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ENERGY BACKUP SYSTEMS MAINTENANCE TRAINING FOR HOSPITAL TECHNICIANS IN HAITI - II

Port-au-Prince, December 5-9, 2011

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Summary

To ensure maintenance and improve chances for sustainability of the backup power systems installed in Haitian hospitals under USAID's Improving Health Facility Infrastructure (IHFI) project, a training workshop was designed and implemented for hospital technicians. The workshop focused on inverter, battery and generator maintenance and operational issues, and built on the base provided in a first workshop on these topics in March 2011. IHFI worked with the Ministry of Health Project Management Unit (UGP) which sponsored and co-funded the training, including bringing 16 hospital technicians and some administrative and other technical staff from facilities throughout Haiti to Port-au-Prince for five days of training. Materials from the US were adapted/translated to Creole, and US trainers, IHFI staff, and instructors from a local vocational school made up the teaching team.

Workshop materials and basic electrical tools were provided to each technician, and interactive, hands-on sessions were designed to meet the training objectives. In addition, participants were taught how to measure and log readings in logbooks and sheets designed for this purpose.

Following are some of the key conclusions and achievements of this training workshop:

- 13 hospital technicians, 1 administrator and 2 technical staff from UGP were trained on operation, maintenance and data logging on battery, inverter and diesel generator systems. Travel and expenses including the hotel stay in Port-au-Prince were paid for all the participating technicians.
- Overall, the participants were very satisfied. The workshop generated good will and a sense of empowerment among technicians, something that has typically been lacking in many health facilities in Haiti. Moreover, the workshop helped build relationships among the technicians, and more importantly, between technicians and the UGP.
- Data collection and logging, in addition to providing valuable data on operations, challenges technicians to be responsible and know their equipment better; this should become one of the underpinnings of the IHFI program in Haiti.
- Additional Creole curriculum materials were developed for this workshop and can be reused, expanded and built upon for additional training.
- Participation of the Ministry of Health and a local vocational school were key contributors to the success of this workshop, and to the expected continuation of more workshops.

Introduction

As part of USAID's Improving Health Facility Infrastructure (IHFI) program in Haiti, Tetra Tech (Tt) worked with the Project Management Unit (UGP) of the Haitian Ministry of Health and Population (MSPP) to organize and deliver an intermediate-level follow-up training workshop for MSPP hospital technicians on maintenance and upkeep of backup power systems in hospitals and clinics. The workshop focused on more advanced aspects of operation, maintenance and monitoring of lead-acid batteries, inverters/rectifiers, and diesel engine generators, spanning five full days. This workshop was designed as a Level II workshop, building on the Level 1 training in March 2011, and focused on the following objectives:

- Review topics from the March course about the Outback inverter MATE data monitoring system, maintenance of the systems, battery equalization, and generator operation to solidify the technicians' comprehension of topics.
- Expand knowledge of intermediate topics such as good wiring practices, sizing overcurrent protection, navigating MATE screens, and understanding if the battery is charged completely.
- Continue to develop, test and enhance a basic training approach and curriculum that can eventually be repeated in country to reach all MSPP and other health facility technicians.
- Continue development of local in-country instructor capacity for future technician trainings, including a local vocational school, Haiti Tec, where much of this capacity could reside.
- Further introduce the concepts and habits of measurement, logging and documentation of key operating parameters of backup power systems, as part of a process to develop data bases of system performance throughout MSPP health facilities.

Organization of the Training

Logistics

The training took place on December 5-9, 2011 at the Haiti Tec facilities in Port-au-Prince, Haiti. Sixteen technicians from all over Haiti were invited to participate. Organization and funding were shared between IHFI and UGP: UGP paid for the welcome ceremony, the lodging, the bus transport between hotel and Haiti Tec, and the technicians' travel to Port-au-Prince, while IHFI covered a small per diem for the participants, and paid for instructors, materials and the participation of Haiti Tec and their facilities.

The Tt team used the Outback Lab System installed in Haiti Tec in March 2011 for the previous training. The system includes a 48V, 225Ah battery bank, a no-contact inverter, and a contact inverter - all connected to a MATE, and was installed on a practice board for participant access and practical exercises.

As part of the class, each participant received a binder with course materials and logging sheets to be completed. Each participant also received a tool kit with: a Kill-a-Watt meter, a hydrometer, a voltage tester, an outlet wiring tester, a big pipette to add water to the batteries, a funnel, wire nuts, electrical tape and a calculator. The full list of instruments can be found in Appendix C. Diplomas for course completion were provided.



Welcome ceremony at the hotel where the participants stayed

Participants

Thirteen hospital technicians, one administrator and two technical staff from UGP attended the five-day training. Twelve of the students were alumni of the March training. Two hospitals (Hinche and Jeremie) sent new technicians to replace those who attended in March, and two new hospitals were represented (Croix des Bouquets and Dame Marie). The full list of participants can be found in Appendix A.



Group picture of the participants and some of the instructors

Instructors

The training was instructed by Carol Weis (Tt), Jude Juste (Tt), Loby Gratia (Tt), Lesly Theard (Tt), Ronick Dieudonne (Tt), Christopher Freitas (Tt), Armand Gerald (Haiti Tec) and Franz Gilbert (Tt). Translations between English and Creole were provided by UGP's participant Delva Nickson.

Carol Weis works part-time as a solar photovoltaic (PV) system instructor and consultant on international projects in countries such as Haiti, Ecuador, Mexico, Nicaragua and Pakistan. She also works part-time as an instructor and PV curriculum developer for Solar Energy International (SEI). She is a Certified Master PV Trainer by the Institute of Sustainable Power & Quality, she has her PV Installer Certification with the North American Board of Certified Energy Practitioners, and she has worked as a

licensed electrician and solar installer in Colorado. For over a decade, Carol has been a lead member of SEI's PV technical team creating a world class PV curriculum for a mainly U.S. market, and now brings that same training rigor to programs in developing countries.

