UNC CHARLOTTE
The WILLIAM STATES LEE COLLEGE *of* ENGINEERING

Senior Design Project Description for FALL 2016

Project Title: Creating a Microgrid for International Disaster Response (CMC_MICRO)

Supporter: CMC

Supporter Technical Representative: ASSIGNED

Faculty Mentor: __X__ ASSIGNED _____ TBD (check one)

Single Team _____ Dual Team _____ (check one)

Personnel (EN/ET): __2__ E, _____ Cp, _____ Cv, __4__ M, _____ SE

(Complete if the number of students required is known)

Expected person-hours: (250 per student)

Description of Project:

Modern health care and disaster response are inextricably linked to high volume, reliable, quality power. Disasters place major strain on energy infrastructure in affected communities. All modern disaster response assets, from Disaster Medical Assistance Teams (DMAT) to urban search and rescue rely heavily on traditional diesel-powered generators. This dependence requires that response agencies either use scarce local fuel sources or maintain a complex logistics and supply system.

Advances in renewable energy and microgrid technology offer the potential to improve mobile disaster medical response capabilities. New innovative design and technology can be utilized to improve capabilities of an off grid "untethered" energy source during disaster response.

The project's goal is to design an "energy system" that can be utilized in austere, international locations post-disaster that decreases demand on diesel generators, employs modern energy management strategies such as microgrid technology, and utilizes renewable energy sources, to expand operational independence. This approach, in turn, allows for longer deployments in potentially more severe environments and minimizes the environmental footprint.

The result of the project will be an "energy system" that can be easily transported by ground, sea, or air to a disaster response. The smaller the system can be, then more mobile and relevant to international disaster response.

Initial Project Requirements (e.g. weight, size, etc.):

The system should be small enough to fit in a Chinook helicopter and transported in the back of a standard pick-up truck. Maximum weight is 1,000 pounds. The size of the "energy system" needs to be less than 1.5 m x 1.5 m x 1 m. The system needs to be rugged as well to withstand dirt/mud roads when transported.

The "energy system" should be compatible with a wide range of power sources. (Investigation and engineering associated with these power sources is not included as part of this project.) These include but, are not limited to:

- Diesel generators (international standards)
- Wind energy
- Solar energy
- Battery
- Hydraulic

Disaster response often occurs in locations that have varied environments and the "energy system" should be robust enough to operate in extremes of weather. For modeling, the system should function in the environments that were encountered during the following sudden onset disasters:

Haiti earthquake in January 2010
Typhoon Haiyan, Philippines, November 2013
Nepal earthquake, April 2015

Load calculations will be based on supporting an outpatient emergency clinic during daytime hours for 100 patients a day. The Emergency Medical Team, type 1 will be deployed for up to 14 days and will need to be self-sufficient/sustainable. The load calculations for the energy required to support the daytime operations of outpatient emergency clinic as well as 24 hour logistic support of the EMT team are approximately 500 kWh a day (based on energy audit of MED-1). During an initial phase of a disaster response with an EMT, type-1 heating and cooling demands of the clinic are minimal as the logistics of running large HVAC units for clinic operations is difficult.

Expected Deliverables/Results:

- Working Disaster "energy system" prototype that a diesel generator and renewable energy production (wind/solar) can "plug" into
- Basic software interface
- All electrical/circuit design prints and schematics
- Cost analysis

List here any specific skills or knowledge needed or suggested (If none please state none):

Power systems and power management