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ENERGY FIELD ASSESSMENT OF DESERT CAMP SITES IN WADI RUM

PUBLIC ACTION FOR WATER, ENERGY AND ENVIRONMENT PROJECT
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PREFACE

The Public Action for Water, Energy and Environment Project (PAP) is a public education and behavior change communication program developed to support USAID's technical and policy investments in the Jordanian water and energy sectors, and to support specific initiatives in the environment, in particular with regard to solid waste. The project has been awarded to ECODIT, a US small business holding the Prosperity, Livelihoods and Conserving Ecosystems, or PLACE, Indefinite Quantity Contract with USAID.

PAP is a five-year-long program that has been designed with three phases:

1. Data collection and assessment phase of nine months ending July 31, 2010;
2. Participatory strategic planning phase of three months that will include dialogue with the relevant stakeholders; and
3. Implementation phase lasting about four years.

The first phase of the project (Assessment and Baseline Phase) is to be completed by the summer of 2010. As part of this phase, ECODIT is conducting numerous surveys, including 12 or more research efforts, and it is from the totality of these efforts that the project will determine its direction and focus on behavior change. ECODIT has divided this phase into the several rapid assessments.

This study is a field assessment of 16 desert camp sites in the city of Aqaba – Wadi Rum and Dieseh districts to evaluate these camps' energy needs and their current energy situation.

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1.0 INTRODUCTION

Jordan has a variety of touristic attractions and its economy is heavily dependent on tourism. A big component of the tourism sector is the camp sites located in particular in the southern part of Jordan. Aqaba, Wadi Rum and Wadi Musa are always the favorite destinations to both local and international tourists who visit Jordan. During their visit, tourists wish to experience the simple bedouin life, stunning scenery and warm weather. The camp sites in Aqaba, Wadi Rum and Wadi Musa are spread throughout the southern Jordanian desert and each camp site offers a different experience and style. The majority of camp sites in these areas are made of simple Bedouin tents with minimal facilities, while others offer more extravagant modern style camping with entertainment activities. The Public Action for Water, Energy and Environment project (PAP) team performed a field situational analysis to assess the current government policies, practices and behaviors related to the issues of water, solid waste and energy at camp sites in Wadi Rum and Dieseh.

1.1 STATEMENT OF NEEDS

The increased number of camp sites in Aqaba, Wadi Rum and Wadi Musa has added pressure on the already limited water and energy resources in the area and in Jordan as a country. Camp sites demand clean water supply, energy and sanitation facilities. Therefore, wise and efficient use of resources will add to the sustainability of the camp sites. Camp sites can cause adverse environmental effects if not constructed properly. The need for Ecological Standards (i.e. Eco-Standards) dedicated to camp sites in Jordan will enhance the image of tourism in Jordan specially at camp sites, attract more campers both locally and internationally as campers are becoming more aware and sensitive to environmental issues and contamination, protect already scarce water and energy resources and encourages camp managers to use available natural resources in more efficient ways. These Eco-Standards will set certain criterion such as energy reduction, general management issues and others, each with certain expectation which must be fulfilled to qualify camp sites as Ecological Camp Site (i.e. Eco-Camp).

1.2 Trip Objectives

The main objectives of this trip are as follows:

1. Assess current camp sites' situation and energy profile
2. Evaluate how to reduce their energy needs
3. Assess the possibility of installing renewable energy for electricity generation

1.3 Team Members

1. The PAP field team was made up of Eng. Ghassan Naji – Senior Energy Specialist,

While in-office support was provided by the following professionals:

2. Mona Greiser – Senior Social Marketing Specialist/ Deputy COP
3. Lina Ghazzawi – Office Manager

2.0METHODOLOGY

2.1 Preliminary Meetings

Upon arrival to the city of Aqaba, few meetings were conducted to get an idea of the prevailing conditions of these camp sites and the organizations that can support them. Meetings were held with the following:

- Mr. Faisal Abu Sondos, Executive Director – the Royal Marine Conservation Society of Jordan (JREDS).
- Mr. Naser Zawaydeh, Head of Tourism Division – Wadi Rum Protected Area.
- Dr. Ahmad Ghandour – Independent Consultant for Aqaba Community and Economic Development (ACED) project.

2.1.1 Meeting with Faisal Abu Sondos

- JREDS are adopting the Green Key (GK) standards at resorts (hotels) in Aqaba. These are international standards that cover several aspects such as: energy, solid waste, safety, water and environment.
- The GK, which is voluntary, gives three advantages: marketing, savings and managerial.
- An example of a resort that gained the GK: Movenpick Hotel/Aqaba.
- When asked about the difference between LEED and GK, Mr. Faisal stated that the GK is more a behavioral standards other than the LEED technical rating system.
- JREDS are a member of the GK international committee, who develop and implement its standards.
- JREDS are very much interested in developing similar standards for desert camps, Mr. Faisal thinks they can get the support of the international committee to make it the first ever eco standards for desert camps in the world.
- Mr. Faisal thinks that there is no risk of rejecting such standards from the international committee.
- Mr. Faisal stated that they submitted a concept paper to PAP explaining the mechanism to develop similar GK standards at the desert camps in Wadi Rum and Dieseh.

2.1.2 Meeting with Dr. Ahmad Ghandour

- ACED assigned Dr. Ahmad on a short task (a month) to do the following:
    - Map existing energy generating practices at camps in Wadi Rum Disi area.
    - Propose different scenarios/options for environmental friendly power generation that can be applicable in the camps.
    - Design and develop a proposal suggesting the most appropriate alternative method(s) to generate power for the remote camps.
    - Design and develop a list of standards of “environmental friendly vehicles”, which shall be met by vehicles used by tour guides and camps in Wadi Rum protected area.

- Investigate the possibility/practicality to integrate these vehicles into the suggested echo power generation system of the camp.
- Prepare the technical specifications and the RFP for the proposed options for the environmental friendly power generation and the vehicles.

- Dr. Ahmad already started his field visits to camps, he stated that he is only considering registered camps.
- Dr. Ahmad said that it is very much easier to use a guide for these visits, where this would be a good icebreaker with the possible 'reluctant' camp owners.
- Eng. Ghassan suggested to do joint field visits with Dr. Ahmad, to better utilize time and to avoid possible repetition of work as there are some overlaps in both missions.
- The idea of these joint visits was welcomed by Dr. Ahmad.
- It was agreed to exchange collected data and findings between both.

2.1.3 Meeting with Mr. Naser Zawaydeh

- Number of registered camps is 41 camps.
- The nominal capacity of any registered camp should not exceed 50 persons.
- It is totally prohibited to use diesel/gasoline generators in registered camps.
- If a camp use diesel/gasoline generator, they will be given a ticket. If this is repeated 3 times, they will cancel that camp registration, according to the policy; which is not respected actually.
- These tickets are just a 'written warning'; they do not contain fines at all.
- Mr. Naser believes that number of visitors in the year 2011 has dropped dramatically (around 150,000 visitors) due to the Arab Spring. Usually, in the past few years, number of visitors is around 250,000 – 300,000 annually.
- Total revenues in the year 2010 was 3,586,207 JDs (from camping and field trips)

2.2 Field Observations

The methodology developed for this field assessment is driven by the main objectives mentioned earlier in this report.

A diverse sample of 16 campsites in Wadi Rum and Dieseh was visited in order to evaluate their energy situation.

The field survey was conducted by Eng. Ghassan Naji, partially accompanied by Dr. Ahmad Ghandour, who was working on a different task for developing proposal for the optimal clean energy generation method for campsites, and developing a list of standards of "environmental friendly vehicles. For the joint visits that Mr. Ghandour and Naji conducted together, and in order to better utilize time; Mr. Ghandour was walking around to gather information about the energy profile of the camp while Mr. Naji was interviewing camp owner and visitors.

The main variables obtained through the site visits were the following:

1. Camp Capacity
2. Current number of visitors
3. Occupancy level at low and high seasons
4. Acceptance of foreign/local visitors
5. Number of living rooms
6. Number of bedrooms
7. Number of bathrooms and showers
8. Water supply method
9. Hot water availability
10. Method of water heating
11. Number of showers per day per visitor
12. Water consumption per month
13. Number, type and rated power of electrical lamps
14. Number, type and rated power of appliances
15. Generator availability
16. Operation hours of generator
17. Fuel cost
18. Availability of renewable energy components
19. Acceptance of adding renewable energy components
20. Possibility of partial financial contribution (in case of adding renewable components)

For each one of the visited camps, a guide was used to facilitate the process and to override resistance from camp owners; this guide was responsible of making appointments with owners and driving field team to the camp.