Jude Juste is an electrical engineer on the IHFI project with 3 years of experience in the sizing, design, installation, commissioning and maintenance of battery/inverter systems, with specific experience in Outback inverter installations.

Loby Gratia is an electrical technician on the IHFI project with nearly 20 years of experience with electrical installations and inverter repair.

Lesly Theard is an electrical engineer who works as the IHFI in-country project coordinator in Haiti. He has nearly 20 years of experience in batter/inverter systems design and installation, and ran an inverter repair business in Port-au-Prince for many years. He helped pioneer the installation of solar PV systems in Haiti.

Ronick Dieudonne is an electrical engineer on the IHFI project with several years of experience in diesel generator operations and maintenance.

Christopher Freitas has been working with Sun Energy Power International (SunEPI) since October of 2008 and has participated in many projects in Haiti working as a project engineer. Christopher was a co-founder/co-owner of Outback Power Systems, a leading U.S. manufacturer of solar power electronic components used on many of the systems installed by SunEPI. Prior to starting Outback Power, he was the Director of Engineering at Trace Engineering, another inverter manufacturer, where he worked from 1994 to 2001.

Armand Gerald is an independent expert on diesel generators and generator systems who teaches this subject at Haiti Tec.

Frantz Gilbert is the owner and principal technical expert of Services Professionels, a Haitian firm that specializes in repair and maintenance of diesel generators. With more than 20 years of experience, he supervises approximately 15 technicians that service equipment and provide emergency repairs throughout the country.



Tetra Tech employees instructing hospital technicians with Power Point presentations (left) and hands-on practical sessions (right) in Haiti Tec classroom

Course Structure and Content

Summary Agenda

Most of the class consisted of short Power Point presentations interspersed with hands-on labs with the classroom system. The following table provides a brief description of the course structure. The detailed agenda of the training can be found in Appendix B.

Day #	Title	Instructors
Day 1	Review, Basics of electricity, Loads, MATE lab	Carol Weis; Jude Juste; Loby Gratia
Day 2	Batteries, Battery lab, MATE summary screen, MATE logging	Carol Weis; Jude Juste; Loby Gratia
Day 3	Wiring, OutBack Wiring lab	Carol Weis; Christopher Freitas; Jude Juste; Loby Gratia
Day 4	Generator Operation, Maintenance and Monitoring	Ronnick Dieudonne; Armand Gerald; Frantz Gilbert
Day 5	Generator Operation, Maintenance and Monitoring	Ronnick Dieudonne; Armand Gerald; Frantz Gilbert

Day 1 – Review, Loads, MATE navigation, and finding errors and warnings

The first half of the day consisted of reviewing concepts from the March class and a review of the basics of electricity and electrical terminology. A quiz in Creole on electricity basics was applied as an exercise for the participants. It was discovered that the quiz was appropriate in its content, but it was a very slow process for the participants to read the questions and to write down the answers. After two hours of having them work in groups, the exam was discontinued, only half completed, and the next hour was spent reviewing the part they had finished.

The second half of the day the class started with reviewing how to use the Kill-a-Watt meter, how to determine how much energy a load uses, and how the amount of energy affects the design of the inverter and size of a battery bank. The last two hours of class reviewed how to use the MATE with hands-on labs to perform the following:

- How to return to the Main screen
- How to know if your EDH or Generator is connected to the inverter
- Reading the LED lights on the MATE and inverter to understand if your inverter is inverting
- Turning the inverter on and off from the MATE
- Navigating the MATE to find errors and warning screens.

There were a number of discussions as to what preventive measures should be taken when you see a warning flash on the inverter to prevent the system from shutting off in error. Five technicians said that they saw errors happen at their hospital since the March workshop.

A low battery voltage error was created on the classroom inverter lab to have the students find the error and clear it.



Kill-a-Watt meter lab (left) and MATE navigation lab (right)

Day 2 – Battery maintenance and equalization

Most of the entire second day was dedicated to battery safety, maintenance, and equalization. There are many steps involved in doing equalization properly, and thus it took the majority of the day. The class received new hydrometers with temperature compensation, so each technician was required to test the specific gravity of one cell. Most of the students were able to do this well, but several did not use caution, filled the hydrometer too much, and sulfuric acid sprayed out. Safety and caution were stressed before, during, and after this exercise, but everyone might not be competent in this task.

The class practiced drawing a diagram of the battery bank in the classroom and recording the measured specific gravity (SG) of each cell with the addition of the temperature compensation. Each student practiced navigating the MATE to both start and stop the equalization process. The things that they are required to do before, during, and after equalization (EQ) were discussed in depth:

- Before: make sure the battery bank is at 100% state of charge (SOC), make sure the electrolyte is covering the plates (without filling completely), use safety gear, draw a diagram of the battery bank and label each cell, and measure and record the SG of each battery cell.
- During: make sure the AC-in is on, start the EQ with the MATE, check the SG of one pilot cell every 30 minutes to determine when to stop the EQ, check water levels and temperature of the cells every 30 minutes to make sure the plates are never exposed and that the battery doesn't get too hot.
- After: stop the EQ, fill all cells with water to the designated point.

All students received a temperature compensated hydrometer and a water syringe for adding precise amounts of water.

The Haiti Tec batteries were successfully charged to 100% by the end of the class.

Day 3 – Monthly and daily logging, inverter repair, wiring practices

On the third day, Jude Juste and Loby Gratia worked with each technician to verify that they could find and record all information for the daily and monthly logs. After that exercise, Christopher Freitas took

an inverter apart to demonstrate how to replace all circuit boards, and to discuss the common causes of failure.



Christopher Freitas disassembling and reassembling an OutBack inverter

The class then reviewed the 5 summary slides on the MATE and how to read if the battery is being charged or discharged. Next, the class reviewed how to read if the battery is full using voltage, state of charge (SOC), specific gravity (SG), and days since full (DSF) readings. This section was taught not only by presenting still frames of a sample MATE system in PowerPoint, but also based on Haiti Tec's live system, having the students look up information on the MATE and make decisions on what to do based on what was currently happening.

