IMPROVING HEALTH FACILITY INFRASTRUCTURE (IHFI)

A USAID-funded project to provide reliable electrical power for the operation of critical health facilities.

Project Update

December 2012

BACKGROUND

The energy infrastructure in hospitals: example of Haiti

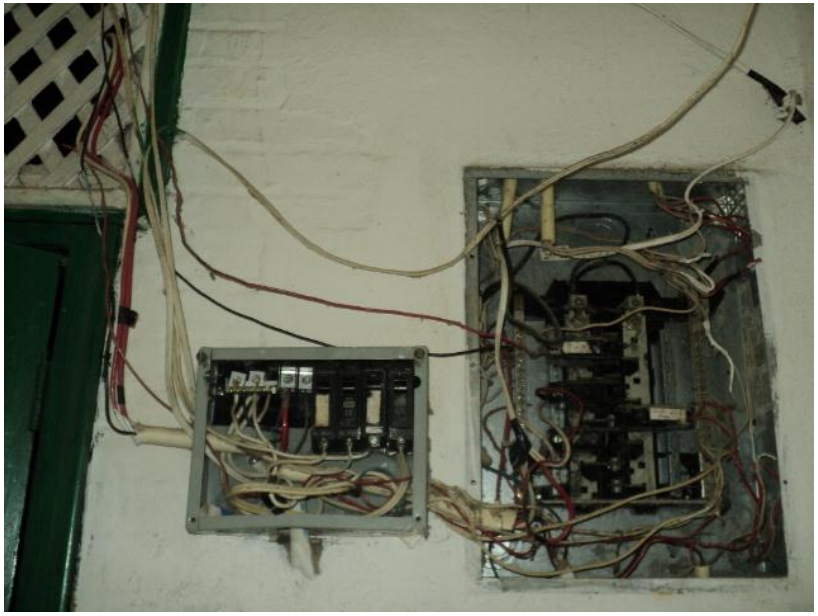
Energy infrastructure for hospitals/clinics – issues:

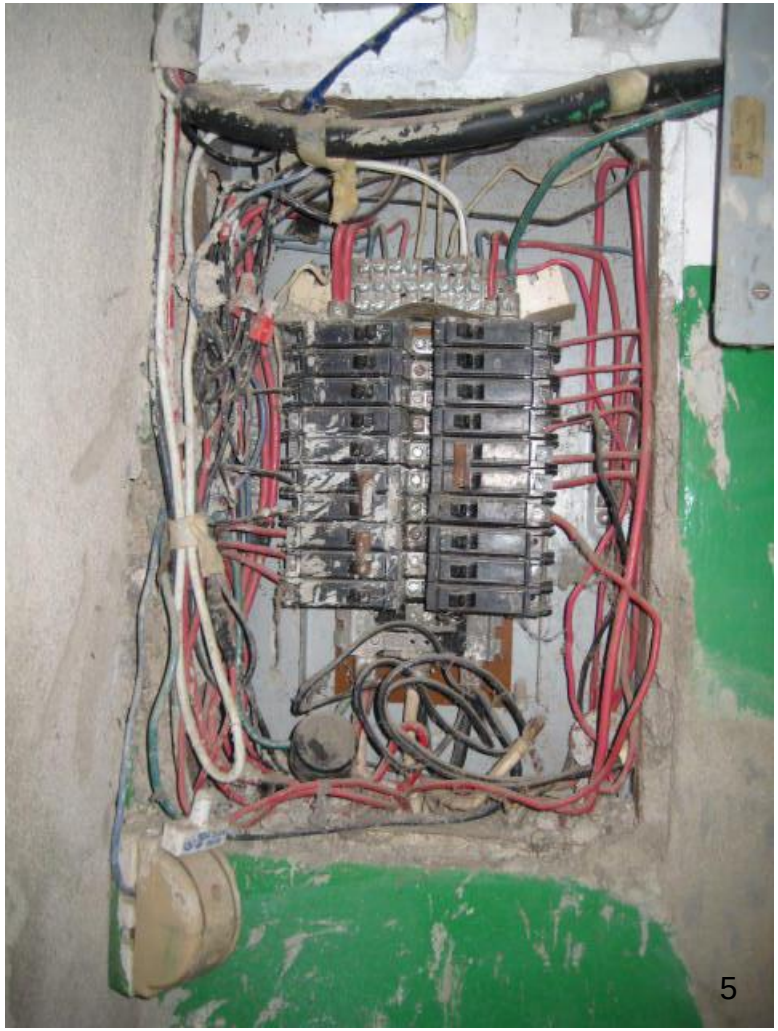
Power Availability	Power Quality	Electrical Installations
• Off grid • Unreliable grid • Diesel generator • Need for battery back-up systems; possible solar PV…	• Variable • Low voltage • Voltage spikes • Sensitivity of laboratory and IT equipment	• Poor, even dangerous, wiring • Lack of maintenance • Bad habits • Unskilled technicians • Ad hoc solutions

Poor, even dangerous, wiring

Load distribution panels

(missing covers; too many ; connections; overloaded circuits; no identification of loads…)





Lack of maintenance

Corroded battery terminals.
No distilled water available.

Dirty generator rooms, causing a potential hazard and making it difficult to identify leaks.

Burned generators

(Example: Saint Antoine de Jérémie Hospital, Grand'Anse, Haiti)

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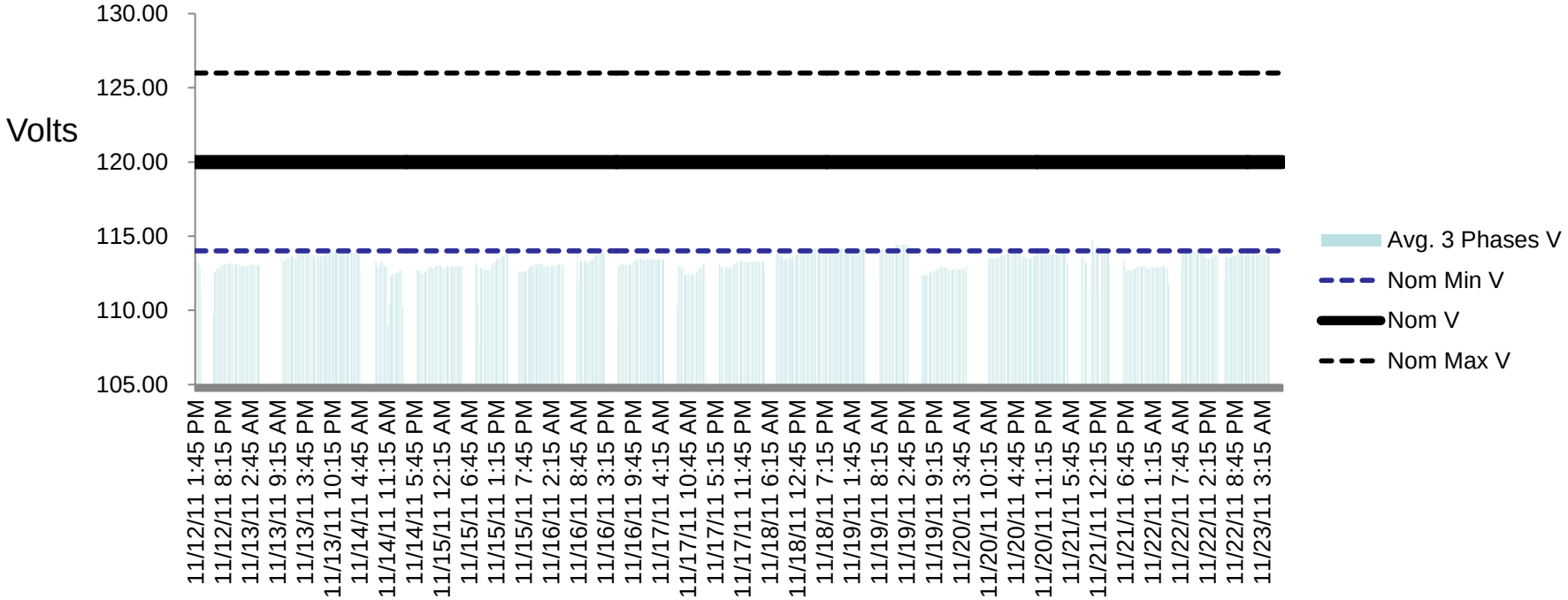
Haiti grid power – Questions of reliability and quality

- Sensitive instruments may be limited to voltage variations of no more than 5%
- No planning or consistency in power outages
- Generators possibly available, but require manual start



Health Center – Camp Perrin

Effects of poor energy infrastructure:

Decrease in Service

- Reduced operating hrs; unserved population
- Reduced capacity for lab tests
- Nighttime safety concerns
- Decline in staff morale

High Cost

- High costs for generator fuel
- Damage to expensive instruments
- Medicine spoilage
- Need to redo lab tests

Evaluation

Technology

Institution

Training

IHFI APPROACH AND ACTIVITIES

How to address energy issues in hospitals in Haiti

Project Approach

Evaluation
- Country baseline evaluations
- Site energy assessments
- Follow-up and tracking