Below a list of the visited camps:

1. Desert Camp
2. Desert Quite
3. Al Barra Al Sahrawi
4. Jabal Al Mitwaga
5. Bedouin Life
6. Abu Raa'd Al Zawaydeh Camp
7. Desert Rose
8. Salman & Hasan Zawaydeh Camp
9. Rahayeb
10. Al Amieleh
11. Seeg Um Al Tawagi
12. Khaled Camp
13. Red Sea
14. Deser Moon
15. Bedouin Cave
16. Wadi Rum Friends

2.3 Data Analysis

At the end of each day during the field assessment, all collected data were compiled and entered into a data base for analysis, which was carried out in-office upon finishing the field trip mission.

3.0KEY FINDINGS

This section addresses the key findings of the study, which developed based on the thorough site survey conducted by the technical team in the 16 camps in Wadi Rum and Dieseh.

3.1 Capacity of Camps and Their Occupation level

The average size capacity of the whole sample was 46 visitors per camp. Most camps were in the capacity of around 35 visitors. 5 camps (31%) of the sample were having a capacity less than 30, other 9 (57%) can host up to 50 visitors, while the remaining two (12%) have a very large capacity (relatively) of 100; although it is not allowed for a registered camp to build a capacity larger than 50 visitors, which somehow shows poor execution of the camps' registration laws and policies.

Occupancy depends on the time of the year, on average; camps are 50% occupied at high seasons while at low seasons camp owners suffer from the very low level of occupancy (ranging from 10% - 0 %), which was clear during field visits of this study. This problem leads owners to downsize their camps' capacity or even totally close them. During field visits, which were in February, only 5 camps were occupied: 2 of them with 8 visitors while the rest 3 with only one visitor!

High season is normally in March, April, May, September, October and November.

Figure one below shows a camp that has been downsized (clear in the right side of the figure), while figure 2 shows a fully erected camp.

Figure 1: A Downsized Camp

Figure 2: Dismantled Tents

Figure 3: Full Capacity Erected Camp

Although these camps suffer from low occupancy levels during low seasons, they do not accept local visitors. Only 2 camps (12%) showed acceptance of hosting Jordanian visitors, but upon certain conditions (couples introduced through a friend). Reasons for that reluctance, as mentioned, are that local visitors:

1. Litter
2. Do not respect the desert life i.e. they look for a luxurious stay in the desert (DJ with loud speakers, lots of lights, AC units, etc.) which contradicts with the message these camps were built for, according to camp owners.

3.2 Structure of Camps

The main components of these camps are:

1. Bedrooms
2. Living rooms
3. Bathrooms
4. Kitchen

Bedrooms could be small size (for two people) or large size (for a group of people, up to 20 sometimes).
Number of available bathrooms (and showers) depends on the camp capacity; on average it was found one bathroom per 12 persons. While usually only one large living room serves the whole visitors, this living room is the main place where people spend their time at night.

Figure 4: Living Room

3.3 Water Supply and Consumption

Camps use water reservoirs to fill their tanks. The average water consumption of visitors is 0.2 m^3 per visitor per week at high seasons, while it drops to 0.07 m^3 at low seasons. Water uses at camps are as follows:

1. Showering
2. Bathroom and hand washing
3. Dishwashing
4. Food and beverage preparing

Showering is the most water consuming component, visitors take at least one shower a day, could go up to 2 showers a day at high seasons.

Figure 5: Water Supply Tanks

3.4 Energy Assessment of Camps

Forms of energy needed in the camps could be either:

1. Electrical: lighting and electrical appliances
2. Thermal: hot water supply, space heating (winter) and cooking needs

The following sections will discuss each sub-component separately.

3.4.1 Lighting

Seven camps (44%) are using electrical lights, while the remaining 9 camps (56%) are using candles, gas lamps, and battery lamps. Reason why these camps are not using electrical lights is not the regulations nor the Bedouin life privacy, but the high cost of installation and the need of energy source to power them. That was clear because these camp owners expressed their wish to have electrical energy supply.

