diversity, promote competitiveness and open up new markets in the cutting edge and cost-effective technologies in various fields. It is engaged in the development of alternate energy systems like solar photovoltaic and solar thermoelectric systems.
4. Solar Line Adaptive Technologies (Pvt) Ltd. provides a complete one window solution, which includes the design, maintenance and installation of the solar panels.
5. The Terminators (Pvt) Ltd. was established in 2003, and has been working in many fields including electrical, mechanical and civil engineering. Mr. Ahmed Zubair, its proprietor, has been affiliated with solar technology for the last ten years.
6. Systek Pakistan is a commercial organization dealing with government and public sectors in Pakistan in the field of renewable energy, solar, wind, thermal and hydel power and in the industrial and medical and dental fields.
7. Wellbeinggreen Company¹⁰ was established in 2007 with a vision to be the leading provider of energy efficiency and Renewable Energy Certificates in Australia. Wellbeinggreen is well advanced with development of three Programs of Activities under the CDM (Clean Development Mechanism) framework. Two of these Programs are for the supply and distribution of solar powered lanterns to households in non-electrified rural villages in Pakistan and Bangladesh. The third Program is in Pakistan for the supply and distribution of Compact Fluorescent Lamps replacing inefficient incandescent lamps.
8. Roland D'Souza is a prominent electrical engineering consultant and human rights activist in Karachi. He also volunteers his time for Shehri (Citizen), a Karachi-based non-government organization dealing with civic issues.
9. Zafar Abbasi is a well-established electrical and plumbing consultant.

The cumulative six and a half hour discussions brought forward a number of technical and financial issues. The list includes economies of scale and break-even in the long-term. Then there is a debate about providing solar panels with or without storage capacities. Further, the issue of Direct Current (DC) versus Alternating Current (AC) at the user end was also raised. The debate is summarized below:

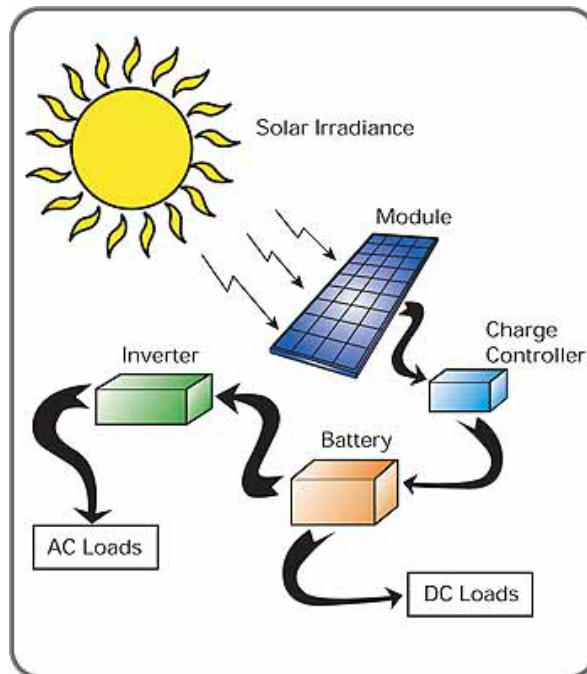
3.5.1 Technical Issues

1. The solar power paraphernalia includes solar panels, electric wires for transmission, invertors (optional), storage batteries (optional) and appliances (either DC or AC). Apart from solar panels (which include solar cells), tampered glass sheets are also used to cover Photo Voltaic (PV) cells. It is the radiation – and not heat - from the sun that is converted into electrical energy through the use of quartz¹¹ and silicon.

¹⁰ <http://www.wellbeinggreen.com.au/index.asp>

¹¹ *Fused quartz is a material of primary importance as it enhances the efficiency of solar powered devices, while also lowering the cost of solar devices. Quartz glass is used in many facets of photovoltaic (PV) cell manufacturing, in light sources, reaction chambers, and tools used in the production of solar cells, thin films, and silicon wafers. The material's stability, chemical purity, transmissivity to light, and heat resistance has made quartz vital to the production of semiconductors. The material is almost inert, durable, and withstands the high temperatures associated with semiconductor fabrication and testing.* Adopted from solarpowerengineering.com

2. The most expensive equipment in the entire solar assembly is the panels, and then come batteries and then the inverters.
3. It is recommended that the power transmission should be of alternating current instead of direct current¹². That means placement of inverters near the solar panels.