Training
- Technicians
- Hospital staff
- Administrators

Technology
- Battery/inverter
- Pilots (solar, LED)
- Remote monitoring

Institution
- Standards
- Manuals
- Monitoring
- Training

1 – Energy needs assessments

Assessment sites

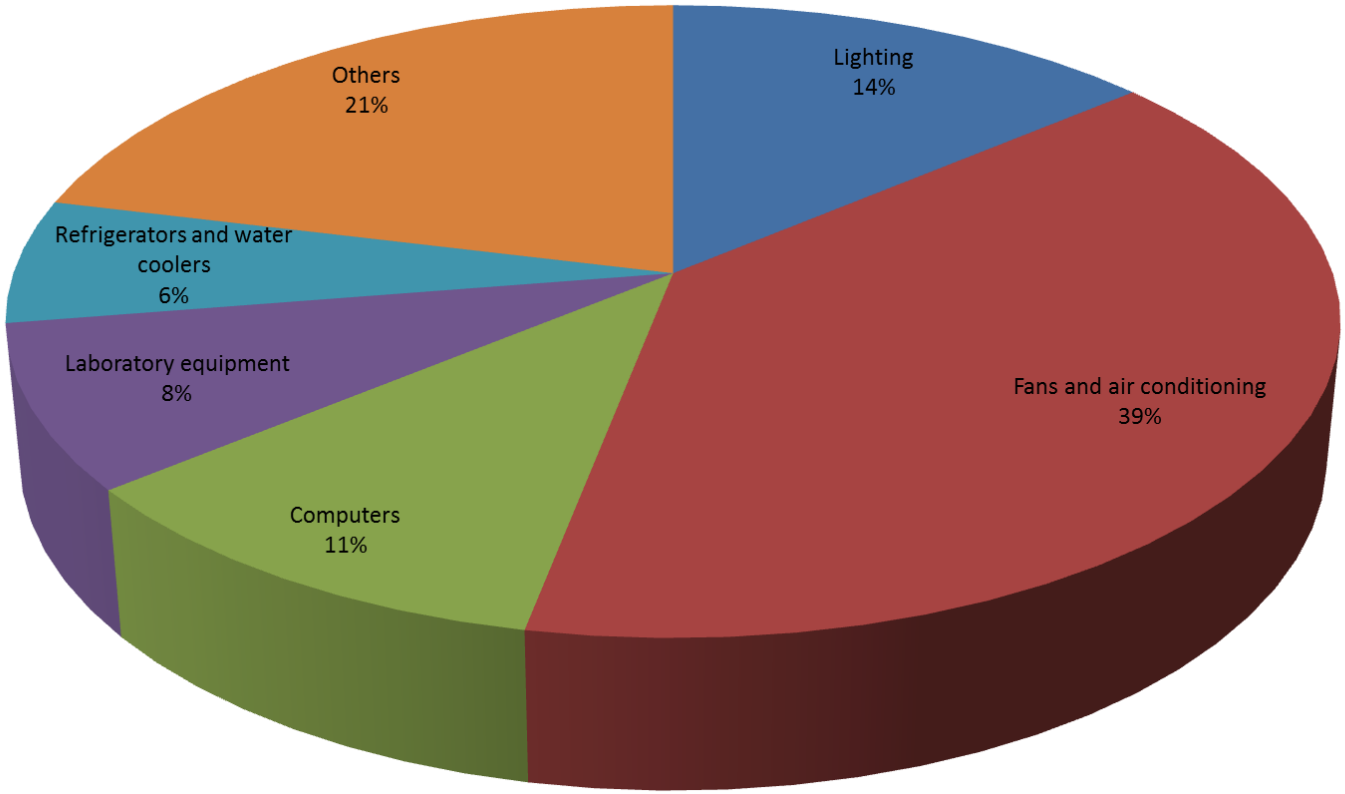
Recent installation sites

As of December 1, 2012:

- 18 assessments were completed since 2011
- 12 assessments ongoing

Load distribution

Average load distribution in 26 hospitals evaluated in 2011 and 2012
Average total load = 43 kW