Figure 6: Gas Light

For the camps using electrical lamps, it was noted that mostly they use a mix of CFLs and Incandescent lamps. CFLs are used due to their light color mainly, rather than the savings they make. Reasons why CFLs are not exclusively used in specific camps:

1. The word of mouth, some owners heard that they cannot rely on just CFLs because they are subject to failure at any point.
2. Camp owners do not 'feel' the savings come from CFLs.
3. "The color of CFLs is only white", according to camp owners. No one knew that there's colored CFL's.
4. CFLs are expensive.

Having done a 'walk through' round over these camps, it was noted that:

1. There's excessive lighting at certain areas (especially the entrance and perimeter lighting).
2. Incandescent lamps can be replaced with efficient CFLs.
3. All electrical loads are connected to one switch or two at most, which consumes more energy that is not needed necessarily.

The below table shows the current lighting load of these camps:

Table 1: Electrical Data of Lighting Fixtures

Camp Name		Desert Quite	Desert Camp	Al Barrah Camp	Abu Raa'd Camp	Rahayeb Camp	Bedouin Cave Camp
Capacity [visitors]		100	50	30	55	100	40
CFL - Type 1	Quantity	2	11	6	1	47	1
	Power (W)	24	24	24	20	20	20
	Operating Period (hrs/day)	6	3	5	5	3.5	5
	Consumed Energy [KWh/year]	105	289	263	37	1201	37
CFL - Type 2	Quantity	0	0	15	0	0	6
	Power (W)	0	0	20	0	0	26
	Operating Period (hrs/day)	0	0	5	0	0	5
	Consumed Energy [KWh/year]	0	0	548	0	0	285
Inc. - Type 1	Quantity	50	8	3	25	0	0
	Power (W)	75	60	60	25	0	0
	Operating Period (hrs/day)	5	3	5	2.5	0	0
	Consumed Energy [KWh/year]	6844	526	329	570	0	0
Inc. - Type 2	Quantity	48	7	0	4	0	0
	Power (W)	40	75	0	60	0	0
	Operating Period (hrs/day)	2.5	3	0	3	0	0
	Consumed Energy [KWh/year]	1752	575	0	263	0	0
Overall Annual KWh		8,701	1,390	1,139	870	1,201	321

One camp, Bedouin Life Camp (also known as Azzabi Camp), is using advanced green techniques in lighting: there were solar lights and motion detectors (to control lighting). This camp is very much open for new technologies, its owner always travel to Europe and bring new technologies he sees there, which made him receive a certificate of recognition for his green behaviors (shown in the below figure).

Figure 7: Recognition Certificate (left) and A Sticker for Visitors in the Azzabi Camp


Figure 8: Motion Detector (Right) and Solar Cell for Lighting Used in Azzabi Camp

3.4.2 Electrical Appliances

It was noted that these camps do not use electrical appliances at all, except one camp that use a small refrigerator. Camp owners use 'ice-boxes' instead of refrigerators.

All camps have gas ovens for cooking, but they tend not to cook in the camp; instead, they let their families (wives) cook at home, which is not far away from the camp.

For hot beverages preparation, gas ovens are used.

3.4.3 Hot Water

Only one camp (Desert Moon Camp) has solar water heater, despite the fact that there are really excessive amounts of solar radiation in the desert. Reasons mentioned of why other camps do not use SWH:

1. High cost
2. Its maintenance, where no one in the desert can maintain it
3. Fear of vandalism, where some owners think that nearby 'enemies' might break the glass!
4. They do not need hot water all the year

Gas water heaters are more trusted between camp owners, 5 camps were having LPG heaters, one of them has SWH but using it only for the kitchen. According to camp owners, gas cylinders are replaced once a week, which costs them 6.5 JDs/Week. If hot water to be needed throughout the year, this will cost around 338 JDs/year; which would pay for installing a new SWH in 2-3 years, depending on the capacity needed.

The remaining 10 camps have no hot water at all, which is a good reason of why visitors avoid them at winter time.