The System

4. The advantages of solar energy include tariff free usage, no Nitrogen Oxides and Carbon-di-oxides pollutants, (popularly called noxes and soxes) as emitted from burning coal and diesel, almost zero maintenance cost and zero waste generation
5. The total wattage for three fans, two 20 watt savers and one telephone charger comes to a total of 350 watts approximately¹³. There was a word of caution, from suppliers/experts about quality of invertors for fans, for if AC ripples are not levelled off properly, they will damage the capacitor in fans.
6. The issue of efficiency was also discussed. It was said that if the total requirement is 350 watts (as an example) we have to use 420 watt panels. This is because of two factors: a) The optimum sun radiations are available for only 6/7 hrs a day while according to our survey the business timings are for 9/10 hrs a day b) Due to overcast conditions¹⁴, efficiency of solar panels also gets reduced.
7. It was also mentioned that the surface area of the panels with reference to angle of the sun needs to be calculated, for maximum efficiency. Use of moveable (motorized) solar panel brackets were recommended for proper and continuous

¹² The alternating current due to its sinusoidal nature repels after giving a shock, so it is less harmful even at 220 volts. Direct Current lacks that capacity and is supposed to be dangerous after 24 volts.

¹³ The aging of fans and the initial torque may bring the starting current up to 100 watts per fan.

¹⁴ Overcast conditions refers to cloudy weather, sunlight angle, shadow of nearby taller buildings, if any, and density of dust particles on glass panels of solar cells.

voltage supply. The arrangement will give proper voltage but will require extra space and will result in increased cost of the package. The solar panels connected to tracking devices generate up to 40 per cent more energy than fixed systems¹⁵.

8. Solar panels are recommended in low density areas and where there is no national grid available. Urdu Bazaar is a high density area.
9. Issue of battery life was also highlighted as the frequent charge-discharge cycles reduce the life of battery. The storage and pollution issue of lead acid batteries also came into discussion and experts recommended nickel-cadmium (popularly called nickel-cad) batteries which through expensive, have a longer life and do not produce pollution. It was also mentioned that without battery the venture is not feasible because of clouds in monsoons and winters, resulting in low-voltage supply.
10. Batteries give maximum efficiency at 25 degree Celsius. Placement of batteries on roof is not recommended as roofs usually have high temperatures¹⁶.
11. It was also observed that the companies are not willing to install a demonstration model for a month or for a greater number of days. Usually they agree for a three to five day demonstration. Nevertheless, they do agree on the advantage of installing demonstration units for their prospective clients' satisfaction.
12. The life of a solar panel is approximately 20 years¹⁷!
13. The issue of production was also discussed, as importing solar panels is perceived to be expensive. The basic raw material (quartz) is available in abundance in the northern areas of Pakistan. However, this raw material is useless for us because its purification and development to a stage where it can be converted into solar cells is not being done in Pakistan. Equipment to do this will have to be imported; but it would be a one-time investment. The other raw material required to manufacture solar cells is silica (sand) which is in inexhaustible quantity in the River Sindh¹⁸. Regarding tempered glass, there are many glass manufacturing factories in Pakistan. There is a need to augment their existing facilities to produce tempered glass of required specifications. For this required machinery could be imported and installed in our existing glass manufacturing factories.
14. A tabular comparison of with/without invertors and with/without batteries is given in Table – 1 below:

¹⁵ <http://pakistaniat.com/2009/02/17/utilizing-solar-energy-in-pakistan/>

¹⁶ Interview with Roland D'Souza

¹⁷ <http://www.mesmarty.com/2009/07/21/solar-energy-timely-solution-of-loadshedding/>

¹⁸ It's mixed with clay and available only when the water level is low.

