

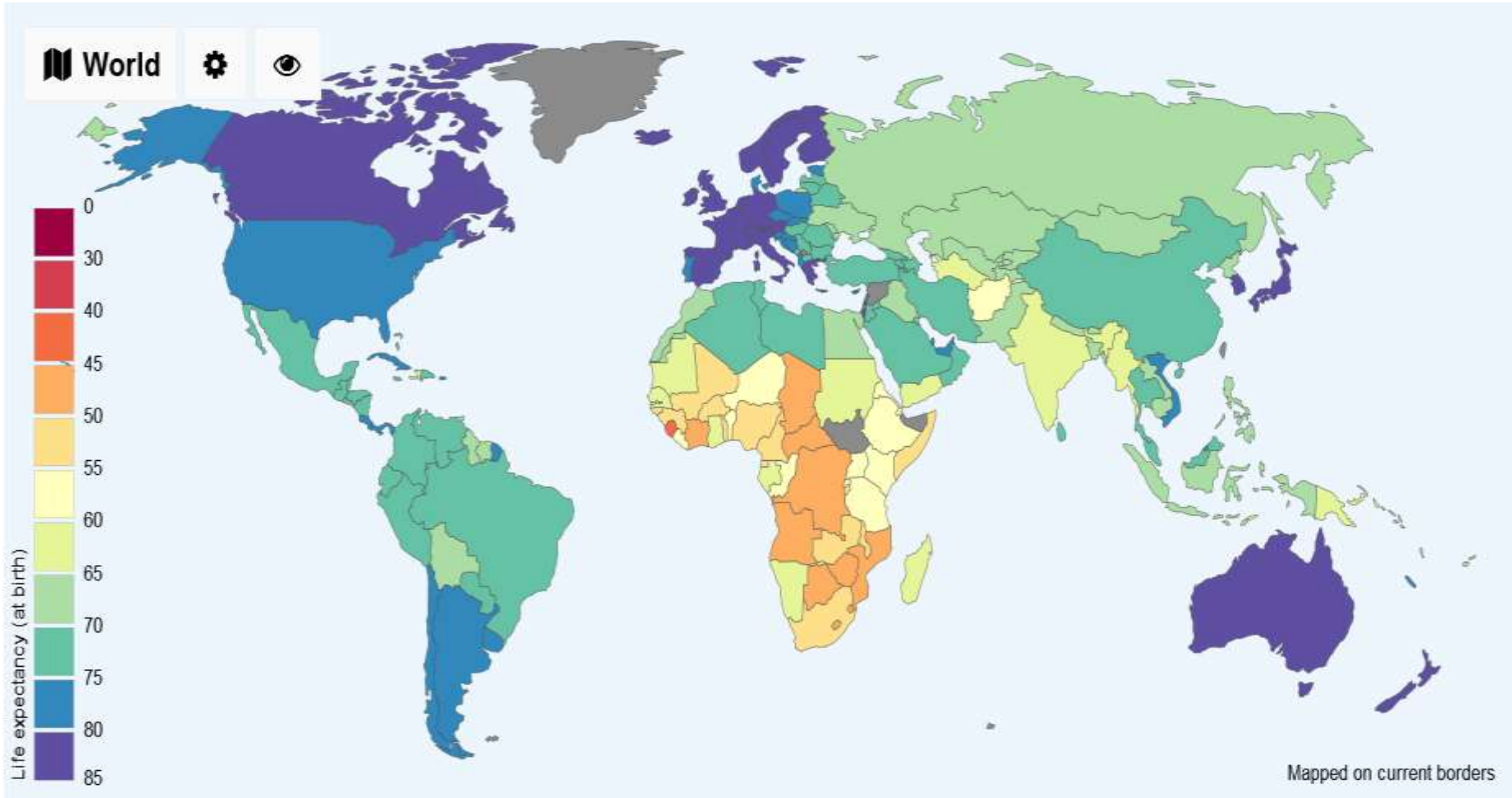
# Humanitarian Service Opportunities for Chemical Engineers

Susquehanna Local Section Meeting  
May 2016

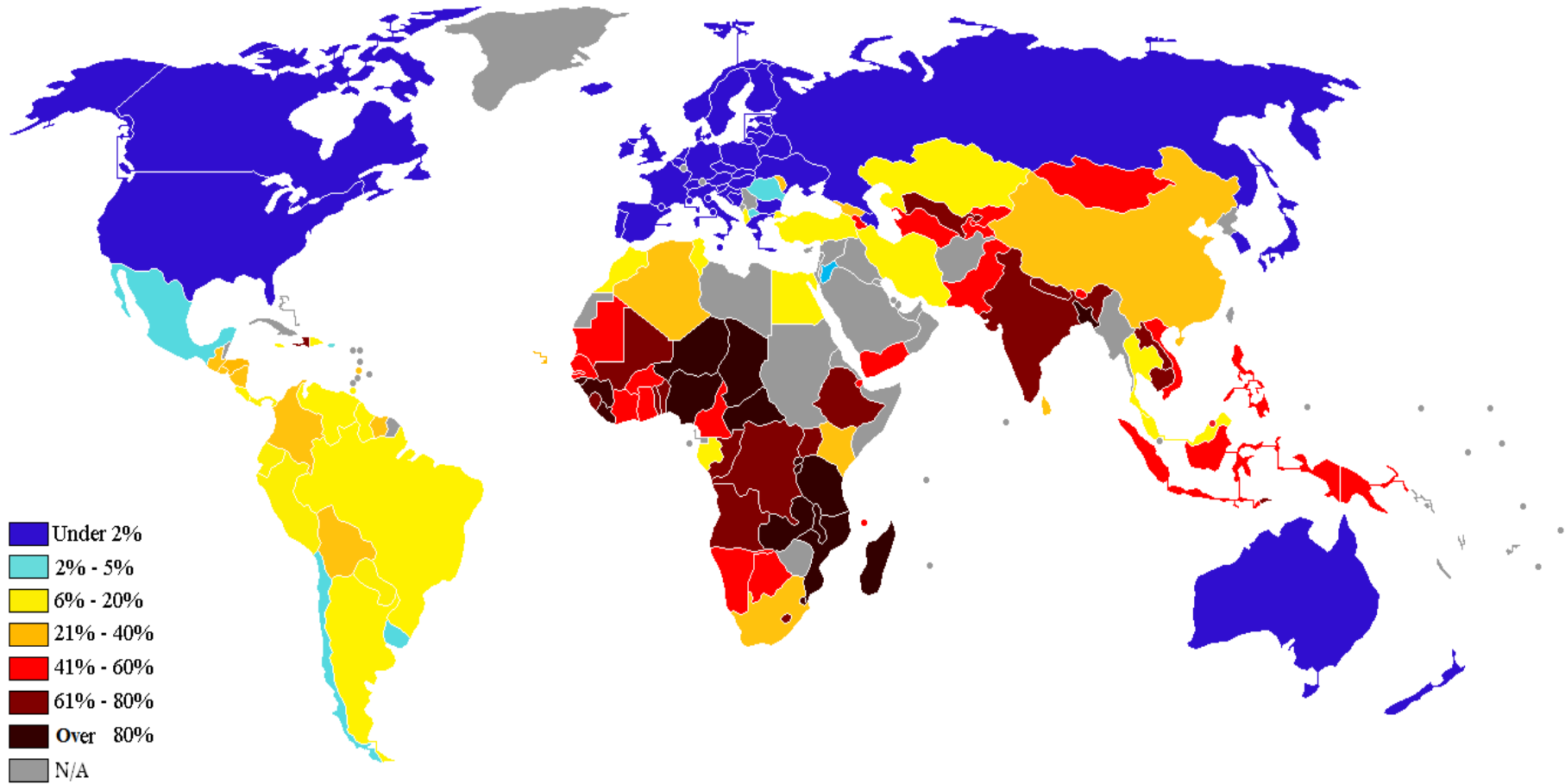
John Cirucci  
Spatial Analytics



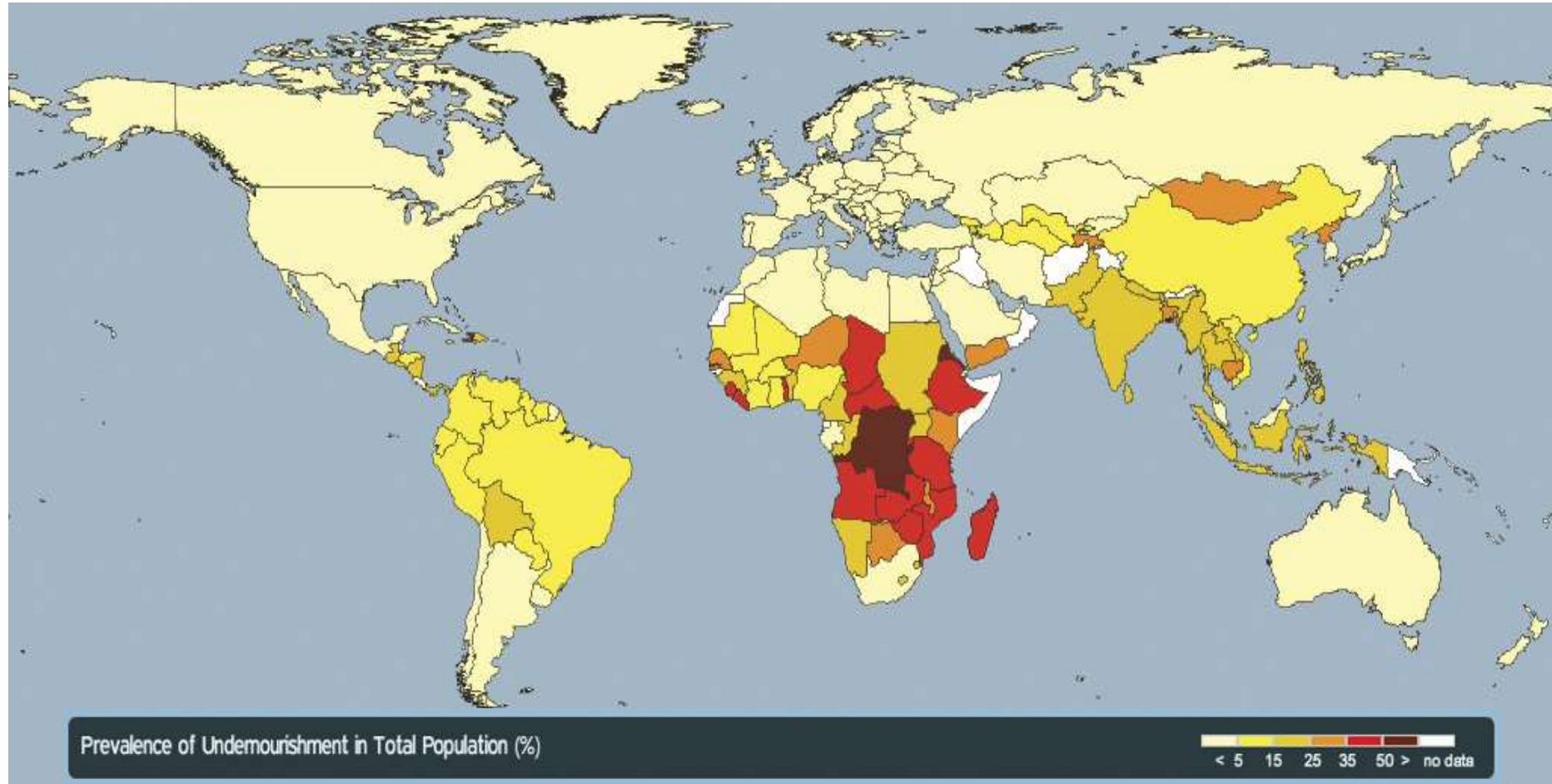
# Life Expectancy



# Population with Income <\$2/day



# Starvation and Undernourishment



800 million people are chronically undernourished  
90 million children <5 are dangerously underweight

# Access to Clean Water



1.4 billion people have no access to electricity  
1 billion more have unreliable electricity networks



3 billion people rely on solid fuels (traditional biomass)  
→ 2 million people per year die due to indoor air pollution

# Engineers' Role in Global Capacity

**Building Commercial and  
Country-Wide Infrastructure**

**Our "day job"**

# Engineers' Role in Global Capacity

earthquake, flood, drought,  
political displacement

**Emergency response to Crisis**

**Building Commercial and  
Country-Wide Infrastructure**

Our "day job"



# Engineers' Role in Global Capacity

earthquake, flood, drought,  
political displacement

**Emergency response to Crisis**

**Building Commercial and  
Country-Wide Infrastructure**

**Meeting Basic Human Needs  
at the Community Level**

Our "day job"

**unmet need affecting  
the greatest segment of  
the world population**

A Word about Cultural Sustainability  
and Appropriate Technology

Some Personal Experiences – Africa  
and Central America

Opportunities with AIChE and other  
organizations

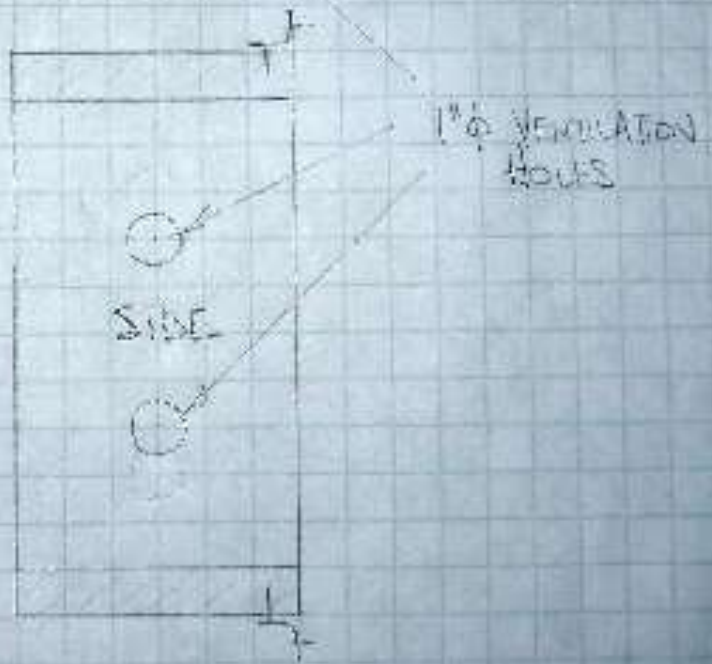
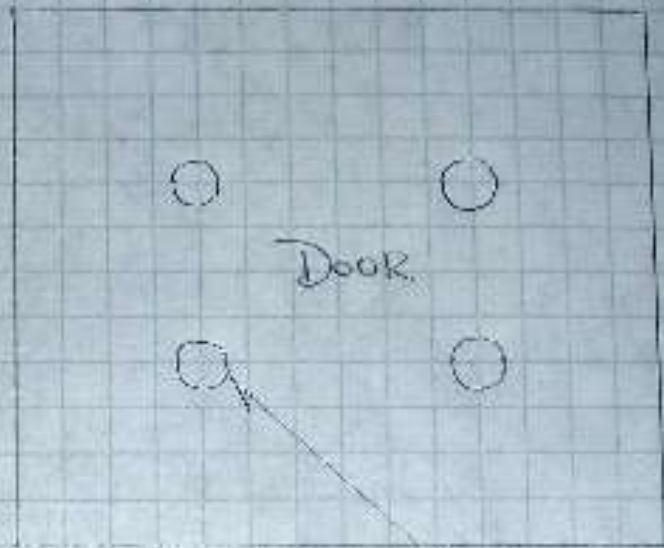
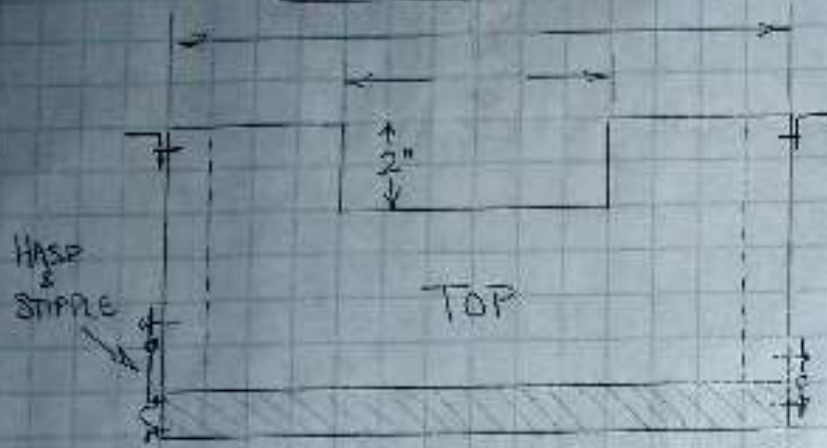


Centennial School Mattru Jong, Sierra Leone



# CLASSROOM BEAKER BOX

15 Nov 2014  
@Rivers





# Cross Cultural Misunderstanding

Core beliefs

National characteristics

Attitudes and world view

Speech styles

Listening habits

Concept of space

Concept of time



Culture eats Strategy for Lunch



Culture eats ~~Strategy~~ for Lunch

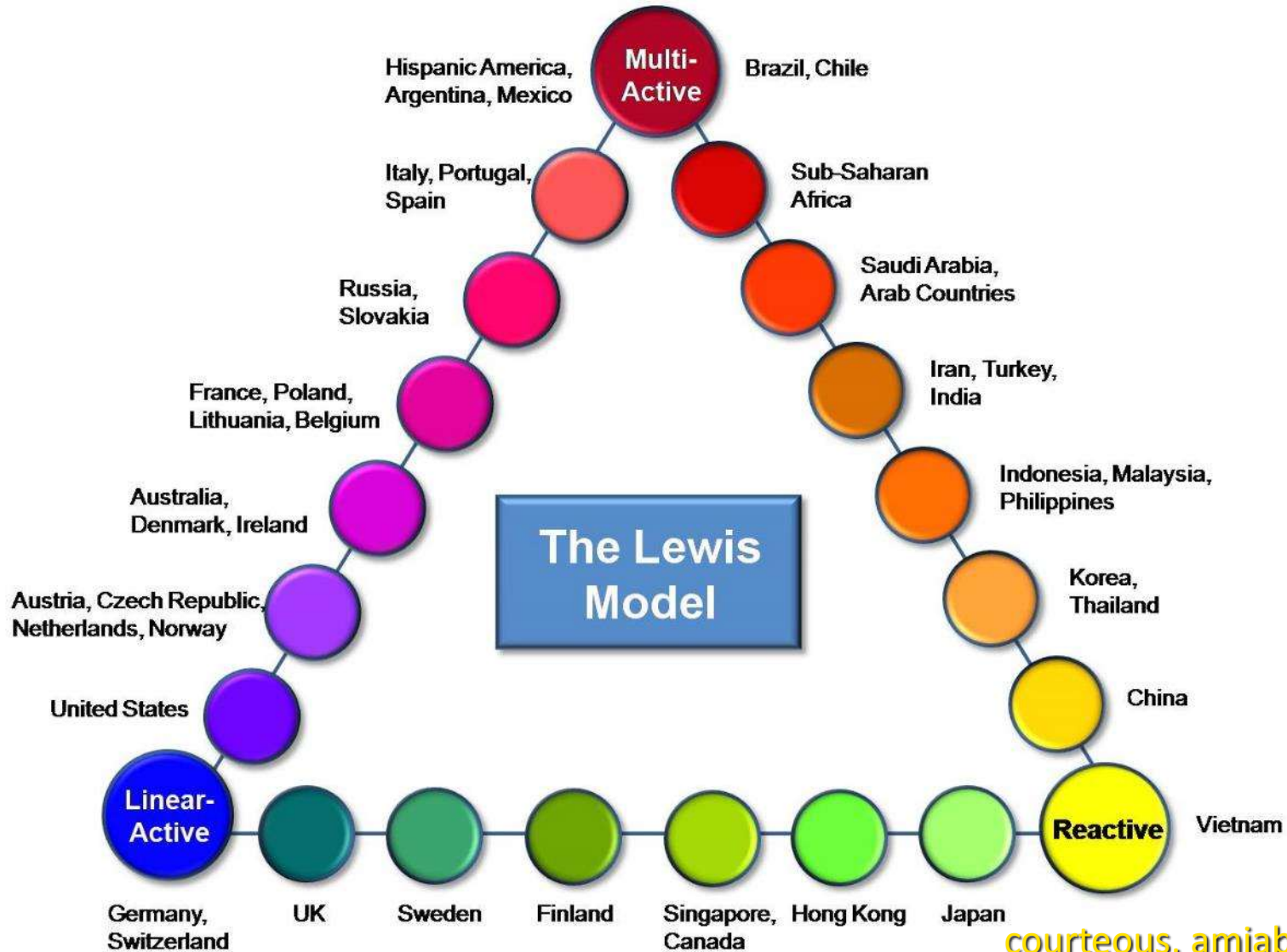
Technology

Culture eats ~~Strategy~~ for Lunch

~~Technology~~

Engineers

**warm, emotional,  
loquacious, impulsive**

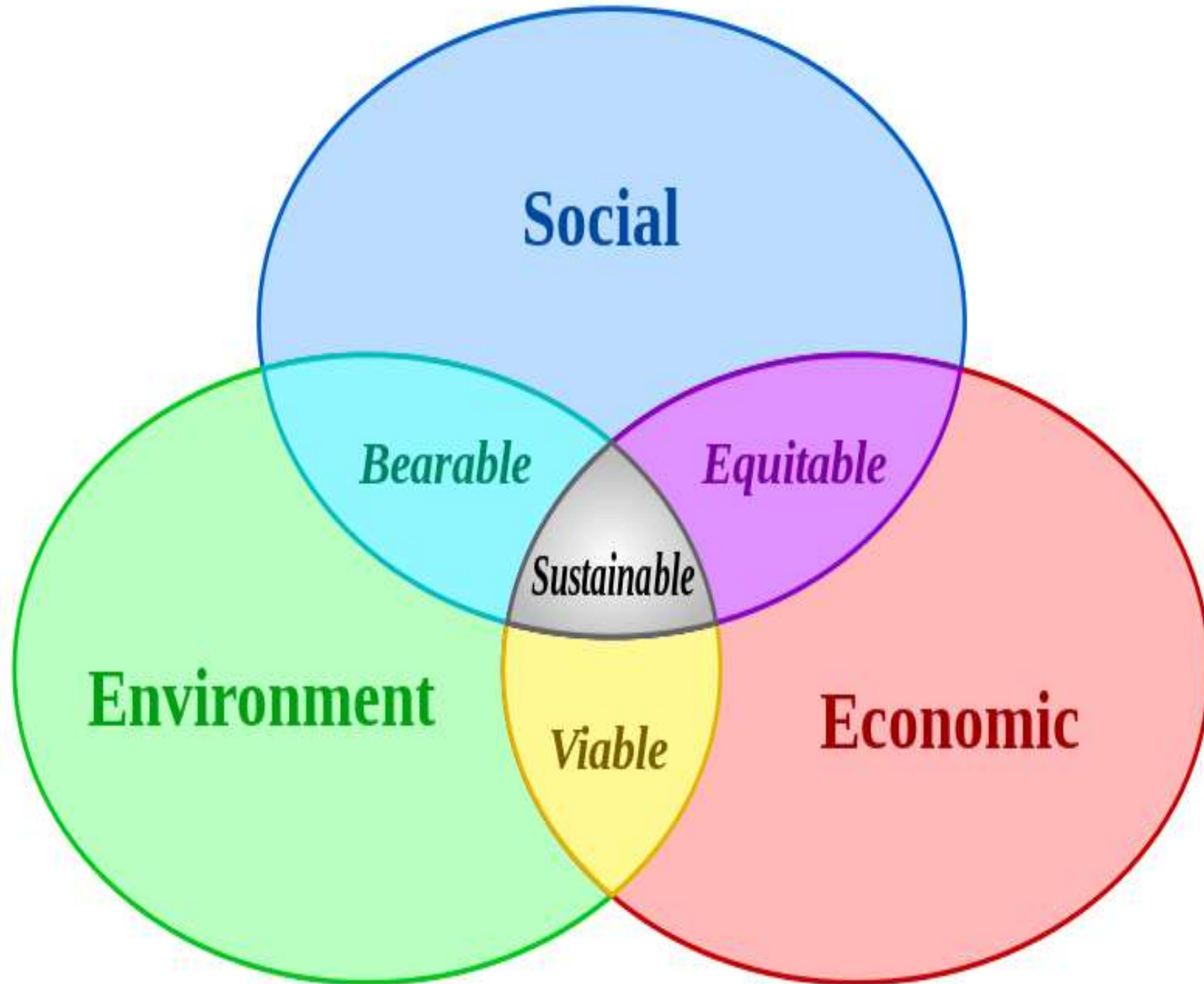


**cool, factual,  
decisive planners**

**courteous, amiable,  
accommodating,  
compromiser, good listener**

# Sustainability

**People – Planet – Prosperity**



# Not Sustainable in Humanitarian Engineering Development

- Community accepts the project as a “gift” rather than takes ownership
- A micro-enterprise that consumes a scarce natural resource
- An irrigation project that leaves insufficient drinking water for some residents
- A piping system using fittings or materials not available locally
- A pump requiring unavailable skilled maintenance
- Installation of imported lighting fixtures with unavailable replacement parts
- Using local steel cables for a bridge that are not certified for the load
- Instruments in a health clinic that rely on an unreliable electricity source
- The inability of the local community to collect monthly water fees from the residents
- Corruption of the Water Board so that collected fees are not spent appropriately
- The inability of the local community to equitably distribute the benefits of the project throughout the community
- Wiring components are vandalized for the value of copper

# Appropriate Technology Guides

- Safety first



# Appropriate Technology Guides

- Safety first
- KISS principle

THE KISS PRINCIPLE

**K**EEP  
**I**T  
**S**IMPLE,  
**S**TUPID

# Appropriate Technology Guides

- Safety first
- KISS principle
- Community participation – selection, finance, construction, operation, maintenance





# Appropriate Technology Guides

- Safety first
- KISS principle
- Community participation – selection, finance, construction, operation, maintenance
- Use local skills, labor and materials *to the extent possible* in construction, operation and maintenance



# Appropriate Technology Guides

- Safety first
- Knowledge
- Community participation
- User involvement, training and construction
- Maintenance
- Must be regionally proven
  - technically
  - socio-economically



# Appropriate Technology Guides

- Safety first
- KISS principle
- Community participation in selection, finance, construction, operation and maintenance
- Use local skills, labour and materials *to the extent possible* in construction and maintenance
- Must be locally proven
  - technically
  - socio-economically
- Engage local & regional NGOs





EWB-USA supports **community-driven** development programs worldwide by **collaborating with local partners** to design and implement **sustainable engineering projects**, while creating transformative experiences and **responsible leaders**

# Engineers Without Borders - USA

a non-profit, volunteer, humanitarian organization

- Established in 2002
- 16,000 members
- 300 chapters
  - Student
  - Professional
- >600 projects
- 50 countries



# EWB Operating Model



## EWB Chapters execute all projects:

- community partnership
- scope development
- fundraising
- project management
- engineering design
- implementation
- ongoing support

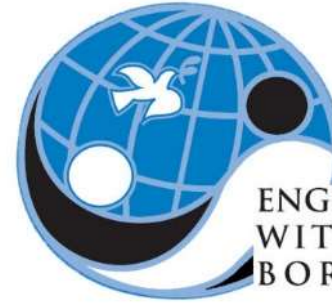
## National Organization

- Small, paid staff in Colorado
- Establishes project guidelines
- Technical Advisory Committees

# AIChE



The Global  
Home of  
Chemical Engineers



ENGINEERS  
WITHOUT  
BORDERS  
USA

- In 2009 AIChE & EWB-USA executed a Memorandum of Understanding
- AIChE endorses the mission of EWB and promotes engagement by chemical engineers
- AIChE encourages ChE students to participate in international service projects
- AIChE provides grants to support EWB humanitarian engineering projects with ChE student team membership



ENGINEERS WITHOUT BORDERS-USA  
PENNSYLVANIA STATE UNIVERSITY  
STUDENT CHAPTER



ENGINEERS  
WITHOUT  
BORDERS

**Carnegie Mellon**



ENGINEERS  
WITHOUT  
BORDERS  
USA

**Lafayette College**



ENGINEERS  
WITHOUT  
BORDERS  
USA

LEHIGH VALLEY PROFESSIONALS



ENGINEERS WITHOUT BORDERS-USA  
UNIVERSITY OF PITTSBURGH  
STUDENT CHAPTER



ENGINEERS WITHOUT BORDERS USA  
LEHIGH UNIVERSITY CