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Energy Needs During Disasters: Workshop Summary Report

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Workshop Summary Report

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Introduction

When natural disasters, such as hurricanes, earthquakes, and floods, occur, thousands of people can be left without homes, electrical power, communications, potable water, and food storage capabilities. Problems such as these can last from one to a few days or several weeks, as in the case of Hurricane Andrew. The loss of electrical power is the direct cause of many of the other problems, such as the loss of communications, lighting, and clean water.

Adequate electrical power is imperative for both disaster relief operations and community rebuilding. However, the disaster may have disrupted the commercial power supply to a community, requiring disaster relief agencies to rely on alternative sources of power. The source of electricity most commonly used is a gasoline-powered electric generator.

Photovoltaic-powered equipment provides electrical power which is renewable, quiet, and safe, and which can be used for many essentials of disaster relief efforts, such as refrigeration, communications and lighting. However, at present, photovoltaics (PV) is used scarcely in disaster relief efforts.

Does PV have a role in such applications? This is an important question within the PV community. To help answer it, the Florida Solar Energy Center (FSEC), an institute of the University of Central Florida, conducted a large-scale needs assessment (Young, 1997). Based on the results of this needs assessment, FSEC conducted a follow-up workshop with representatives of federal and local governments, the PV industry, and disaster relief agencies. This report describes the results of the workshop.

Background

The Florida Solar Energy Center conducted an initial needs assessment to identify the role PV techology may play in disaster relief efforts and to communicate this role to government and disaster relief organizations, utilities, and the PV industry (Young, 1997). Respondents were asked to describe their experience according to the following categories:

- Knowledge of PV and other renewable energy sources.
- Types of disasters encountered.
- Duration of disaster relief efforts.
- Types of disaster relief equipment used that require electrical power.
- Electric generators (how many, what kind) used in disaster relief efforts.
- Means of storage and deployment of disaster relief equipment.

This survey was administered at the 1997 Energy Supply Disruption Workshop in the U. S. Virgin Islands, and the 1997 Florida Governor's Hurricane Conference in Tampa, Florida. In addition, the survey was mailed to members of the Disaster Advisory Committee, a national group consisting of representatives of the various organizations that conduct disaster relief efforts. Table 1 provides a brief synopsis of the results of this initial needs assessment. Detailed results of the survey are reported in Young (1997).

Table 1. Summary of PV needs assessment survey results, from Young (1997).

Issue	Responses (N=49)
Types of generators used	Gasoline 95% Propane: 3% PV: 2%
Types of disasters responded to most	Hurricanes and floods
Typical duration without conventional electricity	2 – 6 weeks
Most widely used applications of PV	Communications and lighting

The results show that PV technology is used infrequently; however, the Young report concluded there are appropriate applications for PV technologies during disaster relief efforts. In a large-scale relief effort, in which conventional electrical power is not available for typical time periods (e.g., two to six weeks), PV equipment can be a viable alternative power source. Appropriate applications are those that require low power, stand-alone operation and long-term use, and where survivor support is difficult to provide (Young, 1997). A number of PV-powered devices presently on the market appear suitable for disaster relief operations, including:

- Building or back-up power systems.
- Battery rechargers.
- Call boxes.
- Flashing arrow and message boards.
- Flashlights.
- Hand-held radio transceivers.
- Highway advisory radios.
- Medical equipment.
- Portable AM/FM radios.
- Portable generators.
- Portable pumping stations
- Refrigerators.
- Security and street lights.
- Victim detection equipment.
- Water purification.

However, the Young (1997) survey was returned by only 49 respondents out of 300 that were administered (16.3%). Thus, more information was needed before making recommendations.

Needs Assessment Workshop

FSEC held a workshop in July 1997 to validate and augment the results of its prior needs assessment and to foster communication between government, the PV industry, and disaster relief agencies. The goal of the workshop was to identify as clearly as possible the most appropriate roles for PV systems in providing power during disaster relief. Approximately two dozen participants attended the workshop. The names, organizations, and addresses of all attendees are provided in Appendix A.

TEAM-Net Approach

This workshop was conducted using an approach called TEAM-Net, which was offered by the University of Central Florida's College of Business Administration. It uses a system of 18 networked laptop computers and specially developed consensus software designed to make workshops and planning meetings more productive and efficient. The system can handle any number of participants, but only 18 can use the system at one time, unless participants are working collaboratively. (For this workshop, each laptop was shared by two participants, with each participant working independently.) The TEAM-Net approach supports meeting activities such as brainstorming, list building, information gathering, voting, organizing, prioritizing, and consensus building, all with immediate feedback to the respondents. An outside facilitator keeps the participants moving through the session efficiently.

Workshop Phase I

As a first step in the FSEC workshop and prior to the start of the session, a list of questions was incorporated into the software. Then, each participant worked independently to respond to ten questions.

Once this initial question and answer session was completed, the responses were compiled into relevant categories. At this point, the facilitator displayed all of the individual responses for each trigger question, one question at a time. All responses to the questions were presented (anonymously) to the group via a projection system. The facilitator generated categories based on the verbal responses from the participants in an open question and answer session. Their choice of categories was based on the responses that were displayed. This categorization process was completed for each trigger question. Tables 2-11 provide the 10 trigger questions, including the most frequent response categories that were generated. The numbers in parentheses indicate the frequency of responses in a particular category. A complete list of participants' responses is provided in Appendix B.

Table 2. Most frequent responses to trigger question number one (N=31).

Trigger Question	Most Frequent Responses (frequency of occurrence)	Percent
1. During disaster recovery, what are the most important electrically powered devices used?	Communications devices (21)	68
	Lighting (12)	39
	Refrigeration (8)	26
	Medical Equipment (7)	23
	Traffic Control (5)	16
	Water & Sewer (3)	10
	Battery Charging (2)	6
	Other (7)	23

Table 3. Most frequent responses to trigger question number two (N=25).

Trigger Question	Most Frequent Responses (frequency of occurrence)	Percent
2. What are the major problems associated with using conventional portable generators during disaster relief?	Fuel/refueling (15)	60
	Noise (13)	52
	Safety (8)	32
	Maintenance (6)	24
	Availability & Supply (5)	20
	Pollution (fumes) (5)	20
	Portablility (4)	16
	Other (3)	12

Table 4. Most frequent responses to trigger question number three (N=29).

Trigger Question	Most Frequent Responses (frequency of occurrence)	Percent
3. What criteria do you suggest as appropriate for selecting electrical power generation equipment for disaster relief?	Reliability (14)	48
	Electrical Sizing (Loads) (10)	35
	Availability (8)	28
	Cost (5)	17
	Ease of Use (5)	17
	Dual Use (2)	7
	Other (7)	24

Table 5. Most frequent responses to trigger question number four (N=24).

Trigger Question	Most Frequent Responses (frequency of occurrence)	Percent
4. What specific advantages do photovoltaic (or PV-hybrid) systems offer compared to conventional portable generators?	No Fuel needed (15)	63
	Reliability/no maintenance (12)	50
	Quiet (10)	42
	Safety (5)	21
	Portability (4)	17
	Ease of Use (3)	12.5
	Other (7)	29

Table 6. Most frequent responses to trigger question number five (N=18).

Trigger Question	Most Frequent Responses (frequency of occurrence)	Percent
5. If your organization has not used photovoltaics in disaster recovery efforts, why not?	Lack of knowledge about availability or use (9)	50
	Too large for power requirements (2)	11
	Lack of funding to procure (1)	6
	N/A or have used (5)	28

Table 7. Most frequent responses to trigger question number six (N=20).

Trigger Question	Most Frequent Responses (frequency of occurrence)	Percent
6. Would your organization be interested in participating in a 3-5 year pilot program involving the use of photovoltaic systems for disaster relief and an assessment of their effectiveness?	Yes (17)	85
	Probably (3)	15

Table 8. Most frequent responses to trigger question number seven (N=19).

Trigger Question	Most Frequent Responses (frequency of occurrence)	Percent
7. How should utility green programs be used for disaster relief?	Persuade customers to pre-pay for energy services during power outages, via a small surcharge on their electric bills (4)	21
	Programs should be made as reliable as conventional programs. Customers say that they will pay the additional cost. Pilot programs should be established to determine feasibility. (1)	5
	Provide PV panels for use during normal periods for electrical generation at schools and utility substations, and convert to recovery efforts as needed. (1)	5
	Provide an incentive for early use of PV. (1)	5
	Provide the panels used for normal electricity to the shelters for use during a disaster (must be a system approach and part of education). (1)	5
	Give local utility customers option to designate an additional amount of funds to be used for disaster green programs. (1)	5
	Maybe people would use PV if it was offered by the utility for a fee per incident, maybe reserved ahead of time. If their area is affected, they would be able to get their PV. This fee would probably then be reimbursable by their insurance company.	5

Table 9. Most frequent responses to trigger question number eight (N=24).

Trigger Question	Most Frequent Responses (frequency of occurrence)	Percent
8. Assuming there are appropriate roles for photovoltaic systems in providing disaster relief, who should pay for or finance the procurement of the equipment? If you would like, list more than one alternative.	The user (12)	50
	Government (8)	33
	Businesses (5)	21
	Disaster Relief Agencies (4)	17
	Tax payers (4)	17
	Insurance Companies (1)	4

Table 10. Most frequent responses to trigger question number nine (N=23).

Trigger Question	Most Frequent Responses (frequency of occurrence)	Percent
9. In using photovoltaics for disaster relief, what effective roles might insurance companies play?	Reduced rates to PV owners (14)	61
	Financing/assisting in purchases for users and local governments (6)	26
	Assist in education (4)	17
	Buy down cost (3)	13
	Research & Development (2)	9

Table 11. Most frequent responses to trigger question number ten (N=23).

Trigger Question	Most Frequent Responses (frequency of occurrence)	Percent
10. List one or more attractive dual-use applications of photovoltaics for disaster relief.	Communications (12)	52
	General street lighting (7)	30
	Traffic control lights and signs (7)	30
	UPS, computer backup power (6)	26
	Water management (5)	22
	Battery charging (4)	17
	Hospital, police, fire dept. systems (4)	17
	Refrigeration (3)	13

Conclusions from Phase I of the Workshop

Responding to the 10 trigger questions and then reducing them into a number of categories completed the first phase of this workshop. All responses and categories were printed and distributed to each of the participants so that they had a personal record of the workshop proceedings to this point.

In summary, the goals of Phase I were to:

(1) identify the most important electrically powered devices used during disaster recovery,
(2) identify problems using conventional portable generators,
(3) identify criteria that should be used to select electric power generation equipment,
(4) list the advantages of PV systems compared with conventional generators,
(5) determine the factors associated with not using PV during disaster recovery efforts,
(6) determine interest in participating in a 3-5 year pilot program using PV,
(7) identify how utility green programs could be used in disaster relief,
(8) determine who should finance procurement of PV equipment for disaster relief,
(9) identify the effective roles insurance companies can play in supporting the use of PV equipment during disaster relief efforts, and
(10) list potential dual-use applications of PV during disaster relief.

Based on the responses generated during this session, the Phase I goals were met (see Tables 2-11). The results also appear to corroborate the findings from the Young (1997) needs assessment.

The trigger questions were based on FSEC's background in PV research and testing, as well as specific experience in applying PV to disaster relief efforts. When applying photovoltaics to any application (whether disaster related or not), the issues raised in these questions need to be understood. The workshop participants provided valuable insight concerning which photovoltaic characteristics play an important role in the application of PV to disaster relief.

Workshop Phase II

In Phase II of the workshop, participants again were asked to provide individual responses using the TEAM-Net system. This time they were asked to list the questions, issues, and/or problems associated with using PV devices during disaster relief. Thus, with a personal knowledge base that likely was amplified during Phase I of the workshop, participants were asked to identify the issues associated with PV use that are most important to them.

At the conclusion of this session, again, all responses were displayed to the group. Participants then were asked to identify appropriate categories for the issues that were generated. Six categories of issues were identified: most important or key, finance, logistics, education, design and marketing. Table 12 provides a summary of the issues or questions that made up each category. Appendix C provides the complete list of responses for each category.

Table 12. Workshop Phase II: Summary of important issues provided by participants concerning PV use during disaster relief efforts. Issues are listed by category (N=27).

Category	Summary of issues (frequency of responses)	Percent
Key Issues:	PV load and design (e.g., practicality of operation given the expense) (6)	22
	Relief and procurement people do not know about PV (4)	15
	How and where to store PV devices (3)	11
	Portability and transportability (3)	11
	Perceived reliability of PV (3)	11
	Utility companies' cooperation and buy in (3)	11
	Viability under severe weather (1)	4
	Appropriate dual uses (1)	4
Finance:	Who will pay for the PV equipment? (6)	22
	Create industry/relief agency partnerships (1)	4
Logistics:	Portability/transportability (3)	11
	Deployment planning and preparation (2)	7
	PV size requirements for needed power output (1)	4
	Reliability in high risk areas (1)	4
	How to get replacement parts (1)	4
Education:	Lack of PV knowledge and sources of education (7)	26
	Disaster planning guidance doesn't include alternate energy sources (1)	4
	Misinformation (1)	4

Table 12. (continued)

Category	Summary of issues (frequency of responses)	Percent
Design:	Size and power output factors (3)	11
	How should PV be optimally designed for needed applications (2)	7
	Reliability during and after disaster (1)	4
Marketing:	Lack of communications between industry and users (2)	7
	Need catalogs and distributors (e.g., where to buy?) (2)	7
	Are batteries DoD transportable materials? (1)	4

Conclusions for Phase II of the Workshop

The issues identified in the workshop were very similar to issues identified in evaluating the role of PV in other applications. ***The participants' responses illustrated a central problem to the widespread use of this technology: the lack of knowledge and understanding of PV by disaster relief organizations.*** However, the workshop responses also showed that PV appears to be a good choice for some situations, specifically because of characteristics such as no fuel requirement, low maintenance, portability and modularity.

Conclusions

The workshop proved to be an extremely useful source of information from stakeholders in disaster relief, and their responses corroborated the findings from the Young (1997) needs assessment. Although it was generally agreed that photovoltaics can often play a useful role in disaster relief efforts, the most significant conclusions from the workshop were:

- Disaster relief organizations, in general, do not have sufficient knowledge, understanding or experience to choose photovoltaics over conventional alternatives.
- A much closer relationship and more direct communication between the photovoltaic industry and members of disaster relief organizations that actually use the equipment during emergencies is necessary.
- Disaster response teams can best determine the usefulness and value of photovoltaic equipment by actually using the equipment in the field.

As a result of the workshop findings, FSEC took two key steps. First, they brought together five disaster relief organizations with photovoltaic system suppliers. Second, they purchased PV systems for use by the five disaster relief organizations (see Table 13). These organizations will use the PV equipment during actual emergencies, evaluate it and decide whether they would be willing to purchase additional equipment in the future. At the same time, FSEC will conduct more in-depth testing and evaluation of the same PV equipment.

Table 13. Photovoltaic systems being procured for disaster relief efforts

Organization/Vendor	Photovoltaic System	Cost	Quantity
Metro/Dade Rescue	Portable generator for commun.		
Hutton Communications	150 W PV	$1900	1
PhotoComm	100 W PV	$1695	1
National Hurricane Center	Portable weather station		
PacComm	50 W PV	$1499	1
Catholic Charities	Portable Generator for shelters		
SunWize	75 W PV	$ 999	1
Solar Electric Specialities	50 W PV	$ 482	1
RACES	Portable generator for commun.		
SunWize	75 W PV	$ 999	1
Sarasota K-9 Search/Rescue	Portable charger for batteries		
United Solar Systems	12 W PV	$ 425	1

If the above approach produces favorable results (i.e., the disaster organizations determine that photovoltaic equipment is the preferred alternative for specific applications), then the approach will be extended to include more disaster organizations and photovoltaic equipment suppliers.

Reference

Young, Jr., William. “Needs Assessment for Applying Photovoltaics to Disaster Relief,” FSEC-CR-935-97, Cocoa, FL, Florida Solar Energy Center, 1997.

Appendix A

ENERGY NEEDS DURING DISASTERS
Technical Workshop - July 23, 1997
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Appendix B

Ten Trigger Questions

Under each of the ten questions listed below are the responses of each workshop participant (in the order received by the system). Numbers in parentheses indicate the arbitrary user ID assigned to that participant. At this stage, no attempt is made to reduce the redundant responses.

1. During disaster recovery, what are the most important electrically powered devices used?

- Communications devices {#64}
- Communications {#65 }
- telecommunication device {#66 }
- Lighting {#67}
- communications {#68}
- water and sewer systems {#69}
- medical {#70}
- Communications {#71}
- Communications, lights, refrigeration, power tools {#72}
- Communications devices such as short wave radios, cell phones, internet connection, etc... {#73}
- lighting {#74}
- radio, lights, food preservation, water purification, pumping gasoline, {#75}
- Communication, water pumping & purification, refrig., traffic control, instrumentation {#76}
- communications {#77}
- lights, refridge, communications, battery charging {#78}
- Public broadcasting (radio,TV) {#79}
- communications {#81}
- energy distribution systems {#83}
- Radios, Lighting, Medical Refrigeration, Battery charging {#84 }
- lighting, medical, refrigeration, traffic control, sanitation {#86}
- radios,lights, {#88}
- radios,lights {#92}
- Refrig., lighting, traffic signals, communication, medical storage, special needs equip. {#95}
- power for special medical needs shelters, radio stations {#102 }
- use of solar thermal for health & safety considerations at food kitchens, medical, etc. {#238}
- Thermal solar water heating systems. {#253}
- establishing communication systems, security lighting {#254}
- communication and medical {#258}