Table 1: A Brief Comparison of Solar Supply With/Without Auxiliaries

	Storage/Battery		Inverter	
	With	Without	With	Without
Advantages	Power back up available in cloudy, rainy seasons and after sunset Total independence from KESC	No per year expense of battery No fire hazard No space issues No movable parts	Provides Alternating current Can use the existing fans, bulbs and telephone charger point	Obligated to use Direct Current A much cheaper option
Disadvantages	Hazard of acid fumes (in case of lead batteries) Increased maintenance Long payback period as it will increase the capital cost	No backups in decreased efficiency periods Fluctuations in supply according to the availability of sun rays	Additional space required near solar panels As solar panels are installed in open spaces, therefore security measures need to be taken for the safety of invertors Maintenance required	DC transmission above 24 Volts is a serious electric shock hazard DC current related fans and savers will have to be purchased

3.5.2 Financial Issues

1. There is a consensus amongst all the interviewees that solar power has every potential to be an important source of energy in the future. In the long run it is cost effective but in short term it is expensive.
2. The discussions also identified various packages for the Urdu Bazaar shopkeepers. These are given below:
 - i) Package 1 for those who consume less energy (one fan and two energy savers).
 - ii) Package 2 for those who consume medium energy (two fans and two energy savers).
 - iii) Package 3 for those who consume high energy (two fan, four energy savers, computer and photocopy machine).
 - iv) Package 4 is for two bulbs and one telephone charger point.

Installation cost of Solar System for Package 1 is Rs 98,000 (US\$ 1,140) for 5'x6' panel including invertors for AC Current. This will result in an average saving of Rs 1,800 (US\$ 21)

per month of KESC Bill. Ni-cad batteries costing Rs 36,000 (US\$ 419) will be required every 6 years for the solar systems. This means an expenditure of Rs 500 (US\$ 6) per month. The net saving as a result is Rs 1,800 (US\$ 21) (KESC billing), minus Rs 500 (solar battery expenses) is equal to Rs 1,300 (US\$ 15) per month. Thus the investment in the solar system will be recovered in 6 years. Life of the solar system is 20 years at the minimum and so for the next 14 years, the expense will only be that of the batteries.

- Running cost of various options available (taken from questionnaire result and feedback from Solar Companies) are given in Table – 3 below.

Table 3: Cost Analysis in Pak Rupees of Different Energy Sources and Possibilities

	KESC	UPS (Average)	Generator (Average)	Solar (with Storage- Average for Package 1 in Table 2)	Solar (without Storage- Average for Package 1 in Table 2)
Running Cost	1,800 (Billing)	1,000 (battery cost)	5,882 (energy source)	500 (battery replacement/5 years)	No Cost
Capital Cost	-	20,000	20,000	98,000	61,500
Replacement in years	-	5	5-10	20	20
Capital Cost/year	-	4,000	2,666	4,900	3,075
Advantages	No replacement Cost	Automatic backup system	Constant supply.	No noise and air pollution Constant supply	No running cost
Disadvantages	KESC Maintenance Load shedding Perpetually increasing power tariff	Short lived battery. Pollution Unsafe for appliances Short lived battery.	High running cost. Noise and Air Pollution. Storage space issues	High Initial Cost Storage Required. Theft. Battery Replacement every 5 years	No energy during non-sunlight hours.

- If storage is not used, then the cost of the solar option is Rs 61,500 (US\$ 715) for Package 1. In this case there are no running costs involved.
- There is a 50 per cent duty on ni-cad batteries. If this duty is waived the Rs 98,000 (US\$ 1,140) solar option cost will be reduced to Rs 80,000 (US\$ 930) per unit. There is also a 30 per cent duty on solar panels. If that is waived as well the cost will be further reduced by another Rs 15,000 (US\$ 175). This will bring down the cost with storage to Rs 65,000 (US\$ 755).

