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MARKET DEFINITION STUDY OF PHOTOVOLTAIC POWER FOR REMOTE VILLAGES IN THE UNITED STATES

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INTRODUCTION

Acceptance of the idea of photovoltaics making a significant impact on the world energy needs has been slow in coming. This is largely due to the fact that photovoltaic systems are not currently cost effective in other than low power, remote applications.

However, technological advances, accompanied by the cost improvement resulting from volume production, have rapidly decreased the cost of photovoltaic modules. If this momentum can be maintained, and in fact, accelerated, photovoltaics does have the promise of having a positive impact on the world energy situation, especially in view of the rapidly escalating cost of fossil fuel generation of electricity.

Photovoltaics is, however, a classical "chicken-and-egg" situation. Huge markets can open up if the costs are low enough; and costs can be reduced significantly if there is adequate volume and profit incentive for industry to invest the capital necessary for automated large volume production and cost reduction.

One of the primary purposes of this study is to determine if there is a sizeable market between the small remote and the huge residential/utility markets.

Remote villages have long been thought to hold great promise for photovoltaics and represent a key market. This first part of the study addresses the potential for photovoltaics in remote villages in the U.S. and its territories. A subsequent report will deal with the potential for photovoltaics in remote villages in the international markets, especially in developing countries.

SUMMARY

A "grass roots" evaluation of the market potential for photovoltaic applications in remote villages in the U.S. and its territories provides an estimate of almost 14 MWp available for conversion from a potential to a real market.

This total power potential is based on the energy needs of almost 400 sites reported by Federal Agencies and inputs from over 100 Indian tribes. This potential consists of the following:

U.S. Government Agencies	3,000 KWp
Indian Villages	10,000 KWp
Alaskan Villages	370 KWp
Territories	500 KWp
U.S. Commercial Village Power	Negligible
Total	13,870 KWp

The report details the methodology used, the results achieved, and some recommendations of how to convert this domestic market potential into a near-term market and discusses its contribution to preparing for the really large village power market potential that exists in developing countries.

A summary of the recommendations is as follows:

The Government should:

1. Continue to fund programs, such as FPUP, to encourage Federal Agencies to install photovoltaic systems where they are cost effective in the near term.

2. Require (or at least encourage) agencies planning purchases of fossil fuel generators to first consider photovoltaic systems.

3. Modify the government accounting system to accommodate purchase of high first-cost, low continuing-cost, items such as solar systems.

4. Establish a formal program for replacement of fossil fuel generators with photovoltaic systems when and where feasible.

5. Develop a mechanism for cost-shared funding for solar electrification of Indian and other villages.

The Industry should:

1. Develop standard photovoltaic power packages to simplify the replacement of fossil-fuel generators.

2. Develop low-cost, reliable, efficient DC equipment and appliances to be run directly from the arrays.

LIST OF ILLUSTRATIONS

I. DEFINITION

REMOTE VILLAGE: A grouping of up to 2000 people living in a remote area, but in close enough proximity to interact with each other on a daily basis.

Remote implies that the village is located such that it cannot be supplied economically with central station utility power.

II. OBJECTIVES

A. General

To assess the U.S. market potential for photovoltaics in remote village applications from the point of view of a company engaged in the manufacturing and marketing of photovoltaic modules and systems.

B. Specific

1. To identify the specific types of villages most likely to represent the greatest potential for use of photovoltaic power.
2. To compile a list of potential near-term applications.
3. To quantify the future market potential by type of application.
4. To identify the barriers and obstacles which might inhibit the growth of the market.
5. To recommend action necessary to enhance the development of the market.

III. GENERAL METHODOLOGY

A. Literature Search

A review of the existing literature on the subject pertinent to the study was conducted by Motorola and by Arizona State University at the outset of the program and on specific subjects of interest as the program progressed. Examples of the types of subjects researched are as follows:

1. Village power application
2. Water pumping
3. Refrigeration
4. Lighting
5. Sources of DC equipment
6. Rural electrification
7. Utility rates and cost of power line extension
8. Performance and cost data of alternate forms of generation of electricity, i.e., diesel generators
9. Previous photovoltaic market studies.

A general observation resulting from this literature search is that while volumes of reports on the above subjects exist, extracting the valuable bits of data from them amounts to an almost insurmountable task. An extensive cataloging program, preferably computerized, would be quite helpful to the many organizations searching for this type of data.

B. Personal Interviews

Approximately 100 interviews were conducted with a variety of sources, as the following list shows, to determine what data was already available, what were the best sources of data, and what would be the most appropriate method for obtaining the required information. Some of the organizations contacted were:

1. Forest Service, both headquarters and regional offices
2. Department of Interior
3. Bureau of Reclamation
4. Bureau of Land Management

5. Fish and Wildlife Service
6. Office of Territorial Affairs
7. Bureau of Indian Affairs
8. Indian Health Service
9. Department of the Army
10. Department of the Navy
11. Department of Energy
12. NASA Lewis
13. MIT Lincoln Labs
14. Indian tribal representatives.

C. Questionnaire to Potential Users

As a result of the interviews conducted, it was determined that a questionnaire approach would provide the greatest amount of data in the least amount of time for the smallest cost. It was also determined that while the questionnaires should be standardized enough to allow data compilation, they should be tailored to suit the individual organization responding. The questionnaires must also necessarily be a compromise between two almost mutually exclusive conditions:

1. Detailed enough to provide maximum information.
2. Simple and short enough to guarantee maximum response.

D. Load Estimation and Assumptions

Each site/application reported on was analyzed to determine the size of the array necessary to power the equipment identified. Due to the large number of sites and variability of loads, the KWH and array size are approximate only, and in cases where precise data was not supplied a reasonable assumption was made.

To provide consistency and to ensure a conservative but realistic estimation of the electrical loads, several assumptions had to be made:

1. All systems were assumed to be 12 volt DC systems.
2. The most efficient usage of energy was assumed. For instance, photovoltaics were not used for heating or cooking. Also, energy-efficient DC refrigerators and fluorescent lighting systems were assumed.

3. A conservative efficiency rating on DC motors driving pumps was assumed (60 percent).
4. If not otherwise specified, communication equipment was assumed to be a 25 watt set operating on a five percent transmit duty cycle.
5. To convert the estimated KWH loads to required array peak watts the solar factor was multiplied by 1.3 to compensate for the fact that the load is specified at nominal battery voltage while the modules are specified at the peak power point necessary to charge the batteries.
6. Exhibit 1 displays the load ratings used if not specifically defined in the questionnaire response.

E. Computer Sorting and Tabulation

A computer program was designed by Motorola to allow sorting and tabulation of the mass data accumulated by the survey. Further discussion of these tabulations and the key to reading them are included in Section IV.A of this report.

IV. SPECIFIC METHODOLOGY, RESULTS AND CONCLUSIONS BY MARKET SEGMENT

A. Government Agencies

1. Specific Methodology - A number of government agencies which appeared to have the greatest potential agreed to cooperate with the survey. A questionnaire was designed by Arizona State University to provide the best compromise between the amount of detail required and the simplicity necessary to achieve the high response rate desired. These questionnaires were mailed to a distribution list provided by the agencies. The agencies also wrote a letter to their regional offices encouraging them to cooperate with the survey. Examples of a letter and questionnaire are Exhibits 2 and 3.

The responses to these questionnaires were input to the computer program and tabulated for each responding organization. These tabulations of raw data and the key to reading them are included in Exhibit 4. This data is the basis for most of the figures included in following sections of the report.

2. Results - The agencies cooperating with the survey and the number of responses received were as follows:

Forest Service	398
Land Management	122
National Park Service	112
Reclamation	32
Fish & Wildlife	3
	667

Not all of the responses received were related to true village power applications. The other applications, most for communications and water pumping, are not included in the statistics and projections, but are included in raw data tabulations.

Figure 1 summarizes the results of the survey by agency and by application. The largest power requirements are for water pumping, lighting, refrigeration, and entertainment/education in that order.

REMOTE VILLAGE

PHOTOVOLTAIC APPLICATIONS

User	# Sites	KWH PER DAY										KWp
		Lite	Pump	Refr	Food	Appl	Comm	Educ	Batt	Other	TOTAL	Array
FOREST SERVICE	268	416.0	242.8	171.4	33.6	11.6	57.2	182.6	17.6	120.12	1252.9	456.67
PARK SERVICE	73	1351.4	1420.3	239.1	18.7	21.9	20.3	120.3	9.5	297.8	3499.3	1314.20
LAND MANAGEMENT	32	47.6	58.3	10.3	3.7	0	9.9	12.3	1.6	13.8	157.5	46.92
RECLAMATION	13	27.5	377.9	.3	0	.8	2.7	.4	.1	275.3	685.0	224.51
FISH & WILDLIFE	3	27.1	.9	1.2	.3	3.8	.6	1.1	.2	1.0	35.2	20.1
TOTAL	389	1869.6	2100.2	422.3	56.3	38.1	90.7	316.7	29.0	708.0	5630.9	2062.4

Figure 1

As expected, the Forest Service and National Park Service had the greatest potential demand.

You will notice that the National Park Service has the largest potential demand with fewer sites than the Forest Service. This is due to the fact that the Park Service applications are for fairly large villages, such as work camps, Park headquarters, visitor center, etc., typically running from 8 to 25 people in size, whereas the majority of the Forest Service sites are for fire lookout towers, typically having 2 people per tower.

Figure 2 summarizes the results of the survey sorted another way. In this case the program totals the load demand (or potential demand in KWp) for all remote village sites served by a particular type of power source. The exception being, of course, the first column, which is a total of all the load demand for sites presently having no power at all. The second column shows the total load demand currently being supplied by primary battery, the third by thermo-electric generator, etc.

Expanding the detail of the data from Figure 2 results in the following grouping of sites:

	TOTAL LOAD
Group I - Sites using	
Primary battery	5KWp
Thermoelectric generators	5KWp
Gasoline	157KWp
Propane	152KWp
TOTAL	319KWp
Group II - Sites having an individual site demand less than 10KWp, and served either by diesel generators or having no electricity at all	476KWp
Group III - Same as II, but having site demands of 10 - 25KWp	143KWp

POTENTIAL FOR REPLACEMENT
OF EXISTING ENERGY SOURCES

(Measured in KWp)

	CURRENT SOURCES OF ELECTRICITY						
	None	Battery	Thermo Electric Gen.	Gasoline	Propane	Diesel	TOTAL
FOREST SERVICE	141	3	2	111	49	151	457
NATIONAL PARKS	8	1	2	34	1	1268	1314
RECLAMATION	0	0	0	0	100	124	224
LAND MANAGEMENT	27	1	0	12	2	5	47
FISH & WILDLIFE	17	0	0	0	0	3	20
TOTAL	193	5	4	157	152	1551	2062

Figure 2

Group IV - Same as II, but having site demands of
25 - 50KWp 156KWp

Group V - Same as II, but having site demands of
50 - 100KWp 140KWp

Group VI - Same as II, but having site demands of
100KWp and up 828KWp

Groups I and II represent sites for which photovoltaic systems are currently cost effective. The cost effectiveness of Groups III through VI depends almost entirely on how rapidly the price of diesel fuel escalates and how rapidly the price of photovoltaic systems decreases.

3. Observations - Following are some observations based on survey results, comments, and inputs from the personal interviews with many representatives of these government agencies.

a. Many of the sites are using war-surplus generators, and many of them are oversized for the site load requirement.

b. Due to the Tsongas/FPUP program, many of the agencies are seriously investigating the expanded usage of photovoltaic power systems. However, there are still a large number of potential users who are either unaware of or skeptical about use of photovoltaics as a power source.

c. It is still too easy for government agencies to buy fossil fuel generators, even where photovoltaic systems are cost effective.

d. If a government agency wants to buy a photovoltaic system, it can run into several difficulties:
   (1) In the GSA catalog, photovoltaic systems are classified as "Instruments and Laboratory Equipment," not a likely source for someone looking for an electrical power generator.
   (2) Government accounting systems and budget procedures make it difficult to procure high first-cost, low continuing-cost items such as solar equipment.

e. Even at remote sites a lot of energy is presently being wasted:

   (1) Oversized generators consume excess fuel.

   (2) Many pumps are oversized for the application.

   (3) Expensive locally generated electricity is being used for heating and cooking.

f. The most efficient use of photovoltaics would be the direct current directly from the array, but both the cost and availability of DC equipment may make this approach prohibitive.

4. Conclusions and Recommendations

a. There is an identified market potential for photovoltaic systems, classified as remote village applications, for the surveyed government agencies of about 2MWp. Listed below are estimates of additional potential market that exists in regions which did not report, and an estimate of unreported sites in regions which did report:

Forest Service regions not reporting

California Southern Alaska	Estimate 300KWp

Park Service regions not reporting

North Atlantic Mid-Atlantic North Central	Estimate 200KWp

Unreported sites, other agencies, etc.

Estimate 500KWp

These estimates added to the reported 2MWp would total 3MWp for the government agencies.

b. Several things need to be done to ensure that this total potential demand is converted to a true market demand:

(1) The FPUP program, or one similar to it, administered and executed efficiently and on a timely basis, will encourage widespread usage of photovoltaics in cost-effective applications, and should be continued. To encourage early applications, consideration should be given to modify the FPUP program to allow the funds to be used to make up the cost difference where photovoltaics is nearly competitive with fossil fuel generators.

(2) Agencies should be required to justify purchase of fossil fuel generators where photovoltaic systems are near cost effective.

(3) Reclassify photovoltaics in GSA catalogs to Generators and Generator Sets, Electrical (6115).

(4) The government accounting system should be modified to accommodate high first-cost, low continuing-cost procurements.

(5) Educate and encourage efficient energy usage. Examples:
   (a) Pump water during daylight hours into elevated storage.
   (b) Don't use electricity for heating and cooking.
   (c) Don't use oversize motors for water pumps, fans, etc.

(6) Each agency should establish a program for replacement of fossil fuel generators as primary source of power. Batteries and thermoelectric generators: <u>Now</u>. Gasoline. propane, and diesel generators:
   (a) As replacement is required.
   (b) Starting with oldest and redistributing for backup.

B. Indian Villages

Many factors related to Indian villages have led to the assumption that they represent one of the more important potential domestic markets for photovoltaic village power. The primary factor is the remoteness of many of the Indian homes and villages from the utility grid. Past attempts to identify and quantify the potential for photovoltaics on Indian reservations have not met with a great deal of success. This suggested that a different approach should be considered.

1. Specific Methodology - For this reason a series of meetings and discussions with various activities related to Indian affairs were held. These included discussions with both Washington based and field office representatives of the Bureau of Indian Affairs and the Indian Health Service. Discussions were also held with a sampling of members of Indian tribes.

The primary conclusions reached were that probably the most productive approach would be to go directly to the Indian tribes for the required information, rather than through government agencies such as BIA or IHS. It was further felt that cosponsorship of the survey by some influential organization or association of Indian tribes would enhance the level of response. Since this meant that the responses to a survey would be strictly voluntary, it followed that the questionnaire would have to be short and simple, with a cover letter designed to elicit the cooperation of the tribes. With the assistance of Arizona State University, such a questionnaire and cover letter were designed (see Exhibits 5 and 6).

The letter, the questionnaire, and a newspaper clipping describing the village power installation at Schuchuli on the Papago reservation were mailed to the tribal chairman of the 270 tribes which are located in the 48 contiguous states.

Additional support for the program was solicited and received from the Council of Energy Resource Tribes (CERT).

This is an influential organization of 25 tribes which are rich in energy resources. They reportedly control 50 percent of the nation's uranium, and substantial coal, oil, gas, and geothermal reserves. They encouraged tribal support for the survey in their monthly newsletters.

In order to validate and expand upon the results of the survey, a sample of seven tribes was selected for visits for more detailed discussion (Figure 3).

FIGURE 3

Tribes Visited for Detailed Discussion

Fort McDowell Mohave-Apache
Papago
Navajo
Hopi
San Carlos Apache
Acoma Pueblo
Taos Pueblo

2. Results

a. A total of 99 tribes responded out of 270 surveyed, which represented a gratifying 37 percent response rate.

b. Seventy-five percent of the tribes responding indicated that the majority of their people (over 95 percent) had access to electricity from the utility grid. Even so, a number of inputs were received indicating that even though electricity was available, many tribal members could not afford the high cost of utility power and were not using utility power.

c. Analysis of the inputs of the 24 tribes which had a lower percentage of their population served by the utility grid resulted in the following:

(1) Population not served by the grid - 127,000 people.

(2) Based on an average of 50Wp per person for minimum basic needs.

(potable water, refrigerator for perishable food, and two lights per house) this results in a potential market for photovoltaics of 6.3MWp. An extrapolation of this data to include those tribes that did not respond would lead to an estimate of 200,000 people not served with electricity, or a total market potential of 10MWp.

(3) As shown in Figure 4, over 90 percent of the market potential is represented by one tribe, the Navajo Nation, and 12 tribes represent 99.5 percent of the total potential identified by the survey.

d. Several of the tribes surveyed indicated that though their homes were powered from the grid, there was an interest in the use of photovoltaics for water pumping for stock watering and irrigation.

3. Observations: Barriers and Obstacles - Even though the apparent market potential may be in excess of 10MWp, the real market is probably somewhat lower due to a number of factors, some of which are enumerated below:

a. Some of the tribal members and some of the tribes are quite tradition-oriented, and oppose the ideas of modernization, particularly of the more ancient or religious oriented dwellings and communities.

b. The lack of financial resources available to many of the tribes has prohibited the rapid development of sources of electricity in the past, and without outside financial help in terms of loans or grants, the situation is not likely to change dramatically in the future.

POTENTIAL MARKET FOR

PHOTOVOLTAIC POWER ON INDIAN RESERVATIONS

TRIBE	TOTAL POPULATION	POPULATION NOT SERVED BY GRID %	POPULATION NOT SERVED BY GRID POP.	POTENTIAL AT 50Wp/PERSON KWp	% OF TOTAL
NAVAJO	140,000	83	116,000	5800	91.6
HOPI	8,000	38	3,040	152	
PAPAGO	10,000	30	3,000	150	
SAN CARLOS	6,000	15	900	45	
WHITE MOUNTAIN	8,000	10	800	40	
GILA RIVER	6,700	10	670	33.5	
HAVASUPAI	400	100	400	20	
WHITE EARTH	2,000	20	400	20	
ACOMA PUEBLO	2,000	20	400	20	
TAOS PUEBLO	300	100	300	15	
SHOSHONE-PAIUTE	500	25	125	6.3	
FOND DU LAC	1,000	10	100	5	
SUB TOTAL	184,900		126,135	6306.8	99.6
OTHER 12 RESPONDENTS	1,666		493	24.6	
GRAND TOTAL	186,566		126,628	6331.4	100.0
Est. Total Tribal Pop. in U.S. (excl. Alaska)	571,126		200,000	10,000	

Figure 4

c. Lack of familiarity and confidence in the photovoltaic technology requires an educational program and demonstration to promote awareness.

d. Extreme care must be taken to ensure that early installation and demonstrations are properly sized, designed, and installed to prevent establishing a negative reputation in the early stages of market development.

e. Availability of a broad enough spectrum of DC equipment to be run directly from the arrays is presenting an early problem. For example, the number of types of water pumps and refrigerators capable of being run on DC is quite limited, and expensive, and the production capacity of these suppliers is small today. Because of this limitation, it may be necessary to design AC systems, with the attendan higher cost and system complexity. Use of AC would also expand the variety of appliances which could be used in PV systems but with the attendant risk of overloading it.

4. Positive Factors for Photovoltaics - In spite of the obstacles and barriers previously identified there are numerous positive factors working for photovoltaic applications on Indian reservations.

a. Due to the large distances and dispersion involved in many of the tribal reservations, PV will be cost competitive with grid extension sooner than for most other residential and community applications.

b. The sun is a major factor in the tradition and religion of many of the tribes, so use of its power has a lot of appeal even to the most tradition-minded tribes.

c. The modularity of PV lends itself very well to applications in tribes where the homes are quite dispersed rather than clustered in villages. Such is the case on the Navajo lands.

The capability for local generation eliminates the problem not only of construction of lengthy power lines, but also the necessity for negotiation and purchase of right-of-way for transmission lines. Several tribes have dropped electrification projects because of these right-of-way problems.

d. Most of the tribes want to be as independent as possible. Photovoltaics can go a long way toward giving them energy independence.

5. Conclusions and Recommendations

a. Projection of the results of the survey indicate a minimum market potential of 10MWp. This is based on satisfying the minimum basic needs of the people, i.e., lighting, food refrigeration, and low-lift water pumping.

b. Regardless of the cost effectiveness of photovoltaics, this potential market will not become much of a true commercial market without some external funding stimulation.

Since electrification of Indian homes and villages will, in many ways, improve health, welfare, and standard of living of the inhabitants, there are many organizations which could be considered as sources of such funding. Examples are the Economic Development Administration, Bureau of Indian Affairs, Indian Health Service, Housing and Urban Development, Rural Electrification Administration, etc.

In many cases the tribes would be willing to share a portion of the cost, but this would vary widely from tribe to tribe. A vehicle needs to be identified or established to enable the various tribes to present proposals of this nature. An organized program of photovoltaically powering Indian residences and villages cannot only improve the lot of the Indian tribes, but would also provide valuable experience for government and industry in preparing to penetrate the remote village markets in developing countries.

C. Alaskan Villages

1. Methodology - The state of Alaska and the Office of Environmental Health published a report on sanitation facilities in Alaskan villages. Included in the report is data on sources of electricity for the villages. A list of the villages having no electricity, or having locally generated power was developed. A modified questionnaire was mailed to all of them (70 villages).

2. Results

   a. Of the 25 responses from the 70 villages surveyed 19 were determined to have no source of electrical power. These 19 villages were populated by a total of 2200 people living in 543 residences. As shown in Figure 5, to provide the minimum basic needs (lighting, refrigerator, low-lift water pumps) in Alaska requires twice the array size and almost four times the battery capacity which would be required for similar loads in Arizona. Since some of the villages are fishing villages, occupied only during the summer months, it might be possible to install systems designed to operate part of the year. The example shown in the right hand column of Figure 5 shows that a system designed to operate from March through August requires about 40 percent less array and about 60 percent less battery than a system operating year-round.

      Assuming all 19 of the villages having no power would eventually require power on a year-round basis, this would yield a potential market of about 370KWp.

   b. The six other villages responding and which were not hooked up to a utility grid system have their own generating plants ranging from 5KW to 250KW.

3. Conclusions and Recommendations - Photovoltaics in remote village applications represents a paradox in Alaska. On the one hand, they have a large number of remote villages, many of them inaccessible at times, making it difficult to maintain adequate supplies of fuel to run motor-generator sets. On the other hand, due to the latitude

FIGURE 5

PHOTOVOLTAIC SYSTEM COMPARISON

SUNBELT VS. ALASKA

Typical minimum basic needs for an Indian residence - 122AH per day including safety factors.

	Phoenix	Fairbanks, Alaska	
		All Year	March - August
Array size	330Wp	680Wp	400Wp
Tilt angle	45°	83°	37°
Battery			
No sun	612AH	612AH	612AH
Seasonal	0	1179AH	166AH
TOTAL	702AH	2633AH	1144AH
Approx. system hardware cost (@ $10 per watt module cost)	$5700	$12000	$6400

Includes: Modules, batteries, voltage regulators, structures, wiring harness.

Does not include installation cost.

(60 + N), photovoltaic systems appropriate for Alaska are at least twice the size of similar systems in the S. W. United States, and probably twice as expensive.

Because of the uniqueness of the Alaskan situation, and because of a number of unknowns, such as the effects of reflection of sunlight off snow-covered surfaces during the poorer insolation periods and the effects of arctic environment, it is recommended that a small demonstration/test installation be located in one of the Northern Alaska villages near the Arctic Circle. This could provide valuable information regarding operation of photovoltaic systems at these extreme latitudes.

D. Territories

Many of the U.S. territories are composed of remote island locations which should be quite suitable for photovoltaic village power. Accordingly, survey forms and an explanatory cover letter were sent to the following:

American Samoa
The Virgin Islands
The Trust Territories of the Pacific Islands
Guam
The Northern Mariana Islands

At this writing the response has been limited, although we have been assured that replies are being prepared. Hopefully, these responses will be received in time to be published in the International Report on Photovoltaic Village Power. In the meantime, we are conservatively estimating that potential to be around 500KWp.

E. Commercial Remote Village Power Installations

Arizona State University developed a contact list of 173 commercial companies in the fields of mining, logging, construction, and campgrounds. A sample of these companies was contacted by telephone to determine feasibility and interest in use of photovoltaics for their camps.

While many of the parties contacted expressed interest in solar, most of them indicated they had utility power available at the camps or residences where their employees lived. Contrary to past practices of having mobile living camps for construction crews, logging crews, etc., most companies now operate from a home base in a town or commute daily from motels in nearby towns.

This does not mean that there is no commercial domestic remote village market. It was felt, however, that the potential was small enough, compared to the market segments of government agencies and Indian villages, that spending more time in this area would not be as productive.

V. CONCLUSIONS AND RECOMMENDATIONS

There is a significant, but not large, potential market for photovoltaic systems in the remote village applications in the U.S. The estimated gross potential of 14,000 KWp listed below is about 15 times the size of the total worldwide photovoltaic market in 1978.

Remote Village Estimated Gross Potential

U. S. Government Agencies	3,000 KWp
Indian Villages	10,000 KWp
Alaskan Villages	370 KWp
Territories	500 KWp
U.S. Commercial Village Power	Negligible
TOTAL	13,870 KWp

While this market potential is small compared to the market potential for remote villages in developing countries, a very useful purpose can be served by proceeding to penetrate it. Designing, negotiating, and installing remote village photovoltaic systems in the U.S. can provide answers to many of the technical questions which will be encountered in trying to penetrate the international market for remote villages.

Our recommendation would be to structure programs designed to demonstrate systems in all or a part of that 14,000 KWp potential. The recommendations by market segment are as follows:

A. Government Agencies

This market segment will likely develop in time as photovoltaics becomes more and more cost competitive with fossil fuel generating systems. A concerted push by use of the following programs could, however, considerably accelerate the development of this market.

1. Continue and accelerate implementation of an FPUP type of program. Use the funds not only to install systems where photovoltaics are cost effective today, but also to make up the difference in system cost where photovoltaics are near cost effective.
2. Ensure that photovoltaic systems have been considered before permitting purchase of new fossil fuel powered generators.
3. Make it easy, not difficult, for potential users to specify and purchase photovoltaic systems as recommended on page 10 of this report.
4. Each agency should establish its own formal program for replacing fossil fuel generators with photovoltaic systems.

B. Indian Villages

The Indian village market is uniquely a different story. Without some significant financial assistance only a small part of this potential will ever become a real market. This is true because of the limited resources of most of the poeple living on the reservations, and the limited resources of many of the tribes represented in the potential market

A program could be structured, however, which would not only result in a near-term market for photovoltaics to improve the health and standard of living of inhabitants of Indian lands, and also to serve in gaining valuable experience in designing, installing, and operating remote village systems. This experience would be quite useful to both government and industry in preparing to market these types of systems in countries throughout the world.

A program of this type could consist of the following elements:

1. Federal grants or long-term, low-interest loans.

2. Cost sharing or other such cooperative participation by the Indian tribes. As a minimum they could provide the installation and maintenance labor, with adequate instruction and assistance from government and/or industry. Many tribes, in fact, have their own utility companies which generally provide a distribution function.

3. Providing of electricity to villages which otherwise might go without could also provide a stimulus and capability to develop cottage industries. This would spur the "self-help" programs of interest to so many tribes today.

It is our opinion that one of the agencies whose mission is to assist Indian tribes should take the initiative to develop a program of this type, with the support and cooperation of other government agencies having direct or indirect responsibility of working with Indian tribes, such as BIA, IHS, HUD, EDA, etc.

4/4/79

EXHIBIT 1

LOADS

Kw Hours

LIGHTING (Use Fluorescent)

$\frac{\text{Number of Bulbs x Incandescent Wattage Rating x Hours}}{1000}$ x .2 =

WATER PUMPING

Low Lift - 15' or less, 3 GPM - $\frac{\text{100 W x Hours}}{1000}$ =

Medium to High Lift

If in HP - HP x 1.25 x Hours =

Otherwise, see chart

REFRIGERATION

Small	(5 cu. ft.)	-	.3 x Number of Units	=
Medium	(10 cu. ft.)	-	.6 x Number of Units	=
Large	(15 cu. ft.)	-	.9 x Number of Units	=
Walk-in	(8'x12'x9)	-	11 x " " "	

FOOD PROCESSING

*Coffee Maker	600 W	x Hours / 1000	=
Mixer	150 W		
*Small Stove	1650 W		
Blender	250 W		
*Large Grill	1300 W		
*Large Roaster	1380 W		
*Toaster	1100 W		

OTHER APPLIANCES

Vent Fan	10 W		
Fan	75 W	x Hours / 1000	=
*Vacuum Cleaner	400 W		
*Hand Iron	1000 W		
*Room Heater	1600 W		

COMMUNICATIONS

2-Way Radio - 25 Watts Receive $\frac{\text{6 W x Hours}}{1000}$ =

Transmit $\frac{\text{120 W x Hours}}{1000}$ =

If not specified, assume 5% duty cycle (.3 KwH)

Microwave 3 KwH

ENTERTAINMENT/EDUCATION

Slide Projector	250 W		.
Radio	10 W		
Stereo/Hi-Fi	100 W	x Hours / 1000	=
TV	200 W		
CB Radio - Receive	1 W		
Transmit	10 W		
Movie Projector	300 W		

BATTERY CHARGING

(Assumes 3-day charge cycle) $\frac{\text{200 W Hours x Batteries}}{1000}$ =

OTHER EQUIPMENT

Hand Tools	200 W		
Lathe	300 W		
Drill Press	500 W	x Hours / 1000	=
Power Saw	570 W		
Grain Grinder	1300 W		
Hammer Mill	1900 W		

*Not recommended to use photovoltaics for heating.

EXHIBIT 2

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

WO

REPLY TO: 7310 Buildings and Other Structures
7200 Communications and Electronics

DEC 4 1978

SUBJECT: Photovoltaic Market Survey--Department of Energy

TO: Regional Foresters, Station and Area Directors

The Department of Energy has contracted with Motorola Corporation to conduct a nationwide market survey of possible sites for photovoltaic applications. The Motorola Corporation will send you a supply of survey forms within the next few weeks.

This market survey is timely and is in keeping with our current efforts in the Photovoltaic Commercialization Program (PL 95-238). The data being gathered by DOE/Motorola can be particularly beneficial to you for continued involvement with the PV Commercialization Program.

In order to make this survey information beneficial to both parties, DOE/Motorola has developed a questionnaire designed for our agency's use in surveying sites and loads which presently require onsite generation or use batteries for electrical power. In addition, you should list planned sites where use of photovoltaic cells may be a cost-effective alternative.

Motorola will supply you several hundred of the forms about the first week of December. We ask that these forms be sent to field units as needed.

All forms should be collected at the Regional or Station level and returned, as received, to:

Mr. Clyde Ragsdale
Motorola Semiconductor Products, Inc.
P. O. Box 2953
Phoenix, Arizona 85062

ATTN: Mail Dept. Z 317

All replies must be submitted by January 9, 1979. Motorola will compile the data provided for the DOE market survey.

In return for our efforts, Motorola will provide our agency a Region-by-Region printout of sites, loads and other specific data on a per-project basis. In addition, they will also provide Regional and national project lists and summaries. Specific data may be requested as well.

ORIGINAL PAGE IS
OF POOR QUALITY

Your cooperation in this survey will greatly aid DOE and the Forest Service in identifying opportunities available for photovoltaic applications.

R. M. HOUSLEY
Associate Deputy Chief

Limited Distribution

GLippert/spg/11/27/78

cc: Mr. Ragsdale-Motorola
Coorsh - Eng.
Lippert - Eng.
Moton - Comm. & Elect.

EXHIBIT 3

NASA-LEWIS/FOREST SERVICE
REMOTE VILLAGE SURVEY - PHOTOVOLTAIC USES

Region ______________________ National Forest ______________________
(Name and Number)

District ______________________ Site ______________________
(Number) (Name)

Please help us in defining potential photovoltaic electric power applications at permanent administration or project camps, stations, or recreation areas not having commercially available electric power by filling out the questionnaire below.

1. Do you presently use electricity at your site?

   ___ YES ___ NO (If NO, go to question 8)

2. What power source do you presently use to generate electricity? (Check all applicable).

   _____ Gasoline Generator
   _____ Diesel Generator
   _____ Propane Generator
   _____ Other (Please specify) ______________________

   ____

3. Approximately how old is your generator? ____________. How many generators do you have? ____________. (Note: If you have more than one generator at your site, please give the information for each generator in questions 3-6).

4. Approximately how much did it cost? (Purchase price plus installation).

   ____

   ____

5. Approximately what is your average operating and maintenance cost per month for the generator? (Include fuel, salaries, personnel performing operating and maintenance inspections, etc.)

   ____

   ____

6. What is the Kw rating of the generator? ______________________

   ____

7. Approximately how many days per year is power used at your site? ____________

   ____

8. Listed below are a number of applications for which electric power may be used. Please check (✓) each of the applications you presently use electric power for (or would use electric power for, if available). and give a brief description of the application, and a count of each type of application, as in the examples below:

EXAMPLES

_____ *Lighting (how many lights). We have 15 lights on the property, most using 100 watt bulbs.*

_____ *Water pumping. We have one well, 50 feet deep, with a 1/2 H.P. motor.*

Hours Used/Day

_____ LIGHTING (How many lights, what wattage, etc.)

_____ WATER PUMPING (If possible, give the depth of well, size of pump, length of pumping cycle, etc.)

_____ REFRIGERATION (Food or medical supply storage) _____

_____ FOOD PROCESSING (Stove, grinder, mixer) _____

_____ OTHER APPLIANCES (Heating) _____

_____ COMMUNICATIONS (Short wave radio, etc.) _____

_____ ENTERTAINMENT/EDUCATION (Radio, TV, Stereo) _____

_____ BATTERY CHARGING (For vehicles or other portable uses)

_____ OTHER EQUIPMENT (i.e., security lighting, navagation aids, ventilation, etc.) Specify _____

9. What additional electric power uses do you foresee needing in the next 5 years? (Hand tools, refrigerators, food processing, etc.)

____

____

____

10. How many residents live at your site all year-round? (Maximum number if seasonal). ______________________________

11. Approximately how many public visitors does the site have by season?

_____ Summer Visitors

_____ Fall Visitors

_____ Winter Visitors

_____ Spring Visitors

12. How many miles is your site from the nearest commercially available electric power? ______________________________

EXHIBIT 4

REPORT HEADING CODE

The first three or four columns represent the agency organization codes and specific site names.

E - type energy source currently in use at site (N - no electricity, B - battery, T - thermoelectric generator, G - gasoline generator, P - propane generator, D - diesel generator, S - solar)

AG - age of generator in years

IC - initial cost of generator in $K

OPC - monthly operating and maintenance cost of generator in dollars per month

KW - size of generator in KW output

MT - number of months of year generator is operated

Lite - KW hours per day consumed for lighting

Pump - " " " " " water pumping

Refr - " " " " " refrigerator

Food - " " " " " food processing

Appl - " " " " " other appliances

Comm - " " " " " communications

Educ - " " " " " education and entertainment

Batt - " " " " " vehicle battery charging

Other - " " " " " other loads not specified

TOTAL - " " " " " total of above

PF - factor used to calculate peak watts from KW hours per day (solar factor X 1.3 to allow sufficient voltage to charge batteries)

Array - size of array (1μ KWp) necessary to support load

$$\frac{(\text{Load X PF})}{24}$$

Future - estimate of additional load required at site in future

Res - number of full-time or part-time residents at site

Vis - number of visitors to site per year

Mtg - miles to nearest electrical grid

FOREST SERVICE

RG	FT	DS	SITE	E	AG	IC	OPC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
1	4	2	ROUND	D	20	.0	999		6	7.0	.0	1.8	.0	.0	.3	3.u	.0	1.00	13.10	9.1	5.00	.0	35		30	1
1	4	3	TRAI1	D	30	2.0	999	30	22	10.0	1.8	.0	.0	.3	.3	.2	1.0	36.10	9.10	13.7	.00	50.0	1	2K	0	
1	4	3	SPADE	N	0	.0	0		0	.3	.0	.3	.0	.0	.3	.0	.0	.00	.90	9.1	.40	.0	2	0	0	
1	4	3	LITTL	N	0	.0	0		0	.3	.0	.3	.0	.0	.3	.0	.0	.00	.90	9.1	.40	.0	2		0	
1	4	3	SPYGL	N	0	.0	0		0	.3	.0	.3	.0	.0	.3	.0	.0	.00	.90	9.1	.40	.0	2		0	
1	4	4	STJOE	D	12	3.0	30	3	12	.8	.0	.6	.0	.0	1.0	.0	.0	.10	2.50	9.1	.90	.1	3	1K	4	
1	4	6	LUNCH	N	0	.0	0		0	.3	.0	.3	.0	.0	.3	.0	.0	.00	.90	9.6	.40	.0	2	50	8	
1	4	7	ROMAN	N	0	.0	0		0	.2	.0	.3	.0	.3	.3	.0	.0	.00	1.10	9.1	.30	.0	2	50	10	
1	4	7	BUSSA	S	0	.0	0	40W	12	.1	.0	.0	.0	.0	.3	.0	.0	.00	.40	9.1	.20	.0	0	0	8	
1	4	8	HUGHE	N	0	.0	0		0	.3	.0	.3	.0	.0	.3	.0	.0	.00	.90	9.1	.40	.0	2	50	30	
1	4	8	GISBO	N	0	.0	0		0	.3	.0	.3	.0	.0	.3	.0	.0	.00	.90	9.1	.40	.0	2	150	6	
1	4	9	RED1	D	10	8.0	1500	60	7	32.0	10.0	6.9	.0	.0	.3	23.4	.0	2.0?	64.60	9.1	24.40	.0	120	2K	60	
1	5	1	HEMLO	S	4	2.0	0		12	.3	.0	.3	.0	.0	.3	.0	.0	.00	.90	9.1	.30	.0	0	0	0	
1	5	2	BALD	S	4	2.0	0	0	12	.3	.0	.3	.0	.0	.3	.0	.0	.00	.90	9.1	.30	.0	0	0	0	
1	5	3	EAGLE	S	4	2.0	0	0	12	.3	.0	.3	.0	.0	.3	.0	.0	.00	.30	9.1	.30	.0	0	0	0	
1	5	4	JUNCT	S	4	2.0	0		12	.3	.0	.3	.0	.0	.3	.0	.0	.00	.30	9.1	.30	.0	0	0	0	
1	5	5	COOLW	S	4	2.0	0		12	.3	.0	.3	.0	.0	.3	.0	.0	.00	.30	9.1	.30	.0	0	0	0	
1	5	6	MOCKE	S	4	2.0	0		12	.3	.0	.3	.0	.0	.3	.0	.0	.00	.30	9.1	.30	.0	0	0	0	
1	10	1	COON	N	0	.0	0		0	.2	.0	.3	.0	.0	.3	.2	.0	.00	1.00	9.1	.40	.0	2	100	1	
1	10	1	MISSI	N	0	.0	0	0	0	.2	.0	.3	.0	.0	.3	.2	.0	.00	1.00	9.1	.40	.0	2	100	3	
1	10	4	PRAIR	N	0	.0	0		0	2.6	.0	.9	.2	.0	.3	.5	.0	.20	4.70	9.1	1.80	.0	10	1K	97	
1	10	4	SCHAF	N	0	.0	0		0	2.0	.0	.9	.2	.5	.3	.3	.2	.20	4.60	9.1	1.70	1.5	8	500	25	
1	10	4	SPOTT	N	0	.0	0		0	.2	.0	.3	.0	.0	.3	.2	.0	.10	1.10	9.1	.40	.1	2	25	62	
1	10	4	BLACK	N	0	.0	0		0	1.3	.0	.3	.0	.0	.0	.0	.0	.00	1.60	9.1	.60	.0	20	500	76	
1	10	6	ANNA	P	4	1.8	100	5	2	3.8	.0	.9	.1	.0	.3	.2	.2	.10	5.60	9.1	2.10	.0	16	500	32	
1	10	6	DESER	T	8	3.0	100	30W	12	.1	.0	.0	.0	.0	.3	.0	.0	.00	.40	9.1	.15	.0	0	330	9	
1	10	6	FIRE	N	0	.0	0		0	.2	.0	.3	.0	.0	.3	.2	.0	.00	1.00	9.1	.40	.0	0	250	20	
1	10	6	BETTY	P	4	1.8	100	5	2	3.8	.0	.9	.1	.0	.3	.2	.2	.10	5.60	9.1	2.10	.0	16	500	34	
1	10	6	CHALL	N	0	.0	0		0	.8	.0	.6	.0	.0	.3	.0	.0	.00	1.70	9.1	.60	.1	4	2K	10	
1	10	6	SPRUC	N	0	.0	0		0	.7	.0	.6	.0	.0	.3	.0	.0	.00	1.60	9.1	.60	.1	4	2K	6	
1	10	6	GRAN	N	0	.0	0		0	.7	.0	.6	.0	.0	.3	.0	.0	.00	1.60	9.1	.60	.1	4	2K	15	
1	10	7	CYCLO	N	0	.0	0		0	.2	.0	.3	.0	.0	.3	.1	.0	.00	.90	9.1	.40	.0	2	20	25	
1	10	7	FORD	G	3	2.0	100	5	9	4.0	.5	.9	.1	.0	.3	.1	.0	.00	5.90	9.1	2.20	.4	20	300	35	
1	10	8	JOHNS	N	0	.0	0		0	.2	.0	.3	.0	.0	.3	.1	.0	.00	.90	9.1	.40	.0	2	20	3	
1	14	2	BALDY	N	0	.0	0		0	.3	.0	.3	.0	.0	.3	.0	.0	.00	.90	9.1	.40	.0	2	90	3	
1	14	3	MARST	N	0	.0	0		0	.3	.0	.3	.0	.0	.3	.0	.0	.00	.90	9.1	.40	.0	2	270	4	
1	14	4	KEEL	N	0	.0	0		0	.3	.0	.3	.0	.0	.3	.0	.0	.00	.90	9.1	.40	.0	2	90	2	
1	14	4	YAAK	N	0	.0	0		0	.3	.0	.3	.0	.0	.3	.0	.0	.00	.90	9.1	.40	.0	2	90	3	
1	14	5	SCENE	N	0	.0	0		0	.3	.0	.3	.0	.0	.3	.0	.0	.00	.90	9.1	.40	.0	1	12	6	
1	14	5	SWEDE	N	0	.0	0		0	.3	.0	.3	.0	.0	.3	.0	.0	.00	.90	9.1	.40	.0	2	90	4	
1	14	5	BIGCR	N	0	.0	0	0	0	.3	.0	.3	.0	.0	.3	.0	.0	.00	.90	9.1	.40	.0	2	90	14	
1	14	6	CALX	N	0	.0	0		0	.3	.0	.3	.0	.0	.3	.0	.0	.00	.90	9.1	.40	.0	2	12	5	
1	14	6	KENEG	N	0	.0	0		0	.3	.0	.3	.0	.0	.3	.0	.0	.00	.90	9.1	.40	.0	2	24	3	
1	14	6	ZIEGL	N	0	.0	0		0	.3	.0	.3	.0	.0	.3	.0	.0	.00	.90	9.1	.40	.0	2	90	16	
1	14	7	GEM	N	0	.0	0		0	.3	.0	.3	.0	.0	.3	.0	.0	.00	.90	9.1	.40	.0	2	12	6	
1	15	1	INDIA	N	0	.0	0	0	0	.3	.0	.0	.0	.0	.0	.0	.0	.00	.30	9.1	.10	.0	0	0	21	
1	15	1	PRETT	N	0	.0	0	0	0	.3	.0	.0	.0	.0	.0	.0	.0	.00	.30	9.1	.10	.0	0	0	28	
1	15	1	PALOO	N	0	.0	0		0	.1	.0	.0	.0	.0	.0	.0	.0	.00	.10	9.1	.04	.0	0	0	0	
1	15	1	BENCH	N	0	.0	0		0	.3	.0	.0	.0	.0	.0	.0	.0	.00	.30	9.1	.10	.0	0	0	12	
1	15	1	ROCK	N	0	.0	0		0	.3	.0	.0	.0	.0	.0	.0	.0	.00	.30	9.1	.10	.0	0	0	29	
1	15	1	GATES	N	0	.0	0		0	1.6	.3	.0	.0	.0	.3	.0	.0	.00	2.20	9.1	.80	.0	2	0	20	
1	15	1	WESTF	N	0	.0	0		0	.3	.3	.0	.0	.0	.0	.0	.0	.00	.60	9.1	.20	.0	0	0	8	
1	15	1	BADGE	N	0	.0	0		0	.3	.0	.0	.0	.0	.0	.0	.0	.00	.30	9.1	.10	.0	1	0	10	
1	15	1	WRONG	N	0	.0	0	0	0	.1	.0	.0	.0	.0	.0	.0	.0	.00	.10	9.1	.04	.0	0	0	14	
1	15	1	WELCO	N	0	.0	0		0	.3	.0	.0	.0	.0	.0	.0	.0	.00	.30	9.1	.10	.0	0	0	10	

ORIGINAL PAGE IS OF POOR QUALITY

1	15	1	CABIN	N	0	.0	0		0	.3	.0	.0	.0	.0	.0	.0	.0	.00	.30	9.1	.10	.0	0	0	14	
1	15	1	GREEN	N	0	.0	0		0	.3	.0	.0	.0	.0	.0	.0	.0	.00	.30	9.1	.10	.0	0	0	15	
1	15	4	RADIO	N	0	.0	0		0	.3	.0	.0	.0	.0	.3	.0	.0	.00	.60	9.1	.20	.0	0	0	8	
1	15	4	HIGHW	N	0	.0	0		0	.1	.0	.0	.0	.0	.0	.0	.0	.00	.10	9.1	.04	.0	2	9	0	
1	15	4	JUDIT	N	0	.0	0		0	.1	2.7	.0	.0	.0	.3	.0	.0	.00	3.10	9.1	1.20	.0	0	5	10	
1	15	4	DRYWO	N	0	.0	0		0	.1	.0	.0	.0	.0	.0	.0	.0	.00	.10	9.1	.04	.0	2	0	7	
1	15	4	CRYST	N	0	.0	0		0	.1	.0	.0	.0	.0	.0	.0	.0	.00	.10	9.1	.04	.0	0	4	0	
1	16	0	MOBIL	N	0	.0	0		0	1.2	.0	.3	.0	.0	.3	.0	.0	.00	1.80	9.1	.70	.3	4	10	15	PORTA
1	16	3	WHITE	S	2	.0	0		12	1.0	.0	.3	.0	.0	.3	.1	.2	.00	1.90	9.1	.70	.3	0	20	10	
1	16	6	ARROW	U	0	.0	0	2	12	1.0	.0	.3	.0	.0	.3	.1	.2	.00	1.90	9.1	.70	.3	0	200	0	
	TOTAL									86.4	15.6	25.8	.7	1.1	15.7	29.1	2.0	39.90	163.30	596.6	59.75	53.3				

RG	FT	DS	SITE	E	AG	IC	OPC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
2	2	6	GOOSE	P	5	11.1	150	15	5	2.9	5.6	.0	.0	.0	.0	2.0	1.0	.00	10.50	7.8	3.40	.3	25	3K	10	
2	4	2	COLDS	N	0	.0	0		0	.5	5.0	.3	.0	.0	.3	.1	.0	.00	6.20	7.8	2.00	.0	6	0	0	
2	4	6	JACKS	N	0	.0	0		0	.6	3.3	.3	.0	.0	.0	.0	.0	.00	4.20	7.8	1.40	.0	2	0	2	
2	4	6	MESA	G	10	.0	0	5	3	1.6	1.6	.6	.0	.0	.3	.0	.0	.00	4.10	7.8	1.30	.0	12	0	12	
2	4	6	COLUM	G	0	.0	0	2.5	3	1.0	.0	.3	.0	.0	.0	.0	.0	.00	1.30	7.8	.40	.0	4	0	10	
2	4	7	LONGB	N	0	3.3	0		0	.7	3.3	.0	.0	.3	.3	.0	.0	.00	4.60	7.8	1.50	.0	8	0	3	
2	6	4	JACK	N	0	.0	0		0	1.8	1.3	.0	.2	.0	.0	.4	.0	.00	3.70	7.8	1.20	.2	8	40	25	
2	6	4	SAND1	D	1	5.6	400	20	6	16.0	.0	.0	1.2	.0	.3	.8	.0	.40	18.70	7.8	6.00	.2	12	280	10	
2	6	6	PREL1	G	1	4.5	300	12.5	5	4.8	.0	.0	.0	.0	.3	.6	.0	.00	5.70	7.8	1.80	.3	4	70	15	
2	9	5	ALDER	N	0	.0	0		0	.2	1.3	.0	.0	.0	.0	.0	.0	.00	1.50	7.8	.50	.3	5	0	2	
2	9	6	BREWE	N	0	.0	0		0	.2	1.2	.0	.0	.0	.0	.0	.0	.00	1.50	7.8	.50	.3	5	0	2	
2	9	6	CARNE	N	0	.0	0		0	.0	1.3	.0	.0	.0	.0	.0	.0	.90	2.40	7.8	.80	.3	5	0	10	
2	13	2	GLADE	N	0	.0	0		0	1.2	3.8	.3	.0	.0	.0	.1	.0	.00	5.40	7.8	1.80	.0	6	80	20	
2	13	5	ASPEN	N	0	.0	0		0	1.2	3.8	.3	.0	.0	.0	.1	.0	.00	5.40	7.8	1.80	.0	6	80	5	
TOTAL										32.7	31.5	2.1	1.4	.3	1.5	4.1	1.0	1.30	75.20	109.2	24.40	1.9				

RG	FT	JS	SITE	E	AG	IC	OPC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
3	1	1	CALDW	N	15	2.5	110		12	.5	.0	1.2	.0	.0	.0	.9	.0	.10	2.70	6.5	.70	.3	7	0	12	
3	1	3	STRA1	D	22	.0	200	7.5	9	12.0	.0	2.4	.0	.0	.9	4.2	.2	1.20	20.90	6.5	5.70	2.0	25	300	12	
3	1	3	TRAI1	G	30	.0	150	5	50	3.2	.0	.6	.0	.0	.0	.3	.0	.00	4.10	6.5	1.10	.5	4	90	35	
3	1	4	WOODS	N	0	.0	0		0	.6	.0	1.2	.0	.0	.3	2.4	.0	.30	4.80	6.5	1.30	2.0	12	0	6	
3	2	3	MESTE	T	15	2.0	70	7W	12	.2	.0	.0	.0	.0	.3	.0	.0	.00	.50	6.5	.10	.0	0	300	30	
3	6	1	BEAV1	D	2	12.0	600	25	12	10.0	3.7	2.4	.5	4.5	.3	25.2	.0	.00	46.60	6.5	12.60	.0	24	0	25	
3	6	5	MEOWN	D	30	.0	150	5	1	5.7	.0	.6	.0	.0	.0	.0	.0	.00	6.30	6.5	1.70	.0	0	65	35	
3	6	6	NEGR1	D	10	5.0	200	12	9	7.2	.0	.9	.0	.8	.3	.0	.0	.00	9.20	6.5	2.50	.0	50	0	34	
3	6	7	SIGNA	S	0	.0	0		12	.1	.0	.3	.0	.0	.3	.4	.0	.00	1.10	6.5	.30	.0	2	0	7	
3	7	1	WHITE	D	0	.0	0		0	1.0	.0	.9	.0	.0	.3	.0	.2	2.00	4.40	6.5	1.20	.0	2	38K	4	
3	7	2	REDB	N	0	.0	0		0	.7	.0	.3	.3	.0	.3	1.2	.0	.00	2.80	6.5	.80	.0	2	350	3	
3	7	2	REDHI	N	0	.0	0		0	.5	.0	.3	.3	.0	.3	1.2	.0	.00	2.60	6.5	.70	.0	0	950	5	
3	7	2	KENDR	N	0	.0	0		0	.7	.0	.3	.5	.0	.3	1.2	.0	.00	3.00	6.5	.80	.0	2	275	4	
3	7	3	DRYF	N	0	.0	0		0	.5	.0	.3	.3	.0	.3	.8	.0	.00	2.20	6.5	.60	.0	2	190	1	
3	7	4	HULLC	N	0	.0	0		0	.8	.0	.3	.3	.0	.3	.8	.0	.00	2.50	6.5	.70	.0	5	550	1	
3	7	4	GRAND	N	0	.0	0		0	.7	.0	.3	.3	.0	.3	.8	.0	.00	2.40	6.5	.70	.0	4	700	1	
3	9	2	HORSE	N	0	.0	0		0	.6	.0	.9	.0	.0	.3	1.0	.0	.07	2.90	6.5	.80	.5	2	1K	2	
3	9	6	CWOOD	N	0	.0	0		0	.5	.3	.0	.0	.0	.0	.0	.0	.15	1.00	6.5	.30	.0	2	0	12	
3	9	6	HYDE	N	0	.0	0		0	.2	.1	.6	.0	.0	.3	1.2	.0	.00	2.40	6.5	.65	.5	2	500	13	
3	9	6	WALNU	P	1	8.0	200	12	11	13.9	.4	.0	.0	.0	.0	1.0	.0	10.00	25.30	6.5	6.90	7.0	20	0	13	
3	10	3	PELAD	P	5	1.0	50	20W	12	.2	.0	.3	.0	.0	.3	.0	.0	.00	.80	6.5	.20	.2	2	0	5	
3	12	3	SUNF	D	15	2.5	110	10	12	3.8	15.0	1.8	1.6	.0	.3	.8	.0	.30	22.30	6.5	6.00	30.0	16	0	45	
	TOTAL									63.5	19.5	15.9	4.1	5.3	5.7	43.4	.4	14.12	170.80	143.0	46.35	43.0				

RG	FT	DS	SITE	E	AG	IC	OPC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
4	2	2	LONG	P	10	1.0	35	7	5	1.2	.0	.0	.0	.0	.0	.3	.0	.00	1.50	7.8	.49	1.8	15	65	3	
4	2	2	ATLTA	U	0	.0	0		5	.5	1.7	1.2	.0	.0	.0	.4	.0	.00	3.40	7.8	1.11	.0	7	50	0	
4	2	2	COTN1	D	2	1.5	300	8	7	3.2	.0	.3	.0	.0	.0	.5	.0	.00	4.00	7.8	1.30	2.4	15	110	10	
4	2	2	DUTC1	D	3	1.5	300	8	6	9.8	.0	1.2	.0	.0	.0	1.0	.0	.00	12.00	7.8	3.90	3.0	37	170	18	0
4	2	3	REAV	D	1	3.5	109	6	8	1.4	.0	1.2	.0	.0	.0	.2	.0	.00	2.80	7.8	.91	2.5	50	100	20	
4	2	4	LAND1	G	1	1.0	100	7	5	9.0	.0	3.3	.0	.0	.3	.0	.3	1.00	13.90	7.8	4.52	.0	35	3K	7	SCCLT
4	2	6	BONG	G	4	.3	10	3	3	.2	.0	.0	.0	.0	.0	.0	.0	.00	.20	7.9	.07	.0	6	300	20	
4	2	6	SAGHN	P	30	.8	15	7	4	.4	.0	.0	.0	.0	.0	.0	.0	.00	.40	7.8	.13	.0	8	3K	13	
4	2	6	SILVR	G	4	.3	10	3	3	.1	.0	.0	.0	.0	.0	.0	.0	.00	.10	7.8	.03	.0	8	1K	30	
4	2	6	THIRD	P	30	.8	15	7	4	.9	.6	.0	.0	.0	.0	.0	.0	.00	1.50	7.8	.49	.0	12	10	20	
4	5	3	8MILE	G	15	.0	0	5	3	.6	.0	.9	.0	.0	.0	.0	.0	.00	1.50	7.8	.49	.0	5	0	5	
4	5	3	MINNE	D	5	5.8	0	20	3	18.0	.0	.0	.0	.0	.0	.0	.0	.00	18.00	7.8	5.85	.0	0	16K	8	
4	5	4	DCYCC	N	0	.0	0		0	3.6	.0	11.0	.2	.0	.0	.0	.0	4.00	18.80	7.8	6.10	.0	40	0	5	TOOL
4	6	3	CUSTR	D	0	2.6	75	6	3	1.6	.0	.0	.0	.0	.0	1.8	.0	.00	3.40	7.8	1.11	4.0	5	15K	12	
4	6	3	YCC	D	0	3.5	100	12	3	4.0	.0	3.6	.6	.0	.0	.8	.0	.00	9.00	7.8	2.93	3.2	41	150	10	
4	6	4	FAIR	D	13	5.0	50	5	5	.8	.0	.0	.0	.0	.0	.2	.0	.00	1.00	7.8	.33	.0	0	2K	10	
4	8	1	REDV	G	5	.3	100	2	4	1.2	.0	.6	.0	.0	.0	1.2	.0	.00	3.00	7.8	.98	.0	10	0	10	
4	8	1	OAKC	G	5	.3	100	2	2	1.2	.0	.3	.0	.0	.0	1.2	.0	.00	2.70	7.8	.88	.0	4	0	6	
4	8	1	INDI	G	5	.3	100	2	1	.7	.0	.3	.0	.0	.0	.6	.0	.00	1.60	7.8	.52	.0	4	0	15	
4	8	2	ELKH	G	5	.3	100	2	2	1.2	.0	.6	.0	.0	.0	1.2	.0	.00	3.00	7.8	.98	.0	10	0	15	
4	8	2	CLEA	G	5	.3	100	2	3	1.0	.0	.6	.0	.0	.0	1.2	.0	.00	2.80	7.8	.91	.0	10	0	10	
4	8	3	BIGF	G	5	.3	100	2	4	2.4	.0	.6	.0	.0	.0	1.2	.0	.00	4.20	7.8	1.37	.0	15	0	12	
4	8	3	BELK	G	5	.3	100	2	1	1.0	.0	.6	.0	.0	.0	1.2	.0	.00	2.80	7.8	.91	.0	8	0	6	0
4	8	3	INSP	G	5	.3	100	2	2	1.0	.0	.6	.0	.0	.0	.0	.0	.00	1.60	7.8	.52	.0	10	0	15	
4	8	4	GOOS1	G	5	25.0	100	2	4	5.6	.0	3.3	.0	.0	.0	6.4	.2	.00	15.50	7.8	5.04	7.0	100	0	10	
4	8	4	KOOS	G	5	.3	100	2	2	1.0	.0	.6	.0	.0	.0	1.2	.0	.00	2.80	7.8	.91	.0	15	0	10	
4	8	4	MT.T	G	5	.3	100	2	3	1.0	.0	.6	.0	.0	.0	1.2	.0	.00	2.80	7.8	.91	.0	10	0	16	
4	10	2	OLSEN	G	18	.0	350	8	4	1.5	.0	.6	.0	.0	.3	.7	.0	.20	3.30	78.8	1.10	3.8	16	0	11	TOOL
4	10	2	INDCR	G	0	.9	0	4	3	1.7	.0	.6	.0	.0	.3	.7	.0	.20	3.50	7.8	1.14	1.0	13	0	20	TOOL
4	10	3	MAMTH	N	0	.0	0		0	.6	.0	.6	.0	.0	.3	.0	.3	.00	1.80	7.8	.59	.6	12	0	9	0
4	10	3	LAKEG	N	0	.0	0		0	.3	.0	.3	.0	.6	.3	.0	.2	.00	1.70	7.8	.55	.8	4	0	10	
4	10	3	STURT	N	0	.0	0		0	.8	.0	.3	.0	1.2	.3	.0	.3	4.00	6.90	7.8	2.24	.3	12	0	8	TOOL
4	10	4	BUCK	G	3	.7	125	4	4	1.5	.0	.3	.0	.0	.3	1.3	.0	.00	3.40	7.8	1.11	.0	15		12	
4	10	4	WARNR	N	0	.0	0		0	.8	.0	.3	.0	.0	.3	1.3	.0	.00	2.70	7.8	.88	.0	10	4K	3	
4	10	5	KIGAL	N	0	.0	0		0	.6	.6	.3	.0	.0	.3	.2	.0	2.00	4.00	7.8	1.30	2.0	10	750	30	TOOL
4	10	5	GOOS	N	0	.0	0		0	.6	1.3	.6	.0	.0	.3	.2	.0	.00	3.00	7.8	.98	2.0	10	750	30	
4	13	1	YJGS	N	0	.0	0		0	4.2	.0	1.2	1.0	.0	.3	1.0	.0	.60	8.30	7.8	2.70	3.5	14	50	18	SCCLT
4	13	2	NOLA1	D	0	6.0	250	15	7	7.2	.0	.6	.0	.0	.3	.0	.3	1.00	9.40	7.8	3.06	9.4	15	330	11	SCCLT
4	14	3	GARF	N	0	.0	0		0	.3	2.5	.3	.3	.0	.3	.8	.0	2.00	6.50	7.8	2.11	.0	4	0	0	TOOL
4	14	4	BOWR	N	0	.0	0		0	.3	.0	.3	.3	.0	.3	.8	.0	2.00	4.00	7.8	1.30	.0	3	0	15	TOOL
4	17	4	SMOK	O	0	.0	0		0	24.0	7.5	3.3	13.2	.0	.3	6.6	.0	2.70	57.60	7.8	18.72	11.0	70	320	0	TRAIL
4	17	4	MEAD	N	0	.0	0		0	3.2	7.5	1.2	2.4	.0	.3	2.4	.0	1.80	18.80	7.8	6.11	1.8	30	51	80	TRAIL
4	17	5	LEEC	N	0	.0	0		0	16.0	7.5	.6	.0	.0	.6	2.4	.0	.50	27.60	7.8	8.97	.0	15	5K	20	SCCLT
4	18	1	MILL	N	0	.0	0		0	.9	.0	.3	.2	.0	.3	1.3	.0	.00	3.00	7.8	.98	4.0	10	39K	8	
4	18	1	BIGSP	N	0	.0	0		0	1.4	1.7	.6	.2	.0	.3	1.3	.0	2.50	8.00	7.8	2.60	4.0	12		4	TOOL
4	18	2	TIMP	N	0	.0	0		0	.4	.0	.3	.3	.0	.3	.8	.0	.00	2.10	7.8	.68	.0	6	150	5	
4	18	3	DIAM	N	0	.0	0		0	.4	2.1	.6	.0	.0	.0	1.3	.2	.00	4.60	7.8	1.50	.0	6	0	15	0
4	18	3	FAYSN	N	0	.0	0		0	.6	.0	.6	.5	.0	.0	.2	.2	2.10	4.20	7.8	1.37	2.6	6	0	8	TOOL
4	18	3	BMORE	G	3	1.0	25	5	3	1.2	7.5	.9	1.0	.3	.2	.6	.2	.20	12.10	7.8	3.93	.0	10	0	5	AIDS
4	19	1	SWILL	G	0	.0	0	8	4	.8	.0	.0	.0	.0	.0	.8	.0	.00	1.60	7.8	.52	1.9	15	500	20	
4	19	3	HIGH	N	0	.0	0		3	.1	.0	.3	.0	.0	.0	.6	.2	.00	1.20	7.8	.40	2.0	3	100	0	
4	19	3	MIROR	G	0	.0	0	8	3	.8	.0	.0	.0	.0	.0	.8	.2	.00	1.80	7.8	.59	2.9	6	3K	20	
4	19	3	LEDGE	G	10	.0	0	8	3	.8	.0	.0	.0	.0	.0	.8	.0	.00	1.60	7.8	.52	3.5	6	500	4	
4	19	4	MILL	G	10	.0	0	10	6	1.6	.0	.0	.0	.0	.0	.4	.2	1.60	3.80	7.8	1.24	3.5	25	1K	6	TOOL
4	19	4	EBLAK	G	0	.0	0	8	6	.6	.0	.0	.0	.0	.0	.8	.2	.00	1.60	7.8	.52	2.9	10	100	30	

4	19	5	BLAKE	G	0	.0	0	8	6	.6	5.0	.0	.0	.0	.0	.8	.2	.00	6.60	7.8	2.15	4.4	25	1K	25	
4	19	5	HEWEN	N	0	.0	0		0	.5	2.5	.0	.0	.0	.0	.8	.2	.00	4.00	7.8	1.30	2.9	5	20	30	
4	19	6	CURTS	N	0	.0	0		0	.5	2.5	.0	.0	.0	.0	.8	.2	.00	4.00	7.8	1.30	1.6	5	100	20	
4	19	6	MONTE	P	5	.0	0	10	6	1.6	.8	.0	.0	.0	.3	.4	.2	1.00	4.30	7.8	1.07	4.8	10	700	4	TOOL
4	19	7	ELK	N	0	.0	0		0	.5	4.9	.3	.0	.0	.0	.5	.2	.00	6.40	7.8	2.08	1.6	5	10	30	
4	19	7	TONY	N	0	.0	0		0	.5	.0	.3	.0	.0	.0	.5	.2	.00	1.50	7.8	.49	1.6	5	2K	20	
4	19	7	BLAC	G	0	.0	0	8	6	.8	.0	.3	.0	.0	.0	.8	.2	.00	2.10	7.8	.68	1.6	4	1K	4	
			TOTAL							150.8	56.2	47.3	20.2	2.1	6.8	54.5	4.4	29.40	371.30	554.7	120.47	105.9				

RG	FT	DS	SITE	E	AG	IC	OPC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
6	1	1	FALL	N	0	.0	0		0	1.0	3.8	.3	.0	.0	.3	2.0	.2	2.00	9.60	10.4	4.20	.0	1	850	4	
6	1	1	ROUND	N	0	.0	0		0	.4	.0	.3	.0	.0	.6	.2	.0	2.40	3.90	10.4	1.70	.0	2	275	8	
6	1	3	CHINA	P	2	4.0	20	15	6	.6	1.9	.0	.0	.0	.0	.0	.0	.00	2.50	10.4	1.10	.0	5	300	20	
6	1	3	CABIN	P	2	4.0	200	15	5	1.2	50.0	.0	.0	.0	.0	.0	.0	.00	51.20	10.4	22.20	.0	10	250	6	
6	1	5	MONTY	N	0	.0	0		0	.3	.0	.3	.8	.0	.3	.1	.2	.00	2.00	10.4	.90	.5	2	150	10	
6	1	5	BLOCK	N	0	.0	0		0	.3	.0	.3	.8	.0	.3	.1	.0	.00	1.80	10.4	.80	.5	1	550	6	
6	1	5	GREEN	N	0	.0	0		0	.3	.0	.3	.3	.0	.3	.1	.0	.00	1.30	10.4	.60	.0	1	300	20	
6	2	1	HORSE	B	0	.0	12		4	.3	.0	.3	.0	.0	.3	.0	.0	.10	1.00	10.4	.40	.0	1	28	5	
6	2	2	ASPEN	N	0	.0	0		0	.3	.0	.3	.0	.0	.1	.0	.0	.00	.66	10.4	.30	.0	3	30	6	
6	2	2	DOGM	N	0	.0	0		0	.1	.0	.3	.0	.0	.0	.0	.0	.00	.40	10.4	.20	.0	1	30	11	
6	2	2	COTT	G	20	.0	150	2.4	2	1.2	.0	.2	.0	.0	.0	.0	.0	.00	1.50	10.4	.70	.8	70	280	8	
6	2	2	DRAKE	N	0	.0	0	0	0	.1	.0	.3	.0	.0	.0	.0	.0	.00	.40	10.4	.20	.0	1	150	10	
6	2	2	DOGL	N	0	.0	0		0	.7	.0	1.8	.0	.0	.0	.0	.0	.00	2.50	10.4	1.10	.2	9	50	7	
6	2	3	THOMA	D	2	5.0	100	7.5	6	.7	.0	.0	.0	.1	.0	.1	.0	.00	.90	10.3	.40	.0	30	75	6	
6	2	3	SKULL	G	5	1.5	50	2.5	4	1.4	.0	.0	.0	.0	.0	.1	.0	.00	1.50	10.4	.70	.0	16	40	12	
6	2	3	MORGA	N	0	.0	0		0	.2	.0	.0	.0	.0	.1	.0	.0	.00	.30	10.4	.13	.0	0	0	0	
6	2	3	CURRI	N	0	.0	0		0	1.0	1.3	.9	1.0	.0	.3	.6	.5	.70	6.30	10.4	2.70	.0	20	45	11	
6	2	3	FREMO	N	0	.0	0		0	.2	.0	.0	.0	.0	.1	.0	.0	.00	.30	10.4	.13	.0	0	0	0	
6	2	4	BALD	N	0	.0	0		0	.2	.0	.0	.0	.0	.4	.0	.0	.00	.60	10.4	.26	.0	0	0	0	
6	2	4	WICKI	N	0	.0	0		0	.5	.2	.6	.0	.0	.3	2.4	.0	.00	4.00	10.4	1.70	.5	8	70	9	
6	2	4	HAGER	N	0	.0	0		0	.2	.0	.0	.0	.0	.1	.0	.0	.00	.30	.0	.00	.0	0		0	
6	2	4	THOMP	N	0	.0	0		0	.3	1.3	.3	.0	.0	.3	1.2	.0	.00	3.40	10.4	1.50	.5	4	200	2	
6	3	1	HELEN	D	1	24.0	2000	130	12	8.0	6.2	21.8	.0	.0	1.8	18.0	.2	2.90	58.90	10.4	25.50	2.0	50	8K	18	
6	3	1	SPIR1	G	10	1.0	10	3.5	5	12.0	.0	22.3	.0	.0	.6	4.0	.0	4.00	42.90	10.4	18.60	5.0	50	127K	18	6
6	3	4	WALPU	N	0	.0	0		0	1.2	1.9	.3	.0	.0	.0	.1	.0	1.00	4.50	10.4	2.00	.0	1	15K	3	
6	3	4	LAWIS	N	0	.0	0		0	3.2	1.9	.3	.0	.0	.0	.4	.0	2.00	7.80	10.4	3.40	.0	1	45K	6	
6	4	1	FLAGT	N	0	.0	0		0	.2	.0	.3	.0	.0	.3	.1	.0	.00	.90	10.4	.40	.1	2	50	8	
6	4	1	DEER	N	0	.0	0		0	.2	.0	.3	.0	.3	.1	.0	.0	.90	1.80	10.4	.20	3.0	100	100	0	
6	4	1	FALL	N	0	.0	0		0	.1	.0	.3	.0	.0	.3	.1	.0	.00	.80	10.4	.35	.1	2	100	8	
6	4	3	MYRTL	N	0	.0	0		0	.2	.0	.3	.0	.3	.1	.0	.0	.90	.00	10.4	.40	.1	2	100	20	
6	4	3	KING	N	0	.0	0		0	.1	.0	.3	.0	.0	.3	.0	.0	.00	.70	10.4	.30	.1	2	0	10	
6	4	3	SUGAR	N	0	.0	0		0	.1	.0	.3	.0	.0	.3	.1	.0	.00	.80	10.4	.35	.1	2	100	30	
6	4	3	CALAM	N	0	.0	0		0	.1	.0	.3	.0	.0	.3	.1	.0	.00	.80	10.4	.35	.1	2	100	15	
6	4	5	DIXIE	S	2	.0	0		4	.1	.0	.3	.0	.0	.0	.0	.0	.00	.40	10.4	.20	.1	1	0	5	
6	4	5	INDIA	N	0	.0	0		0	.1	.0	.3	.0	.0	.3	.1	.0	.00	.80	10.4	.35	.1	2	160	20	
6	4	6	FRAZI	N	0	.0	0		0	.2	.0	.3	.0	.0	.3	.1	.0	.00	.90	10.4	.40	.1	2	150	40	
6	4	6	SHORT	N	0	.0	0		0	.3	.0	.3	.0	.0	.3	.1	.0	.00	1.00	10.4	.40	.1	4	50	40	
6	4	6	ANTEL	N	0	.0	0		0	.2	.0	.3	.0	.0	.3	.1	.0	.00	.90	10.4	.40	.1	2	150	40	
6	4	6	CRANE	D	8	3.5	100	16.5	4	3.0	.0	1.2	.0	2.0	.0	.3	.0	1.20	7.70	10.4	3.30	.2	30	60	40	
6	5	3	HEATH	D	0	.0	125		4	1.4	.0	.6	.0	.1	.3	.1	.0	.10	2.60	10.4	1.10	.0	8	275	14	
6	5	3	HEAT1	G	0	.0	0	50	12	3.8	10.0	.6	.0	.0	.0	.0	.4	.50	15.30	10.4	6.70	.0	1	0	13	
6	6	2	CLACK	N	0	.0	0		0	1.0	1.2	.9	.0	.0	.0	.0	.0	.00	3.10	10.4	1.40	.0	8	0	4	
6	6	2	CLEAR	W	8	1.0	10	.2	12	.1	.0	.0	.0	.0	.3	.0	.0	.00	.40	10.4	.20	.0	2	0	20	
6	6	9	HICKM	N	0	.0	0		0	.1	.0	.0	.0	.0	.9	.0	.0	.00	1.00	10.4	.40	.0	2	0	8	
6	8	3	BETH	D	1	3.6	50	2	4	5.0	3.7	.0	.0	.0	.0	.0	.0	.00	8.70	10.4	3.80	.0	0	1K	5	
6	8	3	BONAP	N	0	.0	0		0	.4	1.2	.3	.0	.0	.0	1.2	.0	.00	3.10	10.4	1.40	.0	0	700	15	
6	8	3	CORNE	N	0	.0	0		0	.4	.0	.3	.0	.0	.0	1.2	.0	.00	1.90	10.4	.80	.0	2	235	10	
6	10	1	SQUAW	P	6	2.0	500	.5	12	.4	.0	.3	.0	.0	.3	.0	.0	.00	1.00	10.4	.43	.1	0	200	5	
6	10	1	DUTCH	N	0	.0	0		0	.4	.0	.3	.0	.0	.3	.0	.0	.00	1.00	10.4	.43	.1	0	200	5	
6	10	2	BIGEL	N	0	.0	0		0	.3	.0	.3	.0	.0	.3	.4	.0	.00	1.30	10.4	.60	.1	4	100	5	
6	10	2	ROBIN	N	0	.0	0		0	.4	.0	.3	.0	.0	.3	.0	.0	.00	1.00	10.3	.43	.1	0	200	5	
6	10	3	IMNAH	N	0	.0	0		0	.7	.0	.3	.0	.0	.3	.4	.0	.00	1.70	10.4	.70	.1	5	100	10	
6	10	3	RUSTL	N	0	.0	0		0	.4	.0	.3	.0	.0	.3	.0	.0	.00	1.00	10.4	.43	.1	0	200	5	
6	10	6	HALLS	N	0	.0	0		0	.4	.0	.3	.0	.0	.3	.0	.0	.00	1.00	10.4	.43	.1	0	200	5	
6	11	1	QUAIL	N	0	.0	0		0	.2	.0	.3	.0	.0	.3	.1	.0	.00	.90	10.4	.40	.0	1	0	15	