The wiring section covered color coding of wires, where to place disconnects, how to size overcurrent protection (breakers and fuses) to wire size, basics of equipment and system grounding, and the importance of not having exposed splices. This section was limited to 1 hour because of the length of the other sections.

All technicians received black, red, white, and green electrical tape, rubber insulating tape, voltage testers, outlet wiring testers, and wire nuts.

Day 4 & 5 – Generators

The final two days of the training were dedicated to the operation, maintenance and monitoring of diesel generators. This section was taught by a combination of three instructors, Armand Gerald, Frantz Gilbert and Ronick Dieudonne, with specific explanatory interventions by Lesly Theard.

On Thursday, the lecture was based on a PowerPoint presentation and covered the following aspects: broad overview of generators (definitions, most common brands), most important components, main circuits (air, fuel, cooling, oil), how to start, operate and stop a generator, and the most common problems.

On Friday, class started by reviewing the required logging and how to understand if there is an error in the readings. The course then covered the maintenance and safety measures, and ended by a hands-on

session on one of Haiti Tec's generators. The three instructors took turns presenting to the class by subject. There was time for the technicians to mention their own experience and problems with generators, and ask specific questions to the instructors.



Generator session led by Frantz Gilbert on one of Haiti Tec's generator

The full list of training materials provided to the participants, as well as some examples, can be found in Appendix C.

Evaluation of the Training

Participants' Evaluation

All the participants filled out an evaluation form; results are provided in Appendix D. Instructors got excellent marks, ranging from 3.7 to 4 and averaging 3.9 out of 4. Similarly the topics covered were clearly in line with the participants' satisfaction, marks ranged from 3.6 to 3.9 and averaged 3.8 out of 4. In terms of logistics, the participants were very satisfied by the tool kit (3.9/4) but less so by the food (3.3/4), transport and classroom (3.5/4). All the participants' evaluations can be found in Appendix F.

General Comments from the Participants

As during the March 2011 workshop, in the battery maintenance section, the technicians raised the issue of distilled water supply, stating that they do not always receive it in a timely manner from the administration. It discussed how having a monthly log of how much water is required by the batteries would help administrators plan for the amount that they needed to give the technicians each month. One technician also mentioned that he tried to submit his logs but the Administrator did not understand them and refused to sign. It explained that the future training for Administrator will help solve this issue.

The technicians also discussed animatedly about their salaries and responsibilities in the hospitals, some of them wanting to get paid more money for having these new responsibilities and duties.

In terms of potential assistance needed in six months, the technicians mentioned first "navigating the MATE" (listed by 10 technicians), then "generator maintenance" (9), "battery maintenance" (8), and "battery equalization" (7).

Regarding the topics that should be covered again in future seminars, the technicians mentioned predominantly the MATE and OutBack inverter (listed by 13 technicians), and the generator (10), followed by wiring (7), batteries (5) and loads (3).

Summary and Recommendations

Overall, the training was a success. The technicians were able to prove their skill levels in some areas, and practice and ask their questions of the other areas. There was a noticeable improvement in confidence level with navigating the MATE from the March class. There was ample time for the more skilled students to help the new students navigate the MATE. The students were thrilled to receive the tools that they were given at the training.

A number of areas were identified as lessons or items to follow-up to improve future trainings, as discussed in the points below.

1) Training facility

- This second training confirmed that Haiti Tec looks to be a good partner for trainings. Their facility is in a good location in Port-au Prince, they have a supportive administrative team, they already have a program that teaches similar classes, and we have identified several professors that expressed interest in using this system in their future classes.
- The battery bank at Haiti Tec should be located in an area with better ventilation and should be in a locked box to prevent accidents.

2) Training follow-up

- It is recommended that the Haiti Tt team call each hospital technician within 2 weeks of the training to verbally verify all systems were equalized and to offer technical assistance. The Haiti Tt team should also call each hospital technician every 3 months to remind them to equalize quarterly and offer technical assistance.
- Tt should continue to conduct regular follow-up visits to each site to review and assist the technicians in the systems maintenance.
- The same trainings, Level I and Level II, should now be offered to new technicians. Follow-up or repeat trainings for the same technicians could be offered annually.

3) Training material

- It is recommended to use the initial quiz as a verbal review to be done with the entire class. This will give the instructor the ability to expand further into concepts when needed, without having to test the literacy levels.
- Now that it has been taught once, the weekly schedule can be adjusted to reflect the amount of time actually needed in class. Some corrections to the existing curriculum can be made from lessons learned in this class.

4) Training organization

- It was worthwhile having a dedicated translator instead of someone that is also acting as a co-instructor, as recommended after the March 2011 training.
- Also as recommended after the March 2011 training, it would be useful for the instructors to meet one day in advance and conduct a mock training in order to go over the different teaching styles and review some basic teaching methodologies.

Appendix A: List of Participating Institutions

Participant Number	Title	Site	Department
1	Technician	Borgne*	North
2	Technician	Limbé*	
3	Technician	Justinien*	
4	Technician	Fort Liberté*	Northeast
5	Technician	Ouanaminthe*	
6	Technician	Port de Paix*	Northwest
7	Administrator	Beraca*	
8	Technician	Jérémie*	Grand Anse
9	Technician	Dame-Marie*	
10	Technician	Les Cayes*	South
11	Technician	Hinche*	Central Plateau
12	Technician	Belladère*	
13	Technician	HUEH*	West
14		UGP*	
15			
16	Technician	Jacmel*	Southeast