Table 4: Cost in Pak Rupees of Four Packages for Urdu Bazaar

Option	Package One	Package Two	Package Three	Package Four
Appliances	One fan, two savers, one telephone point	Two fans, two savers, one telephone point	Two fans, four savers, one telephone point	No fan, two savers, one telephone point
Total load Required from Panels	150 watts	210 watts	250 watts	50 watts
Space required	Not known	7-1/2 feet x 9 feet	10 feet x 12 feet	2-1/2 feet x 3 feet
Panel cost	50,000	70,140	83,500	16,700
Charge controller	3,500	4,000	4,000	4,000
Mechanical structure	Not known	10,000	10,000	5,000
Total cost without storage and inventors (Direct Current)	53,500	84,140	97,500	25,700
Inventors for alternate current	8,000	15,000	15,000	15,000
Total cost without storage and inventors (Alternate Current)	61,500	99,140	112,500	40,700
Storage with lead acid batteries	36,500 (dry cell batteries)	36,500	36,500	20,000
Total cost with storage and inventors (Alternate Current)	98,000	135,640	149,000	60,700

6. The per year and per 5 year expenditure of various sources of power as employed by shopkeepers are as follows:

Table 5: Comparison in Pak Rupees of Cost of Various Modes of Power as Used in Urdu Bazaar

Cost Typology	Generator ¹⁹		UPS		KESC		Solar Energy	
	Per Year	Per 5 Year	Per Year	Per 5 Year	Per Year	Per 5 Year	Per Year	Per 5 Year
Capital Cost	7,500	37,500 (average price)	4,000	20,000 (average price)	4,000	20,000 (meter cost)	19,600	98,000
Running Cost	70,560 ²⁰	352,800	12,240 ²¹	61,200	21,600 ²²	172,800	6,000	30,000
Total Expenses	80,560	362,800	27,240	76,200	21,600	172,800	25,600	128,000

7. One of the suppliers, The Terminators Company, claimed that by locally developing the solar panels they can bring down the cost of 120 watts solar panel from Rs 50,000 (US\$ 581) to Rs 17,000 (US\$ 197) without the inverter, battery, charge controller and wiring. To get the economies of scale the minimum requirement for this would be of 250 units²³.
8. As mentioned above there is a debate of providing DC versus AC current at the user end and AC is opted for. There will be a need to have additional expenses for converters.
9. The duration of warranty also varies from 15 years to 40 years, with repercussions on the final cost. The efficiency of solar panels was also an area of major consideration for experts, as it varies in changing weather conditions and with seasons.
10. There was also a debate of the collective versus individual usage issue. Individual usage means panels for 400 users (the number of shops in Urdu Bazaar). For economy collective use is recommended but then there should be code of conduct for equity in usage between the shopkeepers

Table 6: Recovery Period for Capital Investment for Package 1 of Solar Option

	(Pak Rupees)
Average Cost of KESC billing	1,800
Average Cost of Solar maintenance with Storage	500
Savings per month	1,300
Capital Cost	98,000
Period for recovery of Capital investment versus KESC billing	6 years

¹⁹ Health costs caused by generator noise and cannot be calculated accurately.

²⁰ Per month expense, as noted from various conversation of Urdu Bazaar shopkeepers is Rs 5,880.

²¹ Lead acid battery needs to be replaced after one year. It costs Rs 12,000 and Rs 240 per month is for battery water

²² As per Naseem Bhai's interview (mentioned in previous section) Rs. 1800/ month is the KESC electricity expense.

²³ Interview with Mr. Zubair of The Terminators Private Limited

4. CHOICE OF SOLAR COMPANY FOR FURTHER NEGOTIATIONS

After meeting the various energy suppliers listed in the Study, the authors decided to negotiate further with Wellbeinggreen Company. This is because they were the most cooperative and willing to take the project further. In addition, they offered the most cost-effective. As such, they were introduced to the Urdu Bazaar Shopkeepers' Union. They held discussions with the union leaders independently of the authors and visited the site to assess its suitability. Then, they were invited to a joint meeting between the shopkeepers and the authors.

5. ISSUES IDENTIFIED AT THE JOINT MEETING

The joint meeting between the shopkeepers, authors and the representatives of the Wellbeinggreen Company was held at the Urdu Bazaar Shopkeepers' Union office on 21 January 2011. In addition to the Union leaders, a number of shopkeepers also attended. The findings of this study were presented at the meeting by a PowerPoint presentation (see **Appendix 4: PowerPoint Presentation of the Study**). Copies of the study were also circulated. The representatives of Wellbeinggreen also made a presentation. The following issues emerged out of the discussion.