- water heating for sanitation, food prep etc. can be provided by hybrid solar thermal system {#262}
- security lighting, water purification, traffic lighting, refrigeration, general lighting, communications {#266}

2. What are the major problems associated with using conventional portable generators during disaster relief?

- fuel requirement {#80}
- Getting Fuel {#82}
- Safety {#85}
- noise {#87}
- Fuel acquisition and transportation, danger of refueling, noise, {#89}
- portability {#90}
- Noise, Pollution {#91}
- supply {#93}
- fuel {#94}
- operating them safely (ie not refueling while the engine is running) {#96}
- Fuel, Noise, Fumes, Fire hazard {#97}
- safety {#98}
- fuel requirements due to weight {#99}
- Not available for all needs, many locations require electrician to "hardwire" {#100}
- fuel, noise, weight, ,maintaince, {#101}
- avaibility, noise, fumes, refueling, maintenance {#104}
- combustable fumes noise {#107}
- fuel, transport thereof and maintenance of unit {#111}
- noise, fuel, pollution, availability {#114}
- fuel/noise/transportable/reliability/initial cost {#127}
- operator error {#129}
- difficult to obtain, maintenance, expensive, refueling, noise {#195}
- having to refuel the units -- labor requirement, safety, noise, {#257}
- fuel requirements and safety and noise {#263}
- fuel requirements, generator transport, noise pollution {#270}

3. What criteria do you suggest as appropriate for selecting electrical power generation equipment for disaster relief?

- Reliability, dependability, fuel availability, load capabilit {#103}
- Electrical load requirement {#105}
- appropriate KW size {#106}
- safe operation, rapid response, reliable start-up {#108}
- Dependability {#109}
- Load Selection and appropriateness, {#110}
- Easy to use, sized to fit application, durable. {#112}
- Availability, Money, Tech assist {#113}
- availability, timewise {#115}
- dependability {#117}
- understanding the load, {#118}
- availability {#119}
- Need per application {#121}
- reliability {#123}
- avaibility, cost, duel use, quality of life {#126}
- Load requirements {#130}
- weight, available fuels, reliability {#131}
- ease of use {#132}
- maintenance requirements,on scene {#133}
- reliability, price {#138}
- load requirements {#143}
- durability {#165}
- Cost, reliability, dependability, system approach to provide a total system/ {#173}
- easy to operate with instructions {#175}
- standard kw {#186}
- Portable, dependable, easy to install & refuel, fuel efficient, readily available {#212}
- durability, weight, dual use, reliability {#259}
- electrical load requirements and fueling and dependability and sustainability {#272}
- cost, hours of reliable operation, needed power requirements {#275}

4. What specific advantages do photovoltaic (or PV-hybrid) systems offer compared to conventional portable generators?

- Quiet, reliable, renewable, effiecient, {#116}
- No need for fuel. {#120}
- No refueling, quiet. {#122}
- safe, silent, no need to refuel {#124}
- no need for fuel supplies {#125}
- Safe {#128}
- low maintenance {#135}
- Silence, Fuel requirement, Safety {#139}
- Modular, quiet, cost competitiveness, no fuel, wide availability, extremely reliable {#140}
- Reliability, ease of use, portability, modular, cost, no maintenance {#145}
- quiet, no fuel needed, {#147}
- reliability {#148}
- quiet, low maintenance, no fuel source, can provide dual use (i.e., no need to storehouse until needed), energy efficient {#149}
- quiet/clean/maint of system/safe/fuel {#151}
- no maintanance {#153}
- small need for fuel &quiet {#157}
- No man power required ; totally automataic {#159}
- have not used them, so can not honestly answer. {#161}
- fuel, reliable,ease of installation, scalable, {#176}
- reliable, easy to maintain, not fuel dependent, quiet {#227}
- they don't have to be refueled, light weight, portable, can serve multiple uses, good for small-scale applications where gensets are too large {#265}
- reliability, quiet, no refueling required {#276}
- safety {#277}
- sustainability as no need for refueling {#278}