*sites where laboratory Outback systems have been installed

Appendix B: Training Agenda

Monday, Dec 5	Tuesday, Dec 6	Wednesday, Dec 7	Thursday, Dec 8	Friday, Dec 9
<p>Welcome</p> <p>Review Quiz</p> <p>Basics of electricity terminology review</p> <p>Loads</p> <ol style="list-style-type: none"> 1. Load analysis 2. Energy efficiency 3. Phantom Loads 	<p>Day 1 review</p> <p>Batteries</p> <ol style="list-style-type: none"> 1. Battery Review 2. Checking if your battery is full 3. Equalization <p>Battery LAB</p> <ol style="list-style-type: none"> 1. How to use a hydrometer 2. How to start an EQ Charge 	<p>Day 2 review</p> <p>Wiring</p> <ol style="list-style-type: none"> 1. Wiring, breakers/fuses, grounding 2. Good & bad wiring practices 	<p>Most common diesel generators</p> <p>Generator characteristics</p> <p>Differents Circuits Diesel, cooling, oil</p> <p>How to start a generator</p>	<p>How to operate a generator</p> <p>Generator safety measures</p> <p>Generator daily and monthly logs</p>
Lunch	Lunch	Lunch	Lunch	Lunch
<p>Loads (continued)</p> <ol style="list-style-type: none"> 1. Kill-a-watt meters 2. LAB using meters <p>MATE LAB: Logging Review</p> <ol style="list-style-type: none"> 1. Error screens 2. Monthly logging 	<p>MATE Summary Screens</p> <ol style="list-style-type: none"> 1. Reading MATE summary screens 2. Understanding charging and 3. Discharging 4. Summary Screen Exercise <p>MATE LAB: Logging Checking & recording daily logs</p>	<p>OutBack Wiring LAB</p> <ol style="list-style-type: none"> 1. Rewire Outback inverter system 2. Continue practicing MATE navigation 	<p>Troubleshooting</p> <p>How to stop a generator</p>	<p>Generator LAB</p>

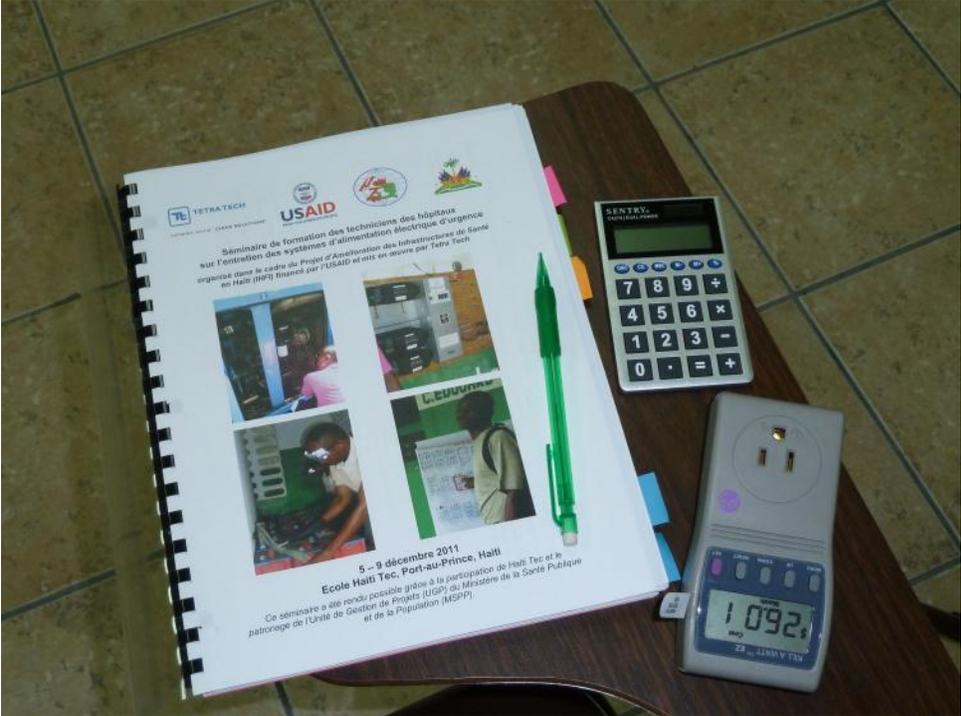
Appendix C: List of Training Materials Provided

The following documents were distributed to all the participants as handout material:

- 1) A binder with the following course material:
 - a. Cover page
 - b. Agenda
 - c. Review Quiz
 - d. PPT slides on loads
 - e. Exercises on loads
 - f. PPT slides on how to use a kill-a-watt meter
 - g. PPT slides on battery maintenance
 - h. PPT slides on MATE screen
 - i. PPT slides on wiring
 - j. Example MATE errors and alarms
 - k. Battery maintenance summary
 - l. PPT slides on generator operation, maintenance and monitoring
 - m. Logging book with
 - i. Equalization methodology
 - ii. Picture of how to use the hydrometer
 - iii. Technician duties summary
 - iv. Equalization log
 - v. Monthly MATE log
 - vi. Daily MATE log
 - vii. Generator log

- 2) A tool kit including the following:
 - a. Electrical tools pouch
 - b. Kill-a-watt meter
 - c. Hydrometer
 - d. Big pipette
 - e. Funnel
 - f. Voltage tester (size of a pen with AAA battery and LED)
 - g. Outlet wiring tester
 - h. Black, red, white, and green electrical tape, and rubber insulative tape
 - i. Wirenuts (in a big ziplock bag)
 - j. A pair of gloves
 - k. Black markers Sharpi
 - l. Pencil
 - m. Calculator

Some of the tools given to each participant



Yon mesaj **avètisman** parèt sou ekran Mate la

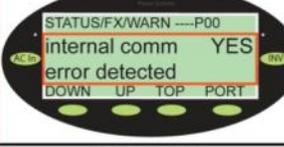


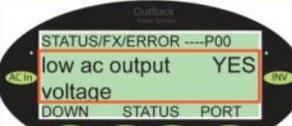
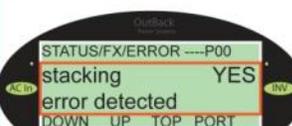
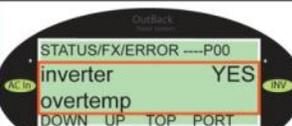
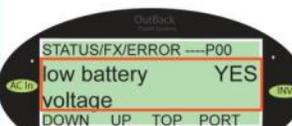
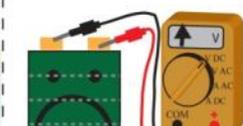
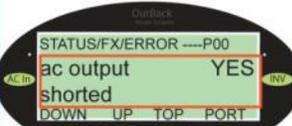
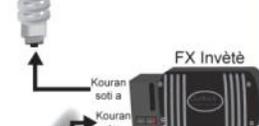