The shopkeepers were in favour of the adopting the solar option. They found it affordable. As a matter of fact, some of them were interested in a more substantial package than what has been offered in the study. However, they had a number of concerns and questions. These are given below:

1. The shopkeepers are afraid that the government might impose a tax on solar power and as such their investment will be compromised.
2. The KESC will lose revenue as a result of their adopting solar energy and as retaliation might disconnect the shops from the grid.
3. The KESC is revenue hungry and resorts to bullying and all sorts of pressure to recover bills. It is possible that it will refuse to believe that solar energy is being used for the energy savers and fans, and will pressurise shopkeepers to pay.
4. The solar panels will be placed on roofs that are accessible. There is no guarantee for their security. They will certainly get stolen, if not by proper thieves then by drug addicts to purchase heroine.
5. They are afraid that the Company might close down and as a result the warranty that they are offering would not be worth much.
6. There was much discussion on the advantages and disadvantages of having individual or collective solar panels.
7. The representatives of Wellbeinggreen also expressed the constraints they face in promoting their products. One, there is a 50 per cent duty on cadmium batteries and a 30 per cent tax on solar panels. If this is removed, a 30 per cent reduction in cost of the final product can be achieved. And two, given the advanced state of glass manufacturing in Pakistan, tempered glass sheets which cover Photo Voltaic cells can be manufactured in the country. This will further reduce costs. The government needs to offer incentives for producing them.

8. The representatives of Wellbeinggreen also displayed individual solar lanterns and fans that operate on a DC current. The solar lanterns cost about Rs 5,000 (US\$ 58) with a solar panel and the solar fan costs Rs 16,000 (US\$ 186). As such, one fan and two savers would cost Rs 26,000 (US\$ 303) as opposed to Rs 98,000 (US\$ 1,140) for the AC system that Wellbeinggreen has proposed.

6. DECISIONS TAKEN

As a result of the discussions, the following decisions were taken.

1. Arif Hasan would write a letter to the Secretary of the Power Department, Government of Sindh explaining the governance related concerns of the shopkeepers. In the letter he will introduce the shopkeeper's union leader who can then follow up things with the Secretary. A copy of the study will also be sent to the Secretary. Arif Hasan has already spoken to her on the subject. The letter has been sent and a copy is attached as **Appendix – 5: Letter to Secretary, Power Department, Government of Sindh**.
2. The shopkeeper's union will share the presentation of the authors with other members and decide on a future course of action. They will keep in touch with Wellbeinggreen and if necessary, with the authors.
3. The concerns of Wellbeinggreen are also being conveyed to the Secretary Power Department and their representative is being introduced to her. (See Appendix 4).
4. The Wellbeinggreen Company should be introduced to the Orangi Pilot Project's Orangi Charitable Trust (OPP-OCT) which has a major presence in the rural areas of Pakistan. It is felt that the OPP-OCT can introduce solar lanterns and fans to its partner organisations in the rural areas and small towns. A very successful meeting was held on January 25, 2011 at the OPP office and plans for a future collaboration have been initiated.

APPENDICES

Survey Questionnaire

**Questionnaire for Research on
Use of Solar Power as Alternate Source of Energy**

Total Questionnaires: 100

Number of this questionnaire:

Place where the interview is conducted:

Date:

1. Name of the respondent and the shop:

2. Male/Female/Transgender:

3. Age of the respondent:

4. Type of Business?

5. For how many years are you doing business here?

6. What are your usual business hours (from am. to pm.)?

7. On an average how many hours you are without national power supply?

8. Do you have generator?

Yes

No

9. If Not why not? (Please provide reasons)

A. _____

B. _____

C. _____

11. If Yes, when you purchased the generator? (Year)

10. If Yes, then in how much you paid for it? (At the time of purchase)

11. What is your per month expense on the running of the generator?

12. What disadvantages of the generator do you see for your business?

A. _____

B. _____

C. _____

13. What disadvantages of the generator do you see for yourself?

A. _____

B. _____

C. _____

14. What are your bare minimum requirements for the shop? (In-terms of bulbs and fans)

15. If you would get the option of getting the same, from solar energy, would you prefer solar option?

Yes

No

16. If yes why and if not why not (Please narrate the reasons):

A. _____

B. _____

C. _____

17. How much money would you like to spend on the solar option (in Rs)?

18. What do you think, that how many businesspersons in this area will agree to the proposal?

Cost Comparison Chart from Different Companies (Estimates for 100 shops)