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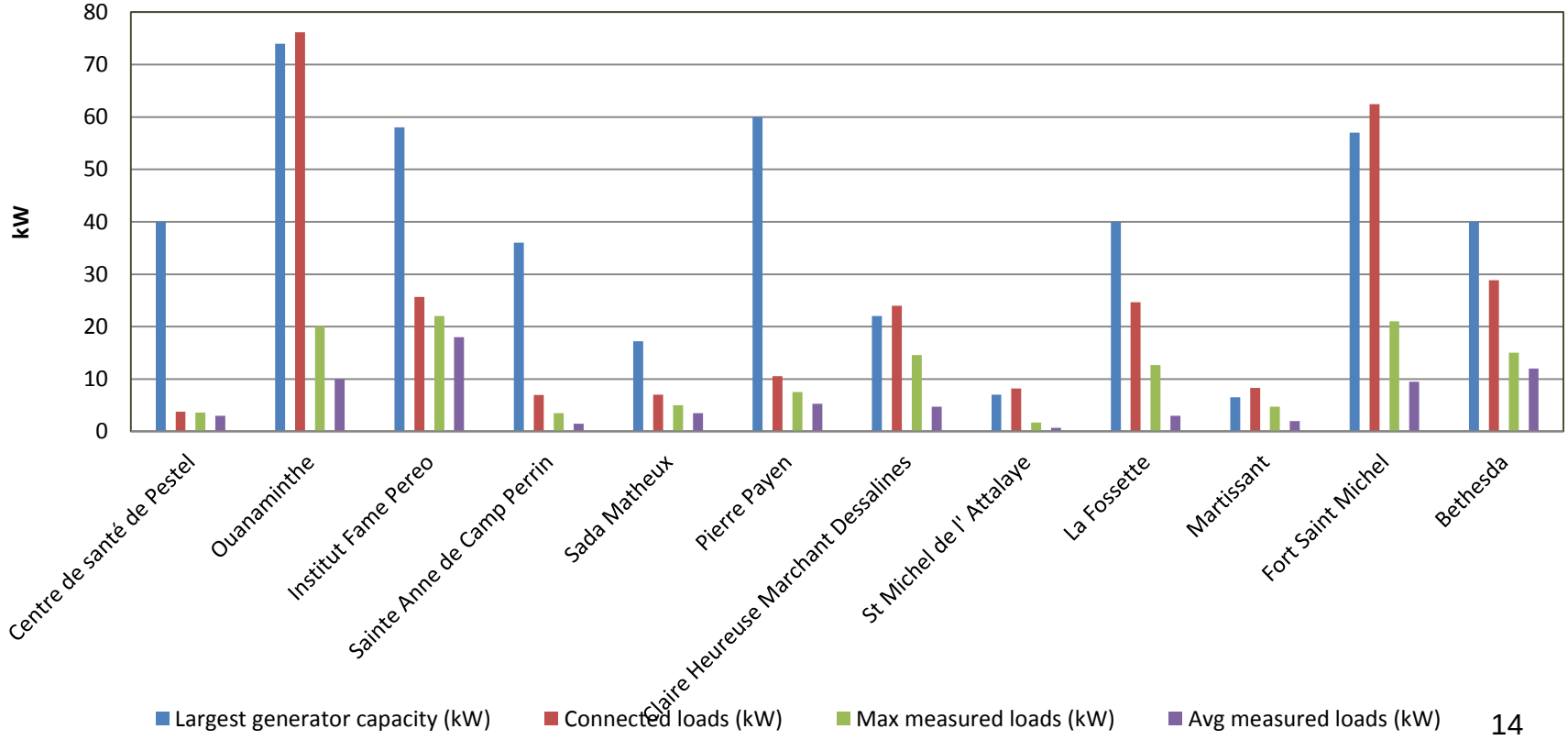
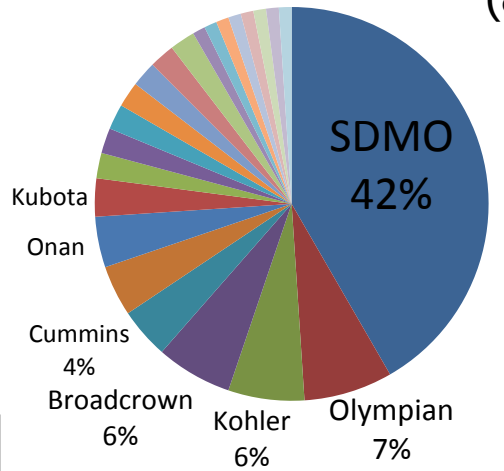
Haiti: Comparison of generator capacity and loads

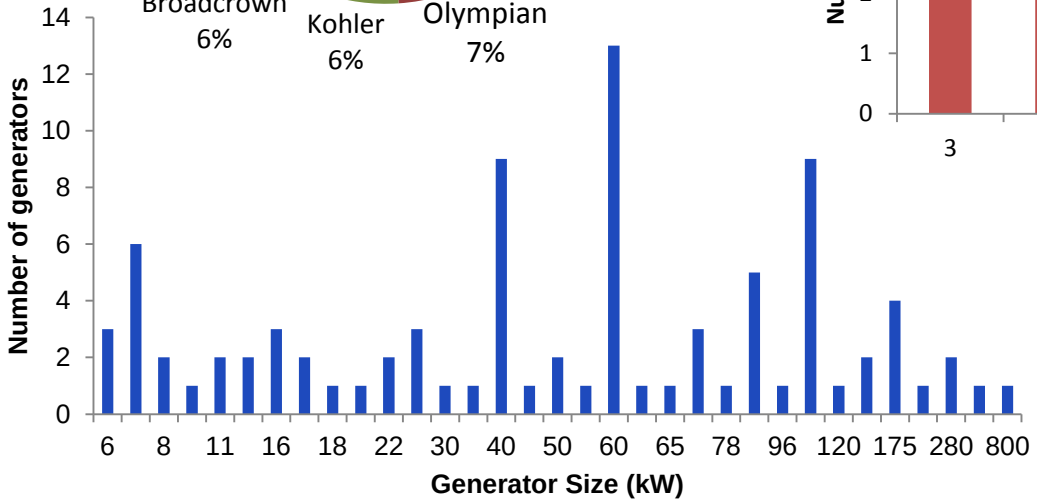
On average (12 hospitals), the measured load represented only 17% of the capacity of the largest generator installed at the hospital



