



Workshop on Improving Energy Services to Support Laboratory Infrastructure at Health Facilities in Haiti

Sponsors: USG PEPFAR Program and Haiti National Reference Laboratory

Training Curriculum Prepared by: USAID Office of Infrastructure & Engineering

Training Instructor: Walt Ratterman

| DAY | AGENDA | NOTES |
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| Day 1 Monday, May 12th | <p>Introductions</p> <ul style="list-style-type: none"> Participants Introductory Remarks Background Information and Course Introduction <p>Roles and responsibilities of different stakeholders</p> <p>Energy Systems Overview</p> <ul style="list-style-type: none"> Why Systems Fail Basic Electrical Principles Short Quiz on Basic Electrical Principles Loads Versus Sources Watt-hour Concept Energy Efficiency Overview of Various System Configurations Overview of Scope | <p>Students, Teachers, Translators, Trainers, Hosts</p> <p>Dr. Bony and Rachanee Cheingsong</p> <p>Program Information, Goals and Key Objectives of the course (Jeff Haeni/USAID Office of Infrastructure & Engineering)</p> <p>Class discussion</p> |
| Day 2 Tuesday, May 13th | <p>Equipment and Inverter / Battery Design</p> <ul style="list-style-type: none"> Load Equipment Site Visit #1 Daily Watt-hour Calculations Inverter / Battery System Design <i>Guest Speaker</i> | <p>Review loads of common laboratory equipment</p> <p>Calculate loads of actual clinic and review energy systems</p> <p>Use spread sheet for tallying loads, watt-hours and diversification</p> <p>Sizing of the Inverter and the battery bank</p> <p>Inverter and Battery Representative Velerio Canez presents on locally available inverters and batteries, approximate costs, and future models</p> |
| Day 3 Wednesday, May 14th | <p>Equipment and Inverter / Battery Design</p> <p>Introduce Generators to the System</p> <ul style="list-style-type: none"> When do we need a generator? The role of the generator in the system. Sizing of the Generator Three Phase versus Single Phase System Installation with the Generator <i>Guest Speakers</i> | <p>Generator Representative Soged and Onan / Cummins & Kohler Representative discuss generator sizing, maintenance, fuel consumption, various models of engines</p> |
| Day 4 Thursday, May 15th | <p>When should we consider Solar, and How?</p> <ul style="list-style-type: none"> When should we consider Solar Panels to charge the batteries? <i>Guest Speaker from Solar Industry</i> Basic Principles of Photovoltaics <ul style="list-style-type: none"> System Concepts and Components Design Concepts The Concept of PSH PSH Resources PSH in Design Inefficiencies and Production Losses System Design with Solar Panels Hands-on look at various components in class <i>Guest Speaker from Solar Industry</i> | <p>Discussion of conditions that might warrant use of solar power</p> <p>Sunenergy representative Rowolson (invited)</p> <p>Sunenergy representative Rowolson (invited) will discuss PV / Generator systems and economics, and overall design considerations</p> |
| Day 5 Friday, May 16th | <p>Installation of Inverter / Battery Systems</p> <ul style="list-style-type: none"> Physical Installation of the Inverter / Battery System AC OUT connections AC IN connections DC Connections Basic Programming Requirements Operation and Maintenance Trouble Shooting | <p>Discussion will follow handbook prepared for class</p> |

Power Conditioning Beyond the Inverter / Battery system:

Student Guest Speaker

Engineer Jakob

Presentation on various types of power conditioning equipment that are available

Day 6 Saturday, May 17th

Class reduced in size from 20 to 10

Installation Work

Wire Sizing

Load Consideration

Temperature Consideration

Voltage Drop

Present voltage drop tables for low voltage work, and interactive V.D. excel sheet for all work

Types of Wire

Branch Circuit Design

Overcurrent Protection

Disconnect Switches

Mounting and Racks

Grounding

DC Wiring (Panels and Batteries)

Series and Parallel Connections

Worksheets on series / parallel wiring exercised

Big difference in voltage drop considerations

Loads likely to be in Battery Cables

Guest Speaker from Solar Industry

Mr. Brierre from RPS will discuss outback power equipment

Day 7 Monday, May 19th

Installation Work

Installation Introduction

Class Design

Purchase the Equipment

Day 8 Tuesday, May 20th

Installation Work

Work on site to install or correct the system

Day 9 Wednesday, May 21st

Installation Work

Work on site to install or correct the system

Day 10 Thursday, May 22nd

System Programming and Maintenance

Programming

Load Management

Maintenance Issues

Day 11 Friday, May 23rd

Wrap Up

Finish discussion on any uncompleted topics

Questions and Answers

Examination