No.	Company Name & Description	Requirement	Watt	Cost in Pak Rupees	A.C or D.C
1.	<p><u>National Engineering Corporation</u></p> <p><u>For D.C</u></p> <p><u>1 Day option</u> Quotation for 6 hours operation solar power system with 180w/100A.H-12V</p> <p><u>2 Days option</u> Quotation for 6 hours operation solar power system and 6 hours back up for next day 180w/180A.H-12V</p> <p><u>4 Days option</u> Quotation for 6 hours operation solar power system and 18 hours back up for next day 180w/360A.H-12V</p> <p><u>For A.C</u></p> <p><u>1 Day option</u> Quotation for 6 hours operation solar power system with 180w/100A.H-12V</p> <p><u>2 Days option</u> Quotation for 6 hours operation solar power system and 6 hours back up for next day 180w/180A.H-12V</p> <p><u>4 Days option</u> Quotation for 6 hours operation solar power system and 18 hours back up for next day 180w/360A.H-12V</p> <p><u>One year warranty</u></p>	<p>1 fan, 2energy savers, 1 phone charger (124w)</p> <p>1 fan, 2energy savers, 1 phone charger (124w)</p> <p>1 fan, 2energy savers, 1 phone charger (124w)</p> <p>Same as above</p> <p>Same as above</p> <p>Same as above</p>	<p>180</p> <p>180</p> <p>180</p> <p>180</p> <p>180</p> <p>180</p>	<p>53,250</p> <p>60,250</p> <p>80,250</p> <p>54,850</p> <p>61,850</p> <p>81,850</p>	<p>D.C</p> <p>D.C</p> <p>D.C</p> <p>A.C</p> <p>A.C</p> <p>A.C</p>
2.	<p><u>Hi- Tech Alternative Energy System</u></p> <p>Solar power supply system with 6 hours back operating solution @ 80,000 per shop for 100 shops comprising.</p> <ul style="list-style-type: none"> Operating Solar Panels, Volt & Current Indication Meter 	<p>1 fan, 2energy savers, 1 phone charger (200 w)</p>	<p>200</p>	<p>80,000</p>	<p>A.C</p>

	<ul style="list-style-type: none"> Batteries Bank Deep-Cycle Maintenance free Battery- Charge Control Circuit Solar Energy Inverter 220 Volt AC Battery Rack with Inverter Housing. Maximum Length of Wiring from point of COMMUNITY-BASED SOLAR POWER SUPPLY SYSTEM to EACH SHOP should NOT exceed 30 Feet; Any ADDITIONAL length of Wiring will be charged at actual. Wiring and installation within premises of 100 feet. <p>Warranty: Battery 5 years, electronic system 2 years, solar panels 25 years</p>				
3.	<p><u>Fusions Group</u></p> <p><u>For Day Time System</u> A.C solution 8 hours working 60x3=180 watt panel cost including inverter and wiring</p> <p><u>For Day & Night Time System</u> A.C solution 18 hours working 60x6=360 watt panel cost including inverter, battery and wiring</p> <p><u>For Day & Night Time System</u> D.C solution 18 hours working 60x4=240 watt panel cost including battery and wiring</p>	<p>1 fan, 2energy savers, (148w)</p> <p>1 fan, 2energy savers</p> <p>1 fan, 2energy savers</p>	<p>180</p> <p>360</p> <p>240</p>	<p>60,900</p> <p>1,12,300</p> <p>76,500</p>	<p>A.C</p> <p>A.C</p> <p>D.C</p>
4.	<p><u>Solar Line Adaptive Technologies (PVT) LTD.</u></p> <p><u>A.C Solar Power System</u> ALT-150-A.C 4 to 5 hours working</p> <p><u>D.C Solar Power System</u> ALT-65D.C 6 Hours saver working and 4 hrs fan working.</p>	<p>1 Energy saving lamp(12w each), 1 ceiling fan(60w) & 1 T.V(40w) 14 inch</p> <p>2 Energy saving lamp(12w each), 1 ceiling fan(30w)</p>	<p>150</p> <p>65</p>	<p>97,500</p> <p>40,000</p>	<p>A.C</p> <p>D.C</p>
5.	<p><u>TRDP TIED</u></p> <ul style="list-style-type: none"> They are importing from china If they want electricity only at day time they use only charge controller If they want back up at night time they attached battery with it. It will give 6 to 8 hours back up to them. <p>2.5 years warranty of charge controller, battery and for solar panels 20 years warranty.</p>	<p>2 Energy saver 1 Fan</p>		<p>8000 12,000</p>	<p>A.C</p>