Figure 9: Rooftop SWH Just Used for Kitchen Needs

3.4.4 Electrical Energy Supply

Although it is not allowed to use any fuel powered generators, 6 camps were doing so. This shows poor respect to laws and regulations as mentioned earlier in this report.
Gasoline generators are commonly used in these camps, despite the fact that:

1. They consume fuel
2. They produce noise that visitors don't like
3. They need maintenance
4. They are against the law

Electricity supply last for 5 hours a day on average, the annual fuel cost of electricity generation is shown in the below table (based on 0.7 Gallons/8 KWh):

Table 2: Fuel Cost of Gasoline Generators at Current Load and Fuel Price (62 fills/liter)

Camp Name	Desert Quite	Desert Camp	Al Barrah Camp	Abu Raa'd Camp	Rahayeb Camp	Bedouin Cave Camp
Capacity [visitors]	100	50	30	55	100	40
Needed Fuel per Year [L]	2,878	460	377	288	397	106
Annual Fuel Cost [JDs]	1,784	285	234	178	246	66

3.5 Possibility of Using Solar Energy for Electricity Generation

All camp owners were very much interested in using clean energy technologies, if there's funding. They showed interest in sharing the capital investment cost with that source of funding, but to a very low limit (only up to 10%). If camps shown in table 2 tend to use PV for their current situation (without retrofitting), the below table shows what implications would be at different funding scenarios:

1. The equipment are 90% funded
2. The equipment are 75% funded
3. The equipment is 50% funded.

Table 3: Feasibility Scenarios of PV at Selected Camps

Camp Name		Desert Quite	Desert Camp	Al Barrah Camp	Abu Raa'd Camp	Rahayeb Camp	Bedouin Cave Camp
Capacity [visitors]		100	50	30	55	100	40
Overall Annual KWh		8,701	1,390	1,139	870	1,201	321
Annual Fuel Cost [JDs]		1,784	285	234	178	246	66
Needed PV Size [KW]		4.9	0.8	0.7	0.5	0.7	0.2
Cost of PV System [JDs]		17,150	2,800	2,450	1,750	2,450	700
Scenario 1: PV are 50% Funded	Cost on Camp Owner [JDs]	8,575	1,400	1,225	875	1,225	350
	Simple Payback [years]	4.81	4.91	5.25	4.91	4.97	5.31
Scenario 2: PV are 75% Funded	Cost on Camp Owner [JDs]	4,288	700	613	438	613	175
	Simple Payback [years]	2.40	2.46	2.62	2.45	2.49	2.66
Scenario 3: PV are 90% Funded	Cost on Camp Owner [JDs]	1,715	280	245	175	245	70
	Simple Payback [years]	0.96	0.98	1.05	0.98	0.99	1.06

From the above table, it can be shown that PV would seem attractive to camp owners, if they are funded.

4.0 RECOMMENDATIONS

1. Promote energy efficient lighting fixtures: It was noted that people do not use CFLs in some locations because they think CFLs are only emitting white light, which is not correct. Besides, it is commonly believed that CFLs do not live long. If these concepts are cleared, camp owners will reduce their energy demand.

2. Re-design electrical lighting systems for camps: It was noted that camps use excessive lighting fixtures especially for entrance and perimeter lighting. Mostly, these excessive lights are incandescent. These fixtures shall be reduced and replaced with more efficient lamps.

3. Re-wire electrical circuits in order to separate loads: It was noted that all electrical devices are connected at one or two switched only, this turns unnecessary loads on that visitors may not be using. It is important to re-wire and install additional switches especially for lighting fixtures.

4. Promote SWH: The use of SWH looks feasible, it is recommended to replace the common LPG heaters with SWH. On the other hand, the absence of hot water supply in some camps made visitors avoid them, installing a clean hot water source will attract visitors.

5. Enforce 'protected areas' laws and regulations: It was noted that camp owners do not respect the law, which was clear from using prohibited Gasoline generators. It is important to create fines, and enforce them; the current law does not charge the outlaw people, it just gives them a written warning that is put on shelves.

6. Promote PV: It is important to replace the Gasoline generators with clean source of energy, for the sake of desert life and for a better camping experience for visitors.

7. Find a Source of Funding: Camp owners cannot afford the high cost of new technologies, such as solar PV. If these systems are funded in anyhow, they will be more attractive.

8. Establishing Green Standards for Camps: Foreign visitors mentioned that if they have a chance to choose between a green camp and conventional one, they will use the green for sure. If there is a rating system that shows 'how green my camp is', camp owners will be motivated to perform green practices. All camp owners showed interest in this idea; they even understand that foreign visitors pay attention to this point. These standards can be developed through other agencies, just like JREDS who showed real interest in that.