6	11	2	ONION	N	0	.0	0		0	.2	.0	.3	.0	.0	.3	.1	.0	.00	.90	10.4	.40	.0	1	0	10
6	11	3	LAKE	N	0	.0	0		0	.2	.0	.3	.0	.0	.3	.1	.0	.00	.90	10.4	.40	.0	1	0	5
6	11	4	BOLAN	N	0	.0	0		0	.2	.0	.3	.0	.0	.3	.1	.0	.00	.90	10.4	.40	.0	1	0	12
6	11	5	BALD	N	0	.0	0		0	.2	.0	.3	.0	.0	.3	.1	.0	.00	.90	10.4	.40	.0	1	0	10
6	14	2	BULL	N	0	.0	0		0	.6	.0	.6	.3	.0	.0	.3	.0	.40	2.30	10.4	1.10	.4	3	1K	3
6	14	2	FINLA	N	0	.0	0		0	.1	.0	.0	.0	.0	.0	.0	.0	.50	.60	10.4	.30	1.0	0	6K	8
6	14	2	TAMAR	N	0	.0	0		0	.5	.0	.3	.3	.0	.3	1.2	.0	.40	3.00	10.4	1.30	.2	1	0	15
6	14	2	FAIRV	N	0	.0	0		0	.6	.0	.0	.0	.0	.0	.0	.0	.60	1.20	10.4	.50	.9	0	2K	6
6	14	2	MADIS	N	0	.0	0		0	[illegible]	.0	.3	.3	.0	.3	.4	.0	.20	1.70	10.4	.74	.2	1	0	11
6	14	2	DITCH	N	0	.0	0		0	.7	.0	.3	.3	.0	.3	.4	.0	.60	2.60	10.4	1.10	.4	3	400	6
6	14	2	BULL	N	0	.0	0		0	.6	.0	.0	.0	.0	.0	.0	.0	1.60	2.20	10.4	1.00	2.0	0	8K	3
6	14	3	HIGH	N	0	.0	0		0	.5	.0	.3	.0	.0	.0	.0	.0	.00	.80	10.4	.35	.0	1	40	5
6	14	3	SUMMI	G	0	.0	0		5	1.6	.0	1.2	.0	.0	.3	.1	.0	.00	3.20	10.4	1.40	.0	6	25	15
6	14	3	GOODM	N	0	.0	0		0	.5	.0	.3	.0	.0	.0	.0	.0	.00	.80	10.4	.35	.0	1	40	9
6	14	4	CLEAR	D	7	6.0	500	12	5	2.4	.0	.9	.6	.0	.0	2.0	.0	2.00	7.90	10.4	3.40	.6	35	0	10
6	14	6	BDCAM	N	0	.0	0		0	2.4	.0	.9	.0	.0	.3	.1	.0	.00	3.70	10.4	1.60	.0	8	5	15
6	14	6	TABLE	N	0	.0	0		0	.8	.0	.3	.0	.0	.6	.1	.0	.60	2.40	10.4	1.00	.0	2	175	20
6	14	6	FRY	N	0	.0	0		0	1.2	.0	.3	.0	.0	.3	.1	.0	.00	1.90	10.4	.80	1.0	4	70	10
6	14	6	LONG	P	4	3.0	40	3	7	5.0	3.8	.9	.0	.0	.3	1.6	.0	.00	11.60	10.4	5.00	.0	12	60	14
6	14	6	BONE	N	0	.0	0		0	.3	.0	.3	.0	.0	.3	.2	.0	.00	1.10	10.4	.50	.0	1	120	20
6	14	6	LOOKO	N	0	.0	0		0	.5	.0	.3	.0	.0	.3	.1	.0	.00	1.20	10.4	.50	.0	3	80	20
6	15	5	ILLAH	N	0	.0	0		0	.3	.0	.3	.0	.0	.0	.3	.0	.00	.90	10.4	.40	.0	1	50	4
6	16	4	ANTLE	N	0	.0	0		0	.8	1.0	.3	.0	.0	.0	.8	.0	.00	2.90	10.4	1.30	.0	0	0	10
6	16	8	FRAZI	N	0	.0	0		0	.1	.0	.3	.0	.0	.3	.0	.0	.00	.70	10.4	.30	.0	2	0	2
6	16	8	PROMI	N	0	.0	0		0	.1	.0	.3	.0	.0	.3	.0	.0	.00	.70	10.4	.30	.0	2	0	8
6	16	8	COLOR	G	16	2.2	85	4.5	5	1.1	.0	.0	.0	.0	.0	.0	.0	.40	1.50	10.4	.70	.0	8	0	16
6	16	8	MULEP	N	0	.0	0		0	.1	.0	.3	.0	.0	.3	.0	.0	.00	.70	10.4	.30	.0	2	0	20
6	16	9	TABLE	N	0	.0	0		0	.3	.0	.3	.0	.0	.6	.8	.0	.00	2.00	10.4	.90	.0	1	100	30
6	16	10	ROUND	D	10	15.0	250		4	2.4	10.0	.0	.0	.0	.3	.0	.0	.00	12.70	10.4	5.50	.0	10	275	2
6	16	10	PHILL	N	0	.0	0		0	12.0	.0	1.2	.6	.0	.0	.4	.0	1.40	15.60	10.4	6.80	.5	25	0	1
6	16	10	4LOOK	N	0	.0	0		0	.3	.0	1.2	.0	.0	.0	.0	.0	.00	1.50	10.4	.65	.5	4	900	20
6	18	1	BUCK	T	5	1.5	500	25W	12	.1	.0	.0	.0	.0	.3	.0	.0	.00	.40	10.4	.20	.0	0	300	10
6	18	1	BOXC	N	0	.0	0		0	1.2	.0	.6	.0	.0	.3	.8	.0	.00	2.90	10.4	1.30	.5	3	0	32
6	18	7	FRISS	S	0	2.0	10	80W	12	.1	.0	.0	.0	.0	.3	.0	.0	.00	.40	10.4	.17	.0	0	50	5
6	18	7	FISHL	G	30	10.0	150	10	5	2.5	.0	.0	.0	.0	.0	1.6	.0	1.60	5.70	10.4	2.50	.6	9	4K	10
6	18	8	HUCKL	N	0	.0	0		0	.3	.0	.0	.0	.0	.0	.0	.0	.00	.30	10.4	.13	.3	1	50	10
6	18	8	TAYLO	N	0	.0	0		0	.6	.0	.0	.0	.0	.0	.0	.0	.00	.60	10.4	.30	.3	3	100	32
6	20	1	SUGAR	N	0	.0	0		0	.7	.0	.3	.4	.0	1.0	.6	.0	.10	3.10	10.4	1.40	.5	2	480	12
6	20	2	YAMSE	N	0	.0	0		0	.4	.0	.3	.0	.0	.3	.0	.0	.00	1.00	10.4	.40	.0	3	200	20
6	20	2	APPLE	N	0	.0	0		0	.5	.0	.3	.0	.0	.3	.1	.0	.00	1.20	10.4	.50	1.0	3	55	3
6	20	2	CALIM	N	0	.0	0		0	.5	.0	.3	.0	.0	.3	.1	.0	.00	1.20	10.4	.50	.3	1	50	5
6	20	3	7MILE	N	0	.0	0		0	1.2	2.5	.3	.0	.0	.3	.0	.0	.00	4.00	10.4	1.70	.0	3	0	0
6	20	3	PELIC	N	0	.0	0		0	.2	.0	.3	.0	.0	3.0	2.0	2.0	.00	5.70	10.4	2.50	.5	0	120	10
6	20	3	PELIC	N	0	.0	0		0	1.6	7.5	.3	.0	.0	.3	.0	.0	.00	9.70	10.4	4.20	.0	3	0	0
6	21	5	SWAN	G	0	.0	0	2.5	5	.2	3.8	.0	.0	.0	.0	.0	.0	.00	4.00	10.4	1.70	.0	0	9K	0
TOTAL										103.1	113.2	76.5	5.7	2.8	25.7	48.4	3.5	29.10	404.36	1029.4	175.66	26.7			

RG	FT	DS	SITE	E	AG	IC	OPC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
9	7	4	NESB1	D	5	1.9	315	20	6	24.0	4.0	.9	.0	.0	.3	1.2	.0	.50	30.90	10.4	13.40	2.0	100	700	5	
9	7	6	SYLVA	P	30	2.5	310	2.5	3	1.1	.0	.0	.0	.0	.6	.0	.0	.50	2.20	10.4	1.00	.2	1	16K	1	
	TOTAL									25.1	4.0	.9	.0	.0	.9	1.2	.0	1.00	33.10	20.8	14.40	2.2				

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RG	FT	DS	SITE	E	AG	IC	OPC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
99	88	77	TEND	N	0	.0	0		0	15.0	.0	.3	.0	.0	.0	.1	3.0	.00	3.90	7.8	1.27	2.4	10	0	15	
99	88	77	DESR1	D	16	3.0	145	5	12	2.8	.0	1.2	.0	.0	.3	.3	.0	.60	5.20	7.8	1.69	7.1	30	0	30	TOOL
99	88	77	MAYBE	G	1	1.0	27	4	3	.3	.0	.0	.0	.0	.0	.0	.2	.00	.50	7.8	.16	.0	0	0	4	
99	88	77	SILVR	N	0	.0	0		0	1.2	.3	.0	.0	.0	.0	.7	2.0	.00	4.20	7.8	1.37	2.4	30	0	30	
99	88	77	RICE	G	10	.0	19	10	2	.7	.0	.0	.0	.0	.3	.0	.2	.00	1.20	7.8	.39	.8	0	0	10	
99	88	77	HORS1	G	1	00.0	50	6	3	.7	.0	.0	.0	.0	.0	.0	.3	2.00	3.00	7.8	.98	.0	4	0	20	TOOL
99	88	77	CARTR	U	0	.0	60		12	1.0	.0	.3	.0	.0	.0	.0	.0	.00	1.30	9.1	.49	.0	0	10	4	
99	88	77	MARCL	D	25	.0	200	5	4	2.6	2.5	.3	.0	.0	.0	.8	.0	.00	6.20	9.1	2.35	.0	4	130	2	
99	88	77	WASH1	D	2	6.0	2283	12	5	.3	.0	.5	.0	.0	.0	.0	.2	2.30	3.30	10.4	1.43	.0	5	20	15	
99	88	77	CARB1	D	5	4.0	200	4	2	7.2	.0	.3	1.5	.0	.3	.0	.2	.00	9.50	10.4	4.12	1.6	15	0	4	
99	88	77	KEEN	P	10	.0	0	10	5	2.6	.0	.0	.0	.0	.0	.0	.2	.40	3.20	10.4	1.39	.0	10	0	10	VENTF
TOTAL										34.4	2.8	2.9	1.5	.0	.9	1.9	6.3	5.30	41.50	96.2	15.64	14.3				