Generator distribution by size, brand and age

Data collected on 89 generators (size and brand) and 21 generators (age) between 2011 and 2012





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2 - Technology

Battery-Inverter systems

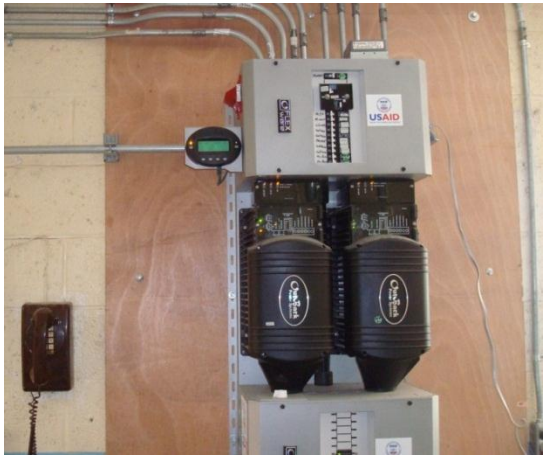
LED lighting retrofit

Electrical wiring improvements

Battery-Inverter backup power systems

As of December 1, 2012

- 18 installations completed
- 4 installations ongoing
- 8 installations planned



The inverter-charger:

- When grid or generator power is available
  → Charges the batteries (AC to DC)
- When no grid power or generator
  → Batteries provide power (DC to AC)

- Contact vs. No-contact

LED lighting retrofit demo

Hôpital de la Communauté Haïtienne (HCH), Port-au-Prince

Existing lighting

- 180 T12 fluorescent lamps -- *typical*
- 24/7 lighting – *if power available*
- 44W per lamp – *high consumption*
- 66 lumens/W – *low efficacy*

4-ft LED replacement tubes

- LED international standards
- 90 lumens/W – high efficacy
- 50% reduction in electricity use
- 2-year payback

Source: ASAMLED, 2012

Electrical wiring improvement

Hôpital Universitaire d'Etat d'Haiti (HUEH), Port-au-Prince

Emergency room

Before

Installation of ceiling lamps and fans

After

3 - Institutions

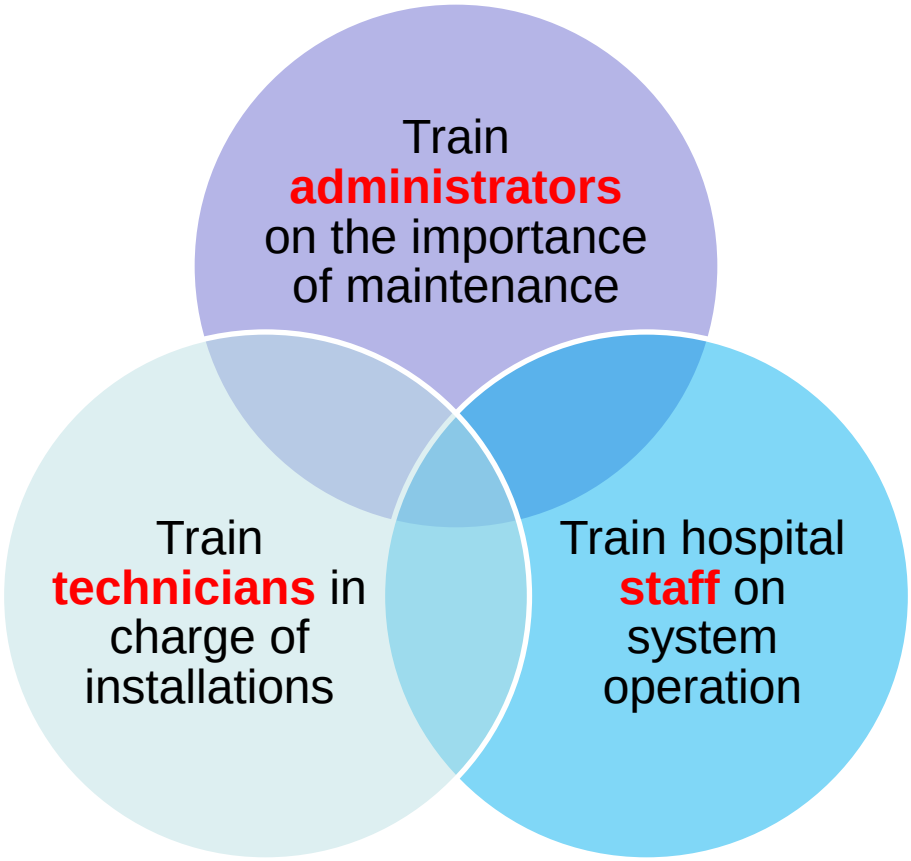
Partners in Haiti

- Ministry of Health (MSPP)'s Project Unit (UGP)
- LNSP
- CDC

Activities

- Standard design, ToR template
- Manuals and procedures
- Monitoring database
- Local companies installation supervision