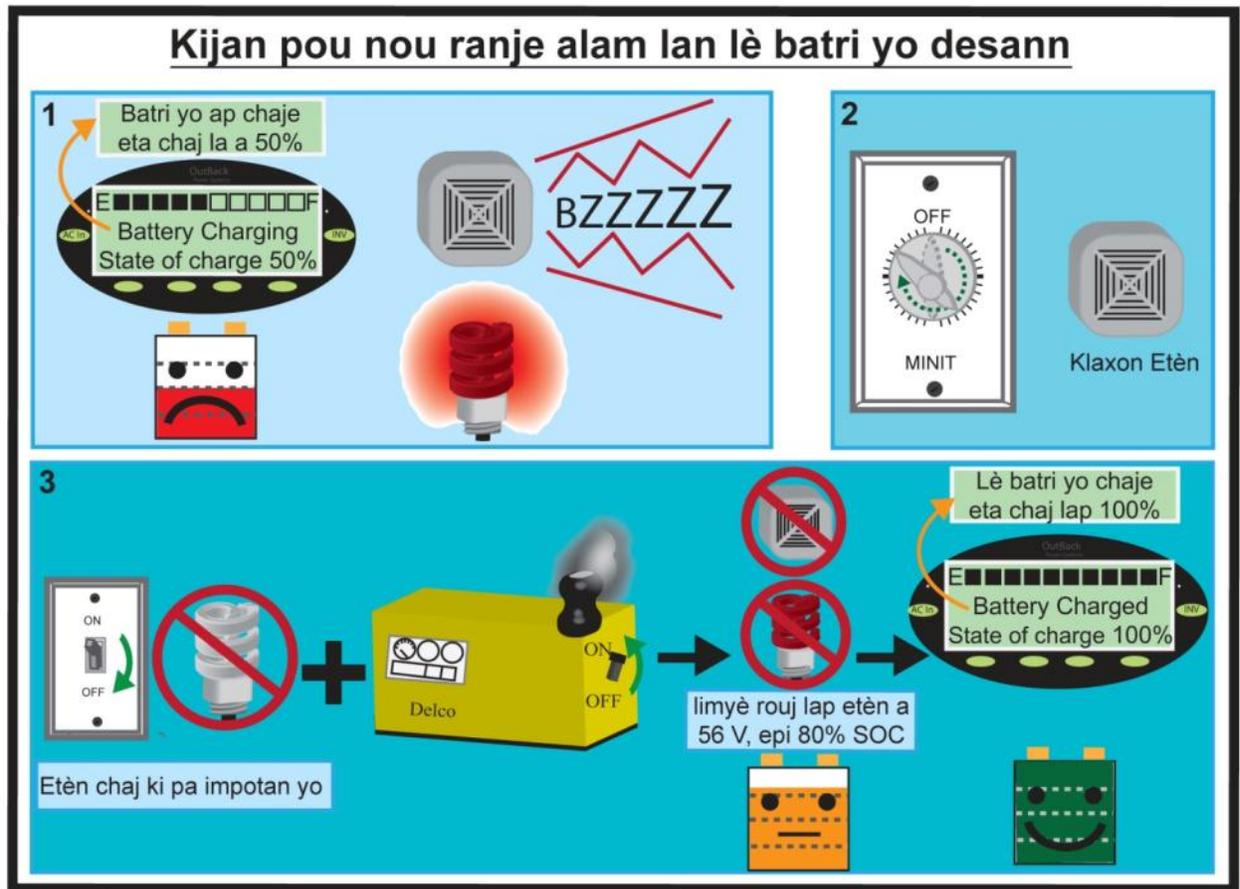
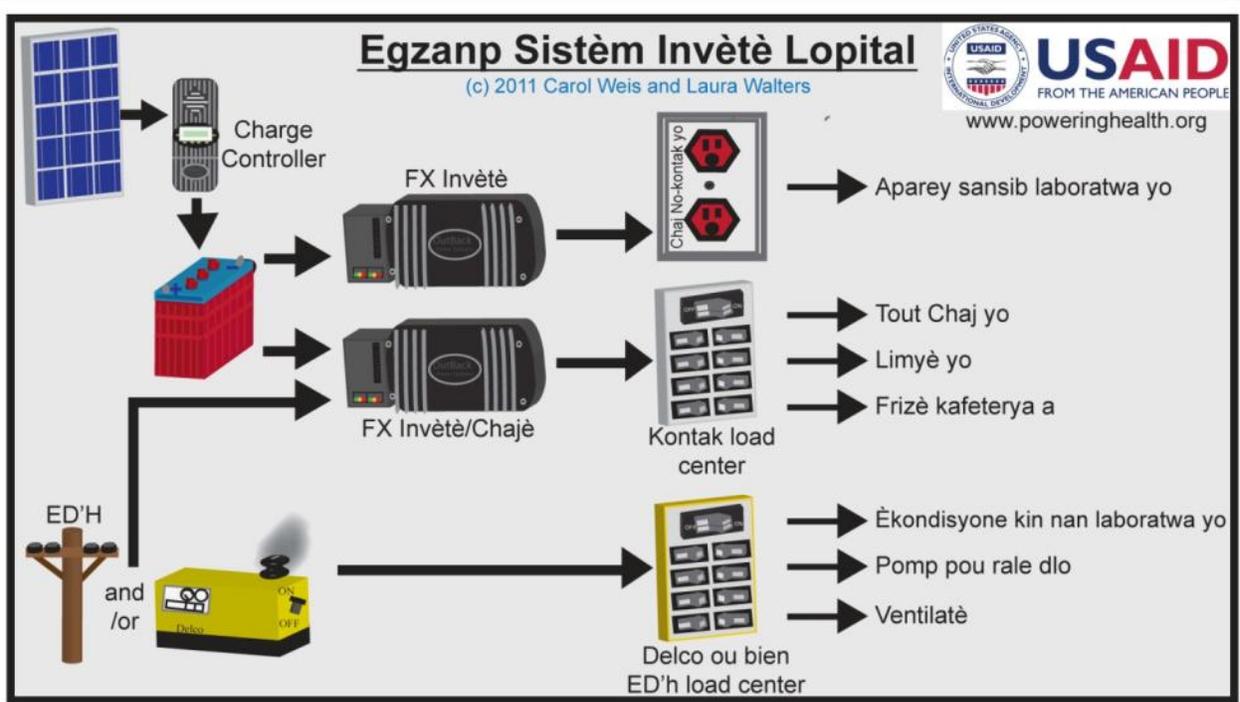