5. If your organization has not used photovoltaics in disaster recovery efforts, why not?

- N/A {#136}
- No established criteria for purchase/selection for demonostration or application {#137}
- Have used {#146}
- Operation requires high power in short time, low power needs such as lighting and battery recharge occur concurrently with generator operation. {#150}
- Did not know that solar solutions would be able to satisfy the need. Now I do. {#155}
- availability of equipment not known about or who is a reliable source {#168}
- unsure how pv could be used {#172}
- too bulky for shipping for perceived power requirement {#179}
- not available--but have personally used them {#180}
- We have some small hand held lanterns {#184}
- do not have money to purchase pv {#185}
- don’t know enough about system to purchase/use what is available at lowest cost {#194}
- did not know to call 1-800--741-3811 {#201}
- not easily accesible or well known {#202}
- not enough information about PV directed to the disaster relief organizations {#206}
- Lack of Knowledge on part of request generating communities {#242}
- Responsibility is in conventional fual allocation {#268}
- we have {#280}

6. Would your organization be interested in participating in a 3-5 year pilot program involving the use of photovoltaic systems for disaster relief and an assessment of their effectiveness?

- yes {#134}
- Yes! {#141}
- Absolutely yes!! {#142}
- possibly {#144}
- Yes {#152}
- yes {#154}
- yes {#156}
- yes {#162}
- YES - NOW! {#167}
- possible {#178}
- yes {#189}
- possibly {#191}
- yes we would {#192}
- The simple answer is yes! {#203}
- yes {#208}
- yes {#209}
- Yes!!! {#213}
- yes {#248}
- Yes!! {#269}
- yes {#282}

7. How should utility green programs be used for disaster relief?

- persuade customers to pre-pay for energy services during power outages, via a small surcharge on their electric bills {#158}
- Utilities can offer pricing similar to current programs and offer PV systems for an increased tarrif charge. {#160}
- don't know {#164}
- Programs should be made as reliable as conventional programs. Customers say that they will the additional cost. Pilot programs should be established to determine feasibility. {#169}
- Mitigation design for cost applicability {#170}
- don't know {#174}
- provide pv panels for use during normal periods for electrical generation at schools and utility substations, and convert to recovery efforts as needed. {#177}
- unknown {#196}
- To overcome initial resistance to this technology. To provide an incentive for early use of PV. To help minimize early adaptors resistance. {#200}
- am not sure, possible to introduce the program to the public at large {#215}
- dont know {#216}
- provide the pannels used for normal electricity to the shelters for use during a disaster(must be a system approach and part of education) {#217}
- don't know if we need to go there. {#222}
- unknown {#225}
- need more info on different models and pricing {#232}
- Give local utility customers option to designate an additional amount of funds to be used disaster green programs. {#267}
- The focus should be on providing value to the customer -- the customer is thus willing to purchase the reliability offered by PV {#274}
- I don't know. I don't see people people paying a premium on their monthly bill unless you can get their A/C running after the disaster. Maybe people would use PV if it was offered by the utility for a fee per incident, maybe reserved ahead of time.If their area is affected,they would be able to get their PV. This fee would probably then be reimbursable by their insurance company. {#284}
- if utilities offered additional bill money inputs it could be used for disaster recovery electrical power for those willing to pay {#287}

8. **Assuming there are appropriate roles for photovoltaic systems in providing disaster relief, who should pay for or finance the procurement of the equipment? If you would like, list more than one alternative.**

- businesses and users {#163}
- The end user. {#166}
- end user, who ever benefits from the systems {#171}
- customers, on a voluntary basis, either through their electric bills, or thru their insurance premiums. governments (local) for public services through tax revenues {#181}
- End user, business community, rate payers. taxpayers {#182}
- Govt. should seed market and prove program then allow market to take over. {#183}
- Federal , state , or local gov. {#187}
- local, state and national organizations tasked with preparedness and response. {#190}
- the user {#205}
- Siemens Solar has financing programs for complete systems. Programs are designed for governments, municipalities and industrial customers. {#219}
- local governments can issue bonds to finance utility acquisition for substation power generation or for environmental mitigation efforts or for schools to purchase; local government would then have top priority to use in disaster recovery efforts. green pricing programs can be used to underwrite cost. utility can purchase and rate base. state and federal government disaster preparedness agencies (FEMA, etc) can purchase as other equipment {#223}
- state and national disaster orginizations. {#229}
- user organizations and county government {#231}
- grant to those in need {#236}
- Federal, state and local business, {#237}
- lets replace PV with generator and it is not a question as they are already used. {#239}
- government grant {#241}
- This is interesting; however, the answer is in the Federal government through DOE or FEMA to encourage programs by providing funding or grants to local governments for certain types of devices. Local governments can normally not provide funding for programs that are not competively priced. {#247}
- FEMA the state and potential beneficiaries {#271}
- Require Red Cross to have PVC on each vehicle used during disaster response and recovery. This allows the general public the opportunity to see the pvc array during a disaster. funding comes from grants to RC {#279}
- The user -- those who wish to avoid the expense of disaster recovery, this may also include insurance companies who desire too minimize the cost of the disaster through avoiding problems -- like keep the business operating to avoid continuity payments {#281, R/E}
- the affected community (maybe have some sort of tax to pay for the equipment prior to a disaster) {#285}
- for governement supported activities by taxes, for businesses and individuals by insurance or industry enhasement programs {#291, PV}
- Govt {#294, EM}

9. In using photovoltaics for disaster relief, what effective roles might insurance companies play?

- Buy down the cost of systems. {#188}
- Offer reduced rates to owners of PV systems. {#193}
- procurement and deployment, assist in education, coordination with government agencies, NGO's and others {#197}
- purchasing PV systems for businesses (ie power supplies for cash registers) and collecting premiums to cover costs {#198}
- Insurance should provide incentives for PV use in addition to buy down programs and reduced rates from utilities {#199}
- Subsidize PV systems for businesses. {#204}
- offer reduced premiums for businesses/individuals using PVs for disaster mitigation purposes (e.g., emergency lighting in stairwells, garages, safety risk areas, back-up power for control systems, etc.) {#207}
- Encourage the routine use of PV thru reduced rates, where the cost of PV power supply replacement and restoration is less than the cost of conventional power system replacement. {#210}
- 1-Discount coverage for any insured that attempts PV as mitigation. 2-Provide to Disaster response agencies to mitigate community wide damage {#214}
- offer reduced rates for those who have an alternative source of power {#218}
- Education, premium reduction for PV adoption, financing & funding programs. {#234}
- assist in the purchase of equipment {#240}
- help with the development of pv systems to use in disasters {#243}
- insurance industry in Europe is financing solar programs based upon global warmings contribution to disasters; US industry can follow suit. insurance industry can provide discounts to businesses that install or support solar equipment, including PV and thermal applications. insurance association and foundation can support efforts through research education and demonstration {#244}
- educating customers, offfer low insurance rates for customers participating in program and Insurance companies pay local government for emergency PV fund {#249}
- offer this as a benefit to customers because they care. It will save them money. {#250}
- lowering cost and providing in field repairs {#251}
- Reduction of policy for certain incentives. {#252}
- Potential co-funder thru reduced premiums. Help promote technology thru advertising {#283}
- This is a risk management tool for insurance companies; therefore PVs become a tool they can offer their customers (business and personal) {#286}
- reduced rates to owners as an incentive to have it; similar to reduced rates for fire extinguishers and smoke detectors. {#288}
- insurance provide incentives for pv systems and buy downs {#293}
- Pay for PV used by the private user. {#296}

10. List one or more attractive dual-use applications of photovoltaics for disaster relief.

- Utility feeder lines, sub-stations, etc. {#211}
- street lighting, powering ice makers at marinas, utility substation battery charging, keeping starting batteries charged during storage, radio station batteries {#220}
- why duel use?????
- computer / telcom back up systems {#221}
- Water Management (i.e. pond aeration, irrigation, pumping systems) {#224}
- UPS systems {#226}
- Traffic signals, traffic information signs, water pumps, street lighting, feeding local hospital, police or fire department systems, portable weather stations, Interstate emergency call boxes, refrigeration units for medications, add on applications for homes, and commercial systems. {#228}
- computer backup power, emergency services power units {#230}
- interchangable application packages for PV recharged battery systems, lights, communication, refrigeration, etc. {#233}
- Street lights , Any other mobile solar unit. Detatchable panels /units from homes for use in applicable areas {#235}
- ups for computers, 911 centers etc {#245}
- Telecommunications, traffic control, PV powering of solar thermal water heating systems, water pumping, instrumentation {#246}
- provide reliable communications backup {#255}
- solar thermal and pv applications on schools that could be used as shelters during disaster and recovery efforts. pv at utility substations that could be dismantled and deployed in recovery areas. portable lighting. stand alone generators for traffic control {#256}
- recharging batteries ; lighting {#260}
- Make universal adapter applications, and all mentioned on #228 {#261}
- Radio broadcast for tourist information and then for disaster information during an emergency. Information signs on the highway that can be used during disasters for evacuation or shelter information. UPS systems before/during and after. {#264}
- this is something that is new to me. it is power that is there every day when not in use for disaster use it where it sets for what is near. {#273}
- signage and traffic signilization or radios {#289}
- communication systems (cellular), battery reccharging, UPS systems, water pumping -- small scale for flooded basements, monitoring systems {#290}
- telecommunications and radio systems, street & traffic lights, message boards {#292}
- ups systems, transportations devices, portable systems, battery charging systems {#295}
- I need them for exclusive use for comm {#297}

Appendix C

In Phase II of the FSEC workshop, participants were asked to identify the most important issues or questions associated with using PV equipment during disaster relief efforts. The complete list of responses is provided below, in terms of categories that were generated: key issues, finance, logistics, education, design and marketing.

Key Issues/Questions

Participant Instructions

Please provide in your own private list the questions, issues and/or problems associated with usage of photovoltaic systems for disaster refief.

Key Issues (issues not categorized—same categories already used)

1. Lack of cooperation from electrical utilities
2. equipment storage, transportation, availability
3. will the solar power unit have a problem being out in all types of weather
4. Storage requirement
5. benefit vs present sources
6. finding appropriate dual uses for PV
7. portable during a severe storm (hurricane, tornado...)
8. Procurement people do not know about PV
9. PV not a threat to conventional generation of utilities
10. Best means of storeage; We have limited space.
11. Need utilities buyin of PV and related technologies
12. Preceived Reliability
13. portable during a severe storm (hurricane, tornado...)
14. Do not know were to buy solutions
15. what kind of a crazy place is this !!!!!!!!!!
16. PV deployment/demonstration opportunities
17. Loads are too large to be practically operated using PV
18. Loads have not been designed to keep power needs to a minimum
19. PV product have not been designed with the specific needs of relief efforts in mind
20. Relief organizations are unaware of the various attributes of PV and how it might benefit them
21. Lack of confidence in solar products on the part of relief agencies (not available through conventional channels)
22. Lack of power tp pound for immediate response purpose
23. Need to increase capacity of solar generation or efficiency of appliances
24. How will deregulation affect deployability of PV in eyes of utilities
25. durability
26. capacity

Finance

1. Who pays for the system.

2. support by federal and state agencies to include incentives for user use
3. where's the money? Who is going to purchase the equipment
4. Identify an industry/relief organization partnership will to commit to a multiyear effort.
5. Capital cost
6. Cost for N.G.O.
7. Funding

Logistics

1. Best way to transport this equipment without damaging.
2. portability
3. how much would the unit weigh that would supply enough power for our equipment
4. Being prepared to deploy equipment before the disaster (preparedness)
5. Viability of system in high risk zone
6. are the batteries used listed on the department of defense transportable materials
7. If our team is deployed, how do we receive emergency parts or replacements!
8. How are they deployed?

Education

1. Not invented here scenario
2. Guidance provided for DEM on plan development does not make provision for alternatives like
3. PV
4. Misinfformation
5. What is the reliability of pv in a disaster
6. How to introduce PV to economy, society, environment
7. Knowing exactly where PV makes the most sense
8. Public and industry does not recognize and/or thereby accept benefits of PV
9. lack of public education
10. General lack of staff knowlege on capabilities of PV

Design

1. What is the reliability of pv in a disaster
2. How do I determine the best pv for my specific application
3. Low power capacity
4. define equipment ops parameters
5. power requirement vs size
6. redesigning equipment for maximum efficiency, so that PV is practical

Marketing

1. are the batteries used listed on the department of defense transportable materials?
2. No catalog
3. Call it a generator
4. where to get eqpt
5. Lack of communications between industry and the users
6. Not invented here scenario