4 - Training program -- Haiti



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Past training activities

Mar. 2011 (3/28-4/1)

- 22 technicians
- 3 days battery/inverter
- 1 day generators
- Level I training

Dec. 2011 (12/5-12-9)

- 16 technicians
- 3 days battery/inverter
- 2 days generators
- Level II training

Mar. 2012 (2/29-3/2)

- 18 technicians
- 3 days generators
- Level I & II training

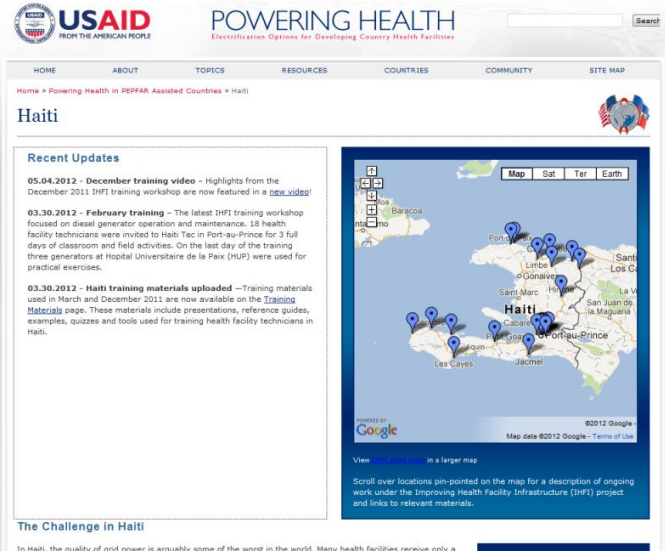
May 2012 (5/21-5/26)

- 26 technicians
- 2.5 days battery/inverter
- 2.5 days generators
- Level I & II training

Knowledge management

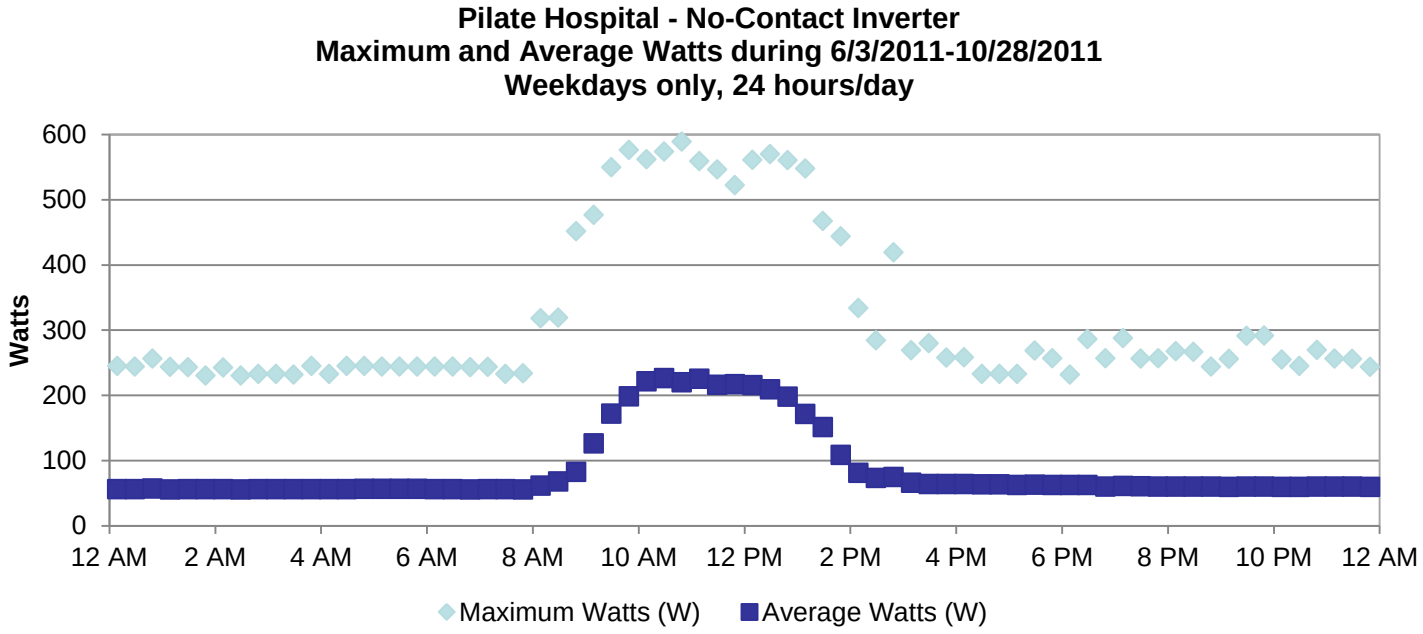
- Monitoring
- Evaluation
- Reporting
- Information dissemination

- www.poweringhealth.org
- www.facebook.com/PoweringHealth
- YouTube – training videos

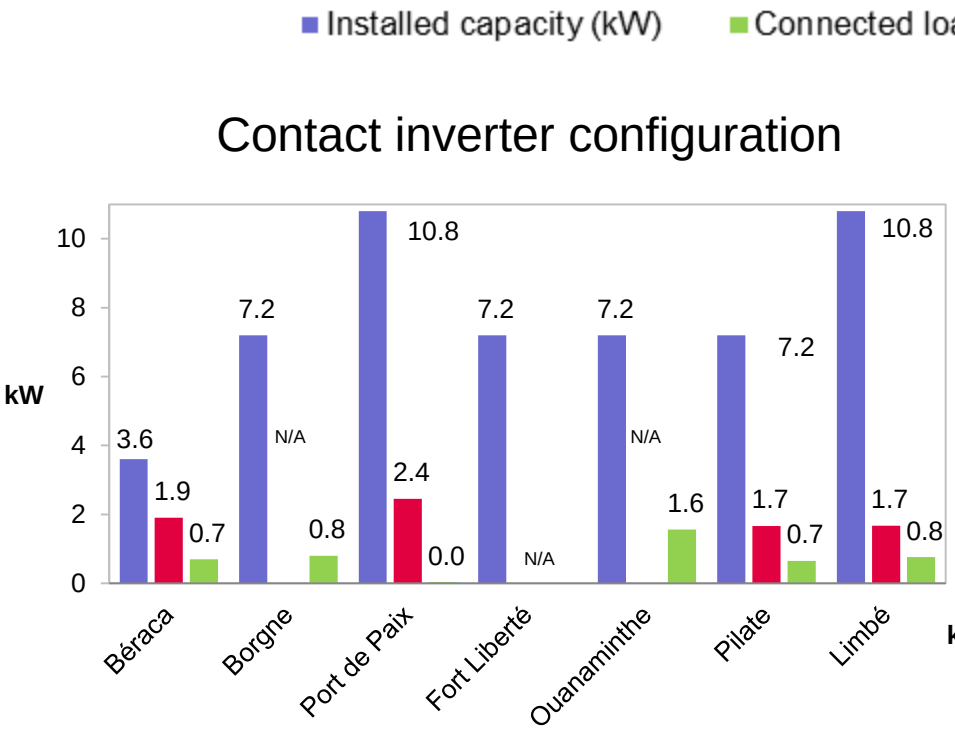


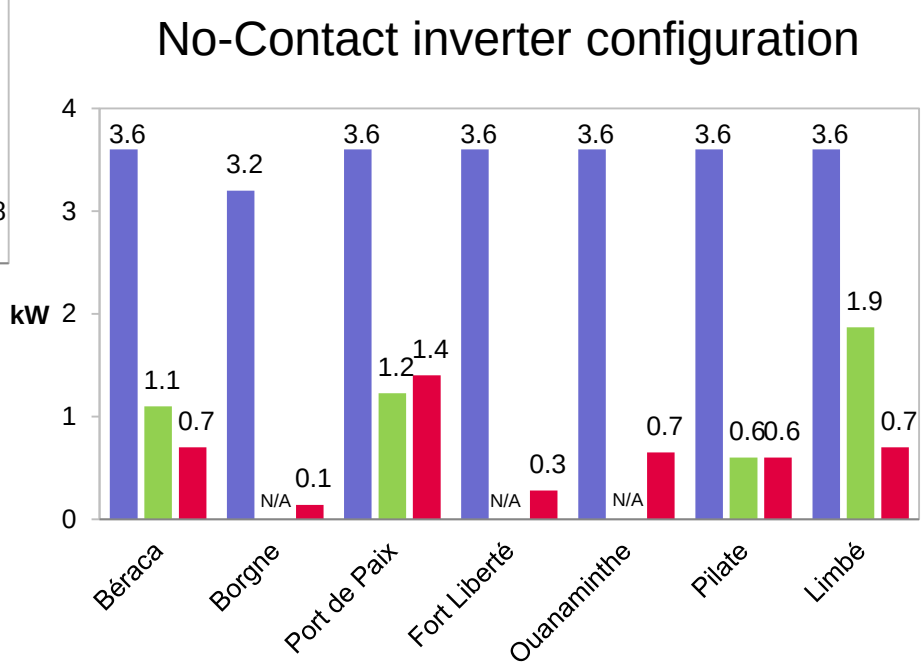
Continuous lab power measurement

- Key data for future design and cost optimization
- Confirmation of capacity for additional critical loads
- Useful information for lab medical supervision
- Attention to nighttime power use

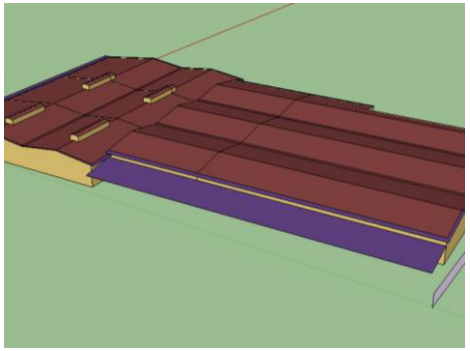


Inverter system monitoring





<u>Conclusion</u>: significant backup capacity is still available (can add additional instruments, lighting, etc.)



OTHER IHFI SUPPORT

Improving energy infrastructure and reducing energy costs

Guyana Health Facilities Situation

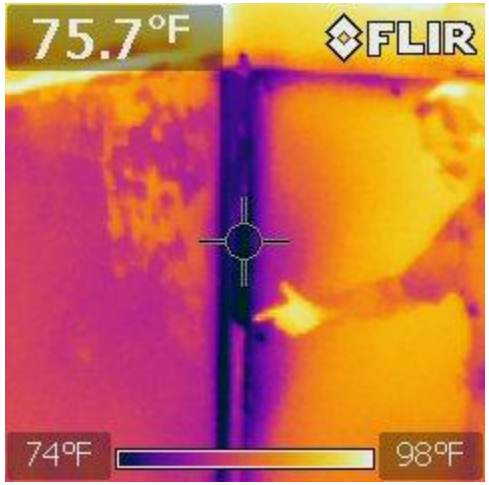
- Large city hospitals
  - Reasonable, reliable power
  - Inefficient use of energy at high cost

Actions: carry out Energy Efficiency Audits and training

- Remote hospitals and clinics
  - Failed and improper solar PV installations
  - No maintenance of batteries
  - Serious needs for additional power
  - Little local capacity

Actions: focus on building local capacity; improve system installations

Guyana Health Facilities Intervention



- Large city hospitals – Georgetown Public
  - AEE energy efficiency audit coupled with training for several technicians
  - Audit followed by a 2-day workshop for local practitioners and policy makers

Results: Detailed energy audit ($500k investment at a 1.7 year payback); improved capacity among local technicians and agencies

- Remote hospitals and clinics
  - Two standard PV systems designed based on assessment loads – 1kW and 1.25kW
  - Local installers bid for installation at 9 sites

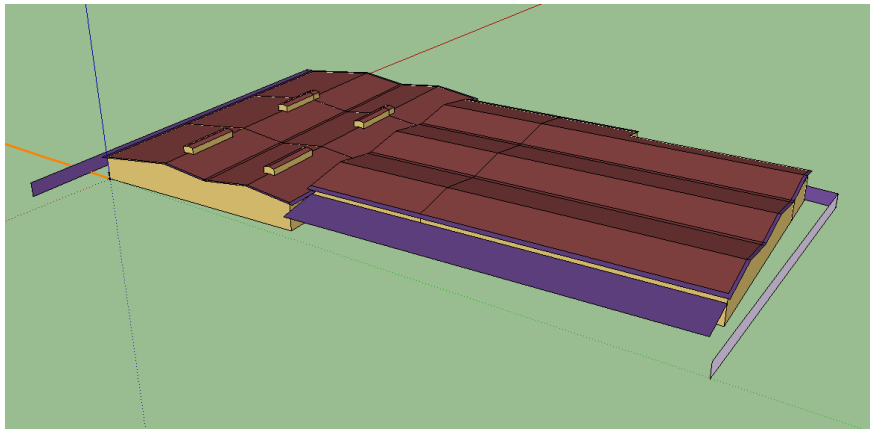
Results: Installation schedule for January 2013

Knowledge Management Contributions

- IT power consumption / minimization
- Battery selection
- UPS selection and use
- Remote monitoring
- Battery chargers
- Technician training materials
- Data logging and analysis
- Parametric analysis for solar PV applications
- Mozambique, Zambia reports

Energy modeling – SCMS Nicaragua

- Medical warehousing complex in Managua
- Target indoor conditions:
  - 30°C
  - 60% relative humidity
- IHFI applied EnergyPlus model created to analyze minimum energy use:
  - Insulated metal panels
  - Low-e materials (e.g. radiant barrier)
  - Weather sealing
  - Natural ventilation controls
  - Earth air tube
  - HVAC consumption estimates



Model geometry for Almacentro medical warehousing complex

- **Results:**
  - Temperature target is feasible through building envelope and ventilation measures
  - Relative humidity target requires an HVAC system consuming 15-25 kWh/m^2 annually
- **Conclusion:**
  - IHFI tool potentially broadly applicable to energy use in medical supply chain

Summary thoughts…

- Challenge: the sustainability of access to energy
- Integration into local institutions is key
- Technology must be appropriate
- Training should lead to empowerment
- Need integrated perspective on new technologies