Invète a kontinye ap mache

Ti limyè invète yo ap limen etèn

Avètisman Mesaj	Avètisman Mesaj - Kreyol	Explikasyon	Solisyon
	ETA / FX / AVÈTISMAN ---P00 Frekans lan OUI wo anpil ANBA ETA PORT	 <p>Frekans sous la rive a 66Hz (lap depase limit li) li ka en pan si frekans kontinye monte pi wo</p>	 <p>Tcheke epi ajiste frekans delco wa</p>
	ETA / FX / AVÈTISMAN ---P00 Frekans la OUI ba anpil ANBA ANWO ANLÈ PORT	 <p>Frekans sous la bese a 54Hz (li two ba) li ka en pan si frekans kontinye bese</p>	 <p>Tcheke epi ajiste frekans delco wa</p>
	ETA / FX / AVÈTISMAN ---P00 voltaj la OUI wo anpil ANBA ANWO ANLÈ PORT	 <p>Voltaj sous la depase 140V (ki se voltaj defo invète a) e nou riske pèdi koneksyon invète yo</p>	 <p>Tcheke epi ajiste voltaj delco wa</p>
	ETA / FX / AVÈTISMAN ---P00 voltaj la OUI ba anpil ANBA ANWO ANLÈ PORT	 <p>Voltaj sous la depase 108 V (ki se voltaj defo invète a) e nou riske pèdi koneksyon invète yo</p>	 <p>Tcheke epi ajiste voltaj delco wa</p>
	ETA / FX / AVÈTISMAN ---P00 kouran soti a OUI depase pi wo vale l' ANBA ANWO ANLÈ PORT	 <p>Chaj yo ap rale pli kouran ke invète yo ka bay</p>	 <p>Diminye nan chaj yo</p>
	ETA / FX / AVÈTISMAN ---P00 tanperati OUI sensor la pa bon ANBA ANWO ANLÈ PORT	 <p>Gen yon tanperati sensor ki pa bon</p>	 <p>Circuit board kin an invète a beswen ranplasan. Rele yon distribitè Outback</p>
	ETA / FX / AVÈTISMAN ---P00 Erè kominikasyon OUI nan invète a ANBA ANWO ANLÈ PORT	 <p>Erè kominikasyon nan invète a</p>	 <p>Circuit board kin an invète a beswen ranplasan. Rele yon distribitè Outback</p>
	ETA / FX / AVÈTISMAN ---P00 ventilatè andan OUI invète a anpàn ANBA ANWO ANLÈ PORT	 <p>Ventilatè ki pou rafredi invète yo pa mache byen</p>	 <p>Ranplase ventilatè invète a</p>

Erè Mesaj	Erè Mesaj - Kreyol	Explikasyon	Solisyon
	ETA / FX / ERÈ -----P00 voltaj la ba nan soti sous la ANBA ANWO ANLÈ PORT	 <p>Invètè pa ka bay ase voltaj pou chaj la</p>	 <p>Diminye sou chaj yo</p>
	ETA / FX / ERÈ -----P00 erè pwogramasyon kouplaj ANBA ANWO ANLÈ PORT	 <p>Pwoblèm komunikasyon nan pami invètè yo</p>	 <p>1. Pwogramasyon Mate la 2. Tcheke HUB ak kab yo wè si pa gen erè</p>
	ETA / FX / ERÈ -----P00 invètè chofe ANBA ANWO ANLÈ PORT	 <p>Invètè depase maksimòm tanperati yo ka travay</p>	 <p>1. Diminye sou chaj yo 2. Invètè yo manke ayere</p>
	ETA / FX / ERÈ -----P00 voltaj batri yo ba ANBA ANWO ANLÈ PORT	 <p>Voltaj batri yo anba "Low battery cut-out voltage" setpoint.</p>	 <p>1. Diminye sou chaj yo 2. Chaje batri yo ak kouran delco a</p>
	ETA / FX / ERÈ -----P00 voltaj batri yo wo ANBA ANWO ANLÈ PORT	 <p>Voltaj batri a monte pi wo ke voltaj maksimòm lan pandan 10S</p>	 <p>Tcheke Charge Controller ki pou system sole a avek lot sous yo</p>
	ETA / FX / ERÈ -----P00 soti kouran an koupe ANBA ANWO ANLÈ PORT	 <p>Invètè yo depase kapasite maksimòm, yo etèn</p>	 <p>1. Diminye sou chaj yo 2. Tcheke fil kouran yo, pou wè si pa gen kousikwi</p>
	ETA / FX / ERÈ -----P00 soti kouran an jwen ak rantrè kouran an ANBA ANWO ANLÈ PORT	 <p>Yo konekte yon lot sous nan soti invètè yo</p>	 <p>Tcheke fil kouran yo</p>