6.	<p><u>The Terminators</u></p> <ul style="list-style-type: none"> • Cost of inventor, battery, charge controller and wiring is not included • Panels will be locally developed • 250 units order required to make this cost possible 	<p>2 Energy savers 1 Telephone outlet 1 Fan</p>	120	17,000	
7.	<p><u>Wellbeingreen</u></p> <ul style="list-style-type: none"> • Cost of installation is not included • Backup time is 10 hours/day • 50 units order required to make this cost possible • Warranty varies for various equipment of the package 	<p>2 Energy savers 1 Telephone outlet 1 Fan</p>	150	98,000	A.C

No Let Up in Karachi Load-shedding

With the mercury touching 37c on Wednesday, citizens of Karachi suffered through yet another day of multiple power outages, which collectively lasted for six hours as the Karachi electric power supply company faced a shortfall of about 600MW in meeting the demand for 2,300MW. (*The Dawn, May 14, 2010*)



As mercury shot up to 40C with 46% humidity on Friday, the KESC unofficially increased power load shedding beyond 10 hours in 24 hours despite receiving an additional oil supply. (*The Dawn, May 15, 2010*)



PowerPoint Presentation of the Study

(See attached file)

25 January 2011

Ms. Rabia Javery Aga
Secretary
Power Department
Government of Sindh
Barrack No. 91, Sindh Secretariat
Karachi

Subject: **Solar Energy Options for Urdu Bazaar Karachi**

Dear Madam

Further to my discussion with you on the subject, I am attaching a study on the acceptability of alternative energy sources for Urdu Bazaar Karachi. The executive summary of the report identifies the concerns and problems of both the Urdu Bazaar shopkeepers and of the solar company (Wellbeinggreen Company) regarding adopting the solar energy option.

The shopkeepers concerns are:

1. The KESC might disconnect them from the grid if they opt for the solar option.
2. The KESC might bully them by disagreeing that part of their appliances are operating on solar energy.
3. Their solar panels would be unsafe on easily accessible roof tops.

They would like to have assurances from the relevant government departments that they will not be subjected to retaliation by the KESC and also that the government would help in protecting their solar installations. In this connection, the Urdu Bazaar Shopkeeper's Union leader Nasim Ahmad Sahib will be getting in touch with you. I hope you will be able to meet with him and offer the safeguards his organisation is seeking.

The Wellbeinggreen Company's concerns are:

1. There is a 30 per cent duty on solar panels and a 50 per cent duty on cadmium batteries. If this is waived then the cost of solar energy products can be reduced by 30 per cent. This will make the products far more affordable to the public.
2. Given the advanced state of glass manufacturing in Pakistan, tempered glass sheets which cover Photo Voltaic cells can be manufactured in the country. This will further reduce costs. The government needs to offer incentives for producing them.

In this connection, representatives of the Company will be getting in touch with you.

With kind regards,

Yours sincerely

Arif Hasan

Copy to:

1. Mr. Nasim Ahmad, President Urdu Bazaar Shopkeeper's Union, Urdu Bazaar, Karachi
2. Mr. Saim Aziz, Marketing Coordinator, Wellbeinggreen, Karachi