NATIONAL PARK SERVICE

RE	CODE	SITE	E	AG	IC	OPC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
WE	0	BUTTE1	D	13	5.0	1000	10	4	1.9	15.0	.6	.0	.0	.3	1.2	.0	.00	17.00	10.4	7.40	.0	4	11K	6	
WE	0	COTTN1	D	3	6.5	621	22	12	4.1	2.5	.6	1.2	.0	.3	3.2	.2	2.80	14.90	6.5	4.00	1.0	15	19K	10	SCCLT
WE	0	DRAKE1	G	0	2.0	1000	5	3	14.4	1.3	25.0	1.2	.0	.3	.0	.0	.00	42.20	10.4	18.30	.0	0	4K	7	
WE	0	KALAP1	D	4	4.3	189	13	12	1.9	.0	1.2	.0	1.3	.3	.6	.0	.00	5.30	6.5	1.43	.0	8	1M	2	TOOL
WE	0	KALAP2	D	3	7.0	216	15	12	12.3	.0	.3	.0	.0	.3	.0	.0	2.70	15.60	6.5	4.20	.0	8	1M	2	TOOL
WE	0	KEYS1	D	10	.0	711	6	6	.8	.6	.6	.0	.0	.3	.9	.2	.00	3.40	6.5	.90	.0	4	3K	11	
WE	0	LHRS1	D	8	2.8	760	10	12	1.3	2.5	.6	.5	.0	.6	.9	.2	.80	7.40	6.5	20.00	.0	4	3K	7	SCCLT
WE	0	SHIV1	D	43	.0	0	8	5	1.8	.0	1.2	.0	.0	.3	.1	.2	.00	3.60	6.5	1.00	12.6	2	200	100	
WE	8120	EANAC1	D	1	9.0	430	20	7	3.5	.0	.9	.0	.2	.6	.6	.2	.00	6.00	7.8	2.00	.0	3	18K	15	ISLAN
WE	8120	SANBA1	G	2	.6	100	1.2	12	.1	.0	.0	.0	.0	.3	.0	.1	.00	.50	7.8	.16	.5	3	4.3	37	ISLAN
WE	8130	EMIGR1	D	10	3.5	255	8	12	.4	.0	.3	.3	.0	.3	1.6	.2	.10	3.20	6.1	.80	.0	3	18H	9	LITE
WE	8130	ROGER1	D	8	5.8	260	5	12	.1	.0	.0	.0	.0	1.0	.0	.2	.10	1.40	6.5	.40	.0	0	0	35	LITE
WE	8130	SCOTTY	N	0	.0	0	0	0	.2	2.5	.0	.0	.0	.0	.0	.0	.00	2.70	6.1	.70	.0	0	21K	2	
WE	8130	TEXAS	N	0	.0	0	0	0	.3	.0	.0	.0	.0	.0	.0	.0	.00	.30	6.1	.08	.0	0	37K	1	
WE	8140	ALCAT1	D	20	.0	0	60	12	40.0	.0	.0	.0	.0	.3	.0	.4	10.50	51.20	9.1	19.40	.0	0	43H	2	SCAT
WE	8210	COTTON	D	14	1.0	225	5	4	1.1	.0	.3	1.0	.0	.3	.7	.0	3.50	6.90	6.5	1.90	.0	8	4K	7	SCCLT
WE	8210	HERMIT	N	0	.0	0	0	0	.6	2.4	.3	1.0	.0	.3	.7	.0	3.50	7.90	6.5	2.10	.0	2	9K	7	SCCLT
WE	8210	PASTR	D	18	1.0	100	8	12	.7	2.4	.3	1.0	.0	.3	.7	.0	1.00	6.40	6.5	1.70	2.8	1	3K	20	SCCLT
WE	8210	TUWEE1	D	35	2.5	200	8	12	1.2	2.4	.3	.0	.0	.3	.7	.2	3.00	8.10	6.5	2.20	2.5	2	3K	60	SCCLT
WE	8210	VIEW	B	0	.4	150	0	12	.3	.0	.0	.0	.0	.0	.0	.0	.00	.30	6.5	.08	.0	200	3M	1	
WE	8660	BATES1	G	2	.3	0	2	10	.1	.6	.6	.0	.0	.0	.0	.0	.00	1.30	6.5	3.50	.7	2	450	20	
WE	8750	QUARTE	D	1	2.9	65	10	11	3.4	.0	.6	.3	.0	.3	2.5	1.2	8.50	16.80	9.1	6.40	1.2	2	0	2	TOOL
WE	8800	YOSCRA	D	0	.0	0	0	12	.1	.0	.3	.0	.0	.3	.2	.2	.00	1.10	8.4	.40	.0	0	0	0	
		TOTAL							**90.6**	**32.2**	**34.0**	**6.5**	**1.5**	**7.0**	**14.6**	**3.5**	**36.50**	**223.50**		**99.05**	**21.3**				

RE	CODE	SITE	E	AG	IC	OPC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
SW	7075	BANDEL	N	0	.0	0	0	0	.3	.0	.3	.0	.0	.3	.0	.1	.00	1.00	6.5	.27	.2	4	750	12	
SW	7250	GILACL	N	0	.0	0	0	0	.5	5.6	.0	.0	.0	.3	1.6	.0	.00	8.00	6.5	2.20	.2	0	45K	2	
SW	7430	KEETSE	N	0	.0	0	0	0	.2	.0	.0	.0	.0	.0	.0	.0	.00	.20	6.5	.05	.2	1	2K	8	
	TOTAL								1.0	5.6	.3	.0	.0	.6	1.6	.1	.00	9.20		2.52	.6				

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RE	CODE	SITE	E	AG	IC	OPC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
SE	5140	CRAGV	G	1	3.5	100	15	7	3.6	.0	.0	.0	.6	.0	.0	.1	.10	4.40	7.8	1.40	.0	0	178K	7	
SE	5140	CRAGY	G	2	3.5	100	15	6	.1	1.8	.0	.0	.0	.0	.0	.1	.00	2.00	7.8	.65	.0	0	0	7	
SE	5140	WAGON	G	4	.6	40	7.5	4	.1	.0	.0	.0	.0	.0	.0	.0	.10	.20	7.8	.06	.0	0	0	3	
SE	5210	LOOKC	G	1	2.0	100	4.5	8	1.0	7.5	.0	.0	.0	.0	.0	.0	.00	8.50	9.1	3.20	.5	0	11K	6	
SE	5210	LOOK1	D	10	.0	600	25	8	.7	1.3	.9	.0	.0	.0	.2	.1	.30	3.50	9.1	1.30	.0	10	11K	6	
SE	5250	ADAM1	D	2	14.0	1750	20	12	3.7	11.2	.6	.3	.0	.0	3.0	.2	10.00	29.00	7.8	9.40	.0	6	110K	8	
SE	5280	FJEF1	D	1	7.0	800	30	12	48.0	25.0	6.0	2.0	.0	.3	3.0	.1	2.60	87.00	7.8	28.30	3.0	12	23K	70	
SE	5280	SHARK	D	15	2.5	325	5	12	1.8	5.0	.3	.0	.0	.1	2.4	.1	.10	9.80	7.8	3.20	.1	2	30K	7	
SE	5322	HORN1	D	2	3.3	325	15	12	1.5	1.3	.6	.0	.0	.0	.6	.0	.00	4.00	9.1	1.50	.0	2	25K	12	
SE	5322	SHIP1	D	3	4.8	450	30	12	3.0	1.3	1.2	.0	.0	.0	2.4	.0	.00	7.90	9.1	3.00	3.0	5	100K	12	
TOTAL									63.5	54.4	9.6	2.3	.6	.4	11.6	.7	13.20	156.30		52.01	6.6				

RE	CODE	SITE	E	AG	IC	OPC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
RM	1320	BERRY	N	0	.0	0	0	0	1.9	.2	.0	.0	.0	.0	.0	.0	.50	2.60	7.8	.85	.0	0	6.5K	20	
RM	1320	SORN1	P	10	1.7	350	10	12	.6	.0	.3	.0	.0	.3	1.2	.1	1.20	3.70	7.8	1.20	.0	3	350	10	
RM	1340	ISKY1	D	2	18.5	4000	50	12	23.8	.0	2.4	.0	2.0	1.2	8.4	.4	.00	38.20	6.5	10.30	.0	15	33K	9	
RM	1340	MAZW1	D	3	37.1	650	50	12	9.4	5.0	2.1	.1	4.2	.9	6.9	.4	3.60	32.60	6.5	8.80	.3	17	3.6K	70	
RM	1340	NEED1	D	1	15.3	1000	40	12	2.6	16.9	7.2	.3	2.0	.3	3.2	.3	3.30	36.10	6.5	9.80	.0	25	63K	40	
RM	1348	DEVI1	D	1	7.8	1000	20	8	11.5	5.0	.6	.0	.0	.3	2.4	.0	.30	20.10	7.8	6.50	.0	3	.3M	9	
RM	1349	BRID1	D	1	15.2	915	40	12	46.0	36.0	3.6	.1	.0	.6	2.7	.5	1.50	91.00	6.5	24.60	5.0	17	72K	38	
RM	1377	NRIM	G	10	.7	150	10	3	1.0	.0	.3	.0	.0	.0	.0	.1	.00	1.40	7.8	.50	.5	1	7K	15	
RM	1430	AVALAN	D	20	3.5	280	4.9	4	8.4	.0	.6	.0	.0	.0	.3	.0	.00	9.30	9.1	3.50	.0	5	0	5	
RM	1430	GOATH1	D	16	8.5	600	45	6	37.3	.0	.0	.0	.0	.3	.1	.0	2.60	40.30	9.1	15.30	.0	17	21K	10	
RM	1430	POLBR1	D	16	4.5	420	10	12	10.1	2.2	.6	.0	.0	.3	.5	.1	.50	14.10	9.1	5.40	.0	14	0	25	
RM	1440	BLFROG	D	10	28.0	3400	175	12	26.8	700.0	7.5	4.0	.0	.0	16.0	.3	33.60	788.20	6.5	213.40	.0	60	.2M	110	
RM	1440	HALCR1	D	10	56.0	2500	200	7	7.2	300.0	2.1	.0	.0	.0	2.4	.4	.00	312.10	6.5	84.50	5.0	8	49K	90	
RM	1440	RAINB1	D	10	.0	3000	50	12	15.6	5.6	4.5	.6	.0	.3	1.0	.1	1.00	28.70	.0	7.80	.0	15	93K	50	
RM	1468	FOSIL	U	0	.0	0	0	5	3.5	.0	.6	.0	.0	.0	.0	.0	.10	4.20	7.8	1.40	.0	0	15K	0	
RM	1520	FALC1	D	2	22.0	1084	50	4	34.1	125.0	11.3	.1	.2	.3	1.0	.5	.10	172.60	7.8	56.10	.0	25	3M	30	ALPIN
RM	1520	RNBOW	G	3	2.5	350	7.5	4	3.0	3.0	.0	.0	.0	.0	.0	.1	.00	3.10	7.8	1.00	.3	0	3M	15	
RM	1560	RAWK1	N	0	.0	0	0	0	.1	.0	.3	.0	.0	.3	.0	.0	.00	.70	7.8	.23	.0	2	3K	1	
RM	1570	BECHLE	D	18	5.0	25	7.5	6	2.5	1.9	.9	.1	.0	.9	.1	.0	.00	6.40	7.8	2.10	.0	8	8K	20	
RM	1570	LAMAR1	D	18	5.0	25	10	6	6.3	.0	.9	.0	.0	.3	.0	.0	.00	7.50	7.8	2.40	.0	3	1M	10	
RM	1590	LAVAP	G	15	.0	150	1.5	3	.3	.0	.3	.0	.0	.3	.1	.0	.00	1.00	7.8	.30	.0	2	10K	20	
	TOTAL								252.0	1200.8	46.1	5.3	8.4	6.6	46.3	3.3	48.30	1613.90		455.98	11.1				

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RE	CODE	SITE	E	AG	IC	OPC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
PN	9150	KSALM1	D	4	22.0	3000	100	5	12.4	.9	4.5	4.5	9.0	.3	3.0	.2	.00	34.80	11.7	16.90	.5	40	2K	35	
PN	9170	EIELSO	D	3	6.0	444	12	4	7.9	.0	.3	.0	.0	.3	.0	.0	.00	8.50	11.7	4.20	.0	2	.2M	72	
PN	9170	MTMCK1	D	0	.0	4565	150	12	84.0	40.0	72.6	.0	.0	1.8	8.0	.4	14.00	220.80	11.7	108.00	.0	262	.2M	7	
PN	9170	TOKLA1	D	1	8.0	789	30	4	6.9	14.2	3.3	.0	.0	.6	.4	.1	1.20	13.70	11.7	6.70	.6	14	0	64	
PN	9170	WONDER	D	3	6.0	444	12	4	1.1	1.3	1.2	.0	.0	.3	.1	.0	.40	4.40	11.7	2.20	.3	8	5K	92	
PN	9450	SUNRI1	D	21	30.0	2	95	4	27.0	.0	2.7	.0	.0	.3	10.0	.0	8.40	48.40	11.7	23.60	24.4	20	.1M	20	
PN	9500	STAIR1	D	1	11.0	350	10	12	1.2	.0	.3	.0	.0	.3	.1	.1	.00	2.00	11.7	1.00	.6	8	9K	12	
	TOTAL								140.5	56.4	84.9	4.5	9.0	3.9	21.6	.8	24.00	332.60		162.60	26.4				

RE	CODE	SITE	E	AG	IC	OPC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
MW	6124	KETTL1	D	20	4.0	450	20	5	13.8	4.1	12.2	.1	2.4	.0	.0	.1	.50	33.20	.0	.00	.0	0	9K	9	
MW	6300	BAILY	U	0	.0	0	0	0	.1	.0	.0	.0	.0	.3	.0	.2	.10	.70	11.7	.34	.0	0	0	0	
MW	6310	AMYGDA	G	2	1.2	30	6	2	.3	1.9	.6	.0	.0	.3	.0	.2	.00	3.30	11.7	1.60	.0	3	400	45	45
MW	6310	DAVID	D	12	3.0	125	13	5	.9	.5	.3	.0	.0	.0	.6	.0	.00	2.30	11.7	1.10	.0	6	0	50	
MW	6310	MALONE	G	2	1.2	30	6	2	.3	1.9	.6	.0	.0	.3	.0	.2	.00	3.30	11.7	1.60	.0	4	400	36	ISLER
MW	6310	MOTT1	D	22	12.0	4500	100	6	180.0	22.5	12.0	.0	.0	.3	12.0	.2	22.70	249.70	11.7	122.00	122.0	55	800	48	ISLER
MW	6310	ROCK1	D	17	16.5	5350	250	6	600.0	20.0	33.4	.0	.0	.3	8.0	.1	22.50	784.30	11.7	382.30	382.0	35	10K	52	ISLER
MW	6310	WIND1	D	15	9.0	4000	100	6	3.2	20.0	4.5	.0	.0	.3	4.0	.1	22.50	54.60	11.7	26.60	.0	25	6K	21	ISLER
MW	6402	VINCE	U	0	.0	0	0	12	5.2	.0	.6	.0	.0	.0	.0	.0	7.50	13.30	11.7	6.50	.0	0	68K	0	LITE
	TOTAL								803.8	70.9	64.2	.1	2.4	1.8	24.6	1.1	175.80	1144.70		542.04	504.00				

LAND MANAGEMENT

REGN	DI	SITE	E	AG	IC	OPC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
ARIZ	AS	WHITNE	N	0	.0	0	0	0	.6	.0	.3	.0	.0	.0	.6	.1	.70	2.30	6.5	.60	.0	2	550	0	
ARIZ	AS	BLROCK	S	0	.0	0	0	8	1.7	2.5	.3	.0	.0	.3	1.2	.1	.70	6.80	6.5	1.80	.2	10	1K	45	
ARIZ	AS	POVERT	N	0	.0	0	0	0	1.6	.0	.3	.0	.0	.3	.6	.1	.70	3.60	6.5	1.00	.2	10	650	60	
ARIZ	ST	MTFS	P	10	.0	175	5	8	2.2	.0	.3	1.0	.0	.3	1.2	.2	1.20	6.40	6.5	1.70	1.9	10	2K	76	
TOTAL									6.1	2.5	1.2	1.0	.0	.9	3.6	.5	3.30	19.10	26.0	5.10	2.3				

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REGN	DI	SITE	E	AG	IC	OPC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
CAL	BF	CPFT1	G	6	1.8	155	43	6	2.4	2.5	1.8	2.4	.0	.6	1.0	.4	.10	11.20	6.5	3.03	.0	15	7K	10	VENTF
CAL	RS	CALICO	G	0	.0	40	5	5	.3	.0	.0	.0	.0	.0	.0	.0	1.30	1.60	7.8	.52	1.8	0	9K	3	TOOL
CAL	RS	SODA	P	1	.8	260	10	12	.5	.0	.3	.0	.0	.0	.0	.0	.00	.80	7.8	.26	.0	60	0	0	
CAL	SV	SUSAN	G	30	3.0	65	5	12	.2	7.0	.0	.0	.0	.0	.0	.0	.50	7.70	7.8	2.50	1.5	0	3K	3	
CAL	SV	OBSERV	N	0	.0	0		0	.2	1.3	.6	.0	.0	.3	.1	.0	.10	2.60	7.8	.85	.3	2	1K	25	VENTF
CAL	SV	BADGER	S	0	1.5	16	0	12	.2	.0	.0	.0	.0	.3	.0	.0	.10	.60	7.8	.20	.8	0	0	125	VENTF
TOTAL									**3.8**	**10.8**	**2.7**	**2.4**	**.0**	**1.2**	**1.1**	**.4**	**2.10**	**24.50**	**45.5**	**7.36**	**4.4**				

REGN	DI	SITE	E	AG	IC	OPC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
COLO	MT	ICYCC	N	0	.0	0	0	0	3.5	.6	2.7	.3	.0	.3	.5	.0	3.00	10.90	7.8	3.54	1.6	65	40	6	SCCLT
TOTAL									3.5	.6	2.7	.3	.0	.3	.5	.0	3.00	10.90	7.8	3.54	1.6				

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REGN	DI	SITE	E	AG	IC	OPC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
MONT	BT	HOLTN	N	0	.0	0	0	0	.6	7.4	.0	.0	.0	.0	.0	.0	.00	8.00	9.1	3.00	.0	0	1K	5	
MONT	BT	GARNT	G	10	.3	10	2	3	.5	15.0	.3	.0	.0	.3	.0	.2	.20	16.50	9.1	6.30	1.5	2	14K	10	TOOL
TOTAL									1.1	22.4	.3	.0	.0	.3	.0	.2	.20	24.50	18.2	9.30	1.5				

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REGN	DI	SITE	E	AG	IC	OPC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
NEVA	CA	SPORTS	N	0	.0	0	0	0	.6	.0	.0	.0	.0	.0	.0	.0	.00	.60	7.8	.20	.0	0	50K	3	
NEVA	EL	SPRUCE	S	5	2.5	100	0	12	.4	.0	.0	.0	.0	.6	.0	.0	.00	1.00	7.8	.30	.0	0	0	50	
NEVA	EL	ELKONT	B	0	.0	0	0	12	.4	.0	.0	.0	.0	3.0	.0	.0	.00	3.40	7.8	1.10	.0	0	0	0	
NEVA	EL	JACKSP	S	5	2.5	100	0	12	.4	.0	.0	.0	.0	.9	.0	.0	.00	1.30	7.8	.42	.0	0	0	20	
NEVA	EL	BALDMT	S	5	2.5	100	0	12	.4	.0	.0	.0	.0	.3	.0	.0	.00	.70	7.8	.23	.0	0	0	20	
NEVA	SV	VPSGR	N	0	.0	0		0	.3	.0	.0	.0	.0	.3	.1	.0	.10	.80	7.8	.00	.0	1	650	0	VENTF
NEVA	WI	OROVAD	N	0	.0	0	0	0	3.2	12.5	.3	.0	.0	.3	1.2	.1	4.20	21.80	7.8	7.10	.0	6	0	1	
NEVA	WI	ONIONL	N	0	.0	0	0	0	.7	.0	.3	.0	.0	.3	.1	.0	.00	1.40	7.8	.50	.0	2	0	50	
TOTAL									6.4	12.5	.6	.0	.0	5.7	1.4	.1	4.30	31.00	62.4	9.85	.0				

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REGN	DI	SITE	E	AG	IC	OPC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
UTAH	MB	KANE1	D	6	3.0	300	2	9	5.0	3.8	.3	.0	.0	.3	.5	.0	.30	10.20	.0	.00	.0	6	12K	45	TELEF
UTAH	MB	SANDW	D	1	3.5	350	12	6	2.0	.0	.3	.0	.0	.3	.5	.0	.00	3.10	7.8	1.00	.0	2	30K	45	
UTAH	MB	SAND	N	0	.0	0	0	0	4.0	2.5	.3	.0	.0	.3	.5	.0	.00	7.60	7.8	2.47	.0	3	15K	5	
UTAH	MB	DINOS	N	0	.0	0	0	0	.6	.0	.0	.0	.0	.3	.5	.0	.00	1.40	7.8	.46	.0	1	4K	15	
UTAH	RF	SAHRA	D	3	7.0	100	10	1	.0	1.9	.0	.0	.0	.0	.0	.2	.00	2.10	7.8	.68	.0	0	0	14	
UTAH	RF	SAHR1	D	0	7.0	275	15	12	8.4	.0	1.0	.0	.0	.3	3.1	.0	.00	12.80	7.8	4.16	.0	5	31H	15	
UTAH	RF	MCMIL	N	0	.0	0	0	0	.1	.0	.0	.0	.0	.0	.0	.0	.20	.30	7.8	.10	.0	10	3K	38	SCCLT
UTAH	RF	HANKE	N	0	.0	0	0	0	.2	1.3	.6	.0	.0	.0	.1	.0	.20	2.30	7.8	.42	.0	10	0	40	SCCLT
UTAH	RF	BEAVR	N	0	.0	0	0	0	.1	.0	.0	.0	.0	.0	.0	.0	.20	.30	7.8	.10	1.2	0	2K	32	SCCLT
UTAH	VR	SCAMP	G	0	1.2	25	4	6	.3	.0	.0	.0	.0	.0	.0	.0	.00	.30	7.8	.10	.0	8	0	50	
UTAH	VR	PARIE	N	0	.0	0	0	0	6.0	.0	.3	.0	.0	.0	.5	.2	.00	7.00	7.8	2.28	.0	4	2K	30	
TOTAL									26.7	9.5	2.8	.0	.0	1.5	5.7	.4	.90	47.40	78.0	11.77	1.2				

FISH AND WILDLIFE

RE	FACILITY	ST	E	AG	IC	OPC	KW	NT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
1	HARTMTN1	OR	D	0	5.0	100	1.6	12	3.7	.0	.6	.0	.0	.3	.1	.1	.20	5.00	10.4	2.20	.0	17	BK	26	
5	GTDISMSW	VA	N	0	.0	0	0	0	2.0	.6	.0	.0	3.8	.0	.0	.0	.80	7.20	10.4	7.50	.0	0	0	5	
5	PARKERRI	MA	N	0	.0	0	0	0	21.4	.3	.6	.3	.0	.3	1.0	.1	.00	24.00	10.4	10.40	.7	4	0	3	
	TOTAL								27.1	.9	1.2	.3	3.8	.6	1.1	.2	1.0	36.2		20.1	.7				

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RECLAMATION

RE	PRO	SITE	E	AG	IC	DFC	KW	MT	LITE	PUMP	REFR	FOOD	APPL	COMM	EDUC	BATT	OTHER	TOTAL	PF	ARRAY	FUTUR	RES	VIS	MTG	OTUSE
MP	CVW	FUNKS	P	4	10.0	20	25	10	.2	.0	.0	.0	.0	.0	.0	.0	.00	.00	7.8	.00	.0	0	0	4	
MP	CVW	REDBLUF	P	10	20.0	20	100	12	14.5	.0	.0	.0	.0	.0	.0	.0	75.00	289.50	7.9	94.00	.0	0	0	0	
MP	CVW	SOFOMTN	P	0	.0	90	0	12	.1	.0	.0	.0	.0	.0	.0	.1	.00	.20	7.8	.06	.0	0	0	0	
MP	CVW	TEHCOLV	U	0	.0	0	0	12	1.0	.0	.0	.0	.0	.0	.0	.0	.00	.00	7.8	.00	.0	0	0	0	25GAT
MP	FRE	FRIANT1	D	2	28.0	50	135	12	3.6	375.0	.0	.0	.0	.3	.0	.0	.00	381.90	7.8	124.00	3.6	0	0	0	
MP	SOL	CAPELL	G	1	4.0	0	1.5	12	1.1	.0	.0	.0	.0	.0	.0	.0	.00	1.10	7.8	.36	.0	0	25K	1	
PN	MIN	GRASSYL	P	1	1.5	20	10	1	.3	.0	.0	.0	.0	.0	.0	.0	.30	.60	10.4	.26	.0	0	0	11	
PN	MIN	LIWOOD	P	3	2.5	150	7.5	4	1.0	.0	.0	.0	.0	.0	.0	.0	.00	1.00	10.4	.43	.0	4	27K	8	
PN	MIN	TEXCRE1	P	1	4.0	0	5	12	1.8	2.5	.3	.0	.8	.3	.2	.0	.00	5.90	10.4	2.60	.0	2	700	15	
PN	MIN	TEXCRE2	P	10	1.0	0	12.5	5	1.8	.4	.0	.0	.0	.0	.2	.0	.00	2.40	10.4	1.00	.0	2	700	15	
UM	MIS	HARVEY	P	1	5.2	5	2.5	12	.7	.0	.0	.0	.0	.9	.0	.0	.00	1.60	9.1	.60	.0	0	0	0	
UM	MIS	OAKES	P	1	5.2	5	2.5	12	.7	.0	.0	.0	.0	.6	.0	.0	.00	1.30	9.6	.60	.0	0	0	0	
UM	MIS	PROPHET	P	1	5.2	5	2.5	12	.7	.0	.0	.0	.0	.6	.0	.0	.00	1.30	9.1	.60	.0	0	0	0	
TOTAL									27.5	377.9	.3	.0	.8	2.7	.4	.1	275.30	686.80		224.51	3.6				

EXHIBIT 5

February 7, 1979

I need your help in working on a program that can have a positive direct and indirect effect on all of us. As you may know, by means of one of the solar technologies known as photovoltaics, electricity can be generated directly from the sun. This means that after the initial investment you can have electricity that is essentially free and non-polluting.

This not only has the potential to reduce our current and future energy costs, but also to provide electricity to locations which are long distances from the electric utility grid. Use of this electricity to pump water, light homes, provide communications, etc., can measurably increase the standard of living of those having expensive electricity or no electricity at all.

In an effort to speed up the process which will allow this solar photovoltaic electricity to be useful to all of us, the U.S. Department of Energy and other agencies are providing money to help fund installations of this type of electrical generating system. A recent example of this is in the village of Schuchuli on the Papago Indian Reservation in Arizona. This village was previously without any electricity. A solar photovoltaic system was dedicated there this past December, and now supplies enough electricity to pump water from their well, light their homes and power refrigerators, sewing machines, and washing machines. More information on this is enclosed.

I am working under contract from the Department of Energy and NASA Lewis Research Center to identify the total market opportunity for photovoltaics to electrify remote villages.

It would be a great help to me in identifying the electrical needs of your villages if you would fill out the enclosed questionnaire. Any information you can provide will be helpful. This information will then be included in my report identifying your tribe as being one which is interested in putting the sun to work for you.

Thank you for your help in advancing the cause of solar energy and the welfare of your tribe. Please send your response to me in the enclosed, self-addressed, postage-paid envelope.

Clyde Ragsdale

Clyde Ragsdale
MOTOROLA
P. O. Box 2953
Phoenix, AZ 85062

EXHIBIT 6

SOLAR ENERGY SURVEY

1. Approximately how many villages are there on your reservation? ________

2. What is the average size (number of people) of these villages? ________

3. Please estimate the approximate percentage of your villages that fit the descriptions below:

   . Have electricity supplied by a utility ______%

   . Have electricity supplied by their own gasoline or diesel generator ______%

   . Have no electricity at all ______%

   Total 100%

4. Below is a list of several applications for which electric power may be used. Please identify which uses are most important for your villages by putting a "1" in the block for the most important use, a "2" for second most important, etc.

   ☐ Lighting

   ☐ Water Pumping

   ☐ Refrigerator

   ☐ Food Processing

   ☐ Communication (2-way radio)

   ☐ Education & Entertainment (Radio, TV)

   ☐ Other (Please specify) ________________________________

5. If you would like to receive more information on the possible use of solar energy on your reservation, please check this box ☐ and let us know who we should contact:

   NAME: ________________________________

   ADDRESS: ________________________________

   TELEPHONE NUMBER: ________________________________

Please mail the completed questionnaire in the self-addressed, postage-paid envelope enclosed.

Thank you for your cooperation.

Clyde Ragsdale
Motorola
P. O. Box 2953
Phoenix, AZ 85062