Entretien Batri Yo

Fason pou nou teste voltaj batri yo

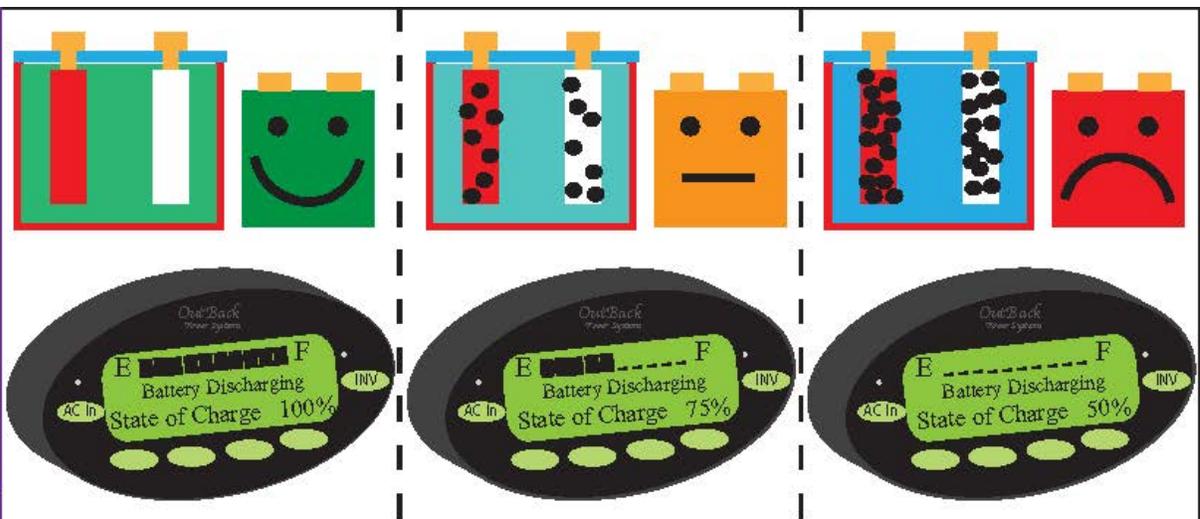
$2V + 2V + 2V = 6V$

Nivo chaj batri yo	Voltaj					
	2V	4V	6V	12V	24V	48V
100 %	2.1	4.2	6.3	12.6	25.2	50.4
75 %	2.07	4.14	6.2	12.4	24.8	49.6
50%	2.03	4.06	6.1	12.2	24.4	48.8
25%	2	4	6	12	24	48
0%	1.97	3.94	5.9	11.8	23.6	47.2

Fason pou retire vè de gri sou bòn batri yo

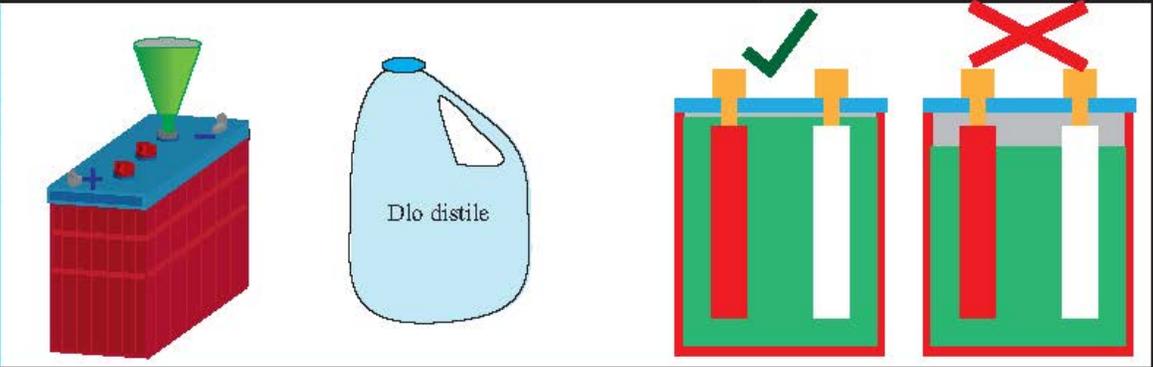


Nivo chaj batri yo



Nivo chaj batri yo	Nivo Acid
100 %	1.255-1.275
75 %	1.215-1.235
50%	1.200-1.180
25%	1.165-1.155
0%	1.130-1.110

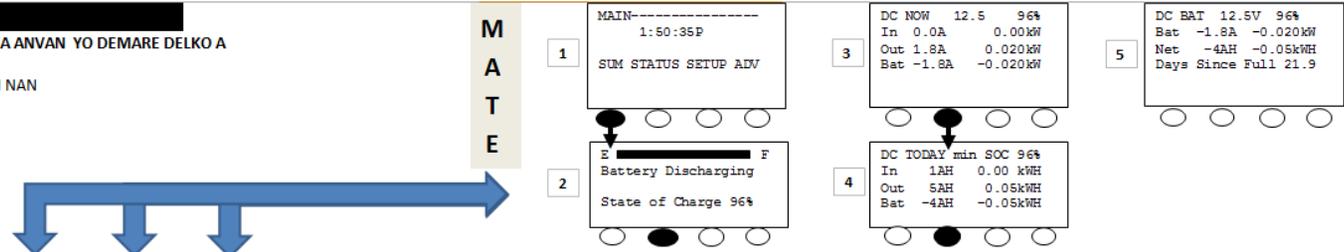
Koman pou mete dlo nan bateri yo



m. vi - Daily Log Sheet (Creole)

Not pou pran chak jou
 POU RANPLI 2 FWA PA JOU: PREMYE FWA ANVAN YO DEMARE DELKO A
 DEZYEM FWA: Avan labrim di swa
 OU DWE RANPLI L SI OU TANDE KLAKSON NAN
 Haiti Energy Team
 Non Sant Sante a:
 Non Teknisyen an:

M
A
T
E



DAT J/M/A	Lè	Inisyal	Voitaj Batri yo (MATE)	Eske Batri yo chaje (MATE)	Jou depi ke batri yo chaje (MATE)	Este ou tande Klakson nan?	Pase Delko Wi ou No	Kisa ou fè		Gen limyè erè ki paret? Wi/No	Si Se Wi ki Erè?	Remak
								Delko				
								Lè li derape	Lè li kampe			
			VDC	%				Start	Stop			
			VDC	%				Start	Stop			
			VDC	%				Start	Stop			
			VDC	%				Start	Stop			
			VDC	%				Start	Stop			
			VDC	%				Start	Stop			
			VDC	%				Start	Stop			
			VDC	%				Start	Stop			
			VDC	%				Start	Stop			
			VDC	%				Start	Stop			
			VDC	%				Start	Stop			
			VDC	%				Start	Stop			
			VDC	%				Start	Stop			
			VDC	%				Start	Stop			
			VDC	%				Start	Stop			
			VDC	%				Start	Stop			
			VDC	%				Start	Stop			
			VDC	%				Start	Stop			
			VDC	%				Start	Stop			
			VDC	%				Start	Stop			

m. v. - Technician Monthly Log (Creole)

Not pou pran chak Mwa

Dwe konplete chak mwa
Haiti Energy Team

Non Sant Sante a:

Non Teknisyen an:

Flex Net DC Monitor - OUTBACK POWER MATE

DAT	Min SOC %	Amphours (AH)			kWH			Remak
		In	Out	Bat	In	Out	Bat	
28/2/11								
27/2/11								
26/2/11								
25/2/11								
24/2/11								
23/2/11								
22/2/11								
21/2/11								
20/2/11								
19/2/11								
18/2/11								
17/2/11								
16/2/11								
15/2/11								
14/2/11								
13/2/11								
12/02/11								
11/02/11								
10/02/11								
09/02/11								
08/02/11								
07/02/11								
06/02/11								
05/02/11								
04/02/11								
03/02/11								
02/02/11								
01/02/11								

Initialize once this is complete this once per month			
Egalize	Tcheke dio nan batri yo	Ki kanite lit dio ou te mete?	Netwaye tèt batri yo ak tèminal yo

Main-----
12:00:30P
SUM STATUS SETUP ADV

E [Progress Bar] F
Battery Discharging
State of Charge 100%

DC Now 50.8V 100%
In 0.1A 0.000kW
Out 0.4A 0.010kW
Bat -0.3A 0.010kW

DC Today minSOC 80%
In 102AH 5.4 kWh
Out 93AH 4.88 kWh
Bat 9AH 0.52 kWh

DC -1 DAY minSOC 72%
In 174AH 8.87 kWh
Out 310AH 15.81 kWh
Bat -136AH -6.94 kWh

DC -2 DAY minSOC 76%
In 420AH 21.42 kWh
Out 256AH 13.06 kWh
Bat 164AH 8.36 kWh

Appendix D: Evaluation of the Training by the Participants

Legend	
1	Very bad
2	Not good
3	Good
4	Excellent

INSTRUCTORS								
#	Armand	Carol	Christopher	Frantz	Jude	Loby	Lesly	Ronick
1	4	4	4	4	4	4	4	4
2	4	4	4	4	4	4	4	-
3	4	4	3	3	4	3	3	3
4	4	4	4	4	4	4	4	4
5	-	-	-	-	-	-	-	-
6	3	4	3	4	3	4	3	3
7	4	4	4	4	4	4	4	4
8	4	4	4	4	4	4	4	4
9	4	4	4	4	4	4	4	4
10	4	4	4	4	4	4	4	4
11	4	4	4	4	4	4	4	4
12	4	4	4	4	4	4	4	4
13	4	4	4	4	4	4	4	4
14	4	4	4	4	4	4	4	4
15	3	4	3	4	4	4	4	3
16	4	4	4	4	4	3	4	3
Avg	3.9	4.0	3.8	3.9	3.9	3.9	3.9	3.7

LOGISTICS							
#	Transport	Hotel	Food	Classroom	Documents	Tools	Organization
1	3	3	3	3	3	4	4
2	4	4	4	4	4	4	4
3	3	4	3	3	4	4	4
4	4	4	3	3	4	4	4
5	-	-	-	-	-	-	-
6	-	-	3	3	3	4	3
7	4	4	4	4	4	3	4
8	4	4	3	3	4	4	3
9	4	4	3	4	4	4	4
10	4		4	4	3	4	3
11	4	3	3	3	4	4	-
12	4	4	4	4	4	4	4
13	1	3		3	3	4	3
14	3		2	4	4	4	4
15	4	4	4	4	3	4	4
16	-	-	-	-	-	-	-
Avg	3.5	3.7	3.3	3.5	3.6	3.9	3.7

TOPICS							
#	Review	Load	Batteries	MATE	OutBack	Wiring	Generator
1	4	4	3	4	4	3	4
2	4	4	4	4	4	4	4
3	3	3	3	3	3	3	3
4	3	4	4	4	3	4	4
5	-	-	-	-	-	-	-
6	4	4	4	4	4	3	4
7	4	4	4	4	4	4	4
8	4	4	4	4	4	3	4
9	4	4	4	4	4	4	4
10	4	4	4	4	4	4	3
11	4	4	4	4	4	4	4
12	4	4	4	4	4	4	4
13	4	4	4	4	4	4	4
14	4	3	4	3	3	2	4
15	4	3	3	4	-	-	4
16	4	4	4	4	4	4	4
Avg	3.9	3.8	3.8	3.9	3.8	3.6	3.9

Assistance needed in six months						
#	Battery maintenance	Battery EQ	Navigating the MATE	Generator maintenance	Other	Other
1	x	x	x	x	Water for batteries	
2			x			
3	x	x	x	x		
4		x	x		Clamps meter AC DC	
5		x	x	x		
6						
7	Money			Tools		
8	x		x	x		
9				x	x	x
10						
11					x	x
12	x	x	x	x	x	x
13	x					
14			x		x	x
15	4	4	4	4		
16	x	x	x	x		
Avg	8	7	10	9	6	4

Topics to cover again in future seminars						
#	Loads	Battery	MATE	OutBack	Wiring	Generator
1	x	x	x	x	x	x
2			x	x		
3				x	x	
4				x		x
5			x	x	x	x
6					x	x
7			x	x		
8		x	x	x		x
9						x
10				x		x
11				x		x
12	x	x	x	x	x	x
13			x		x	
14			x	x	x	
15	3	4	4	3		
16		x	x	x		x
Avg	3	5	10	13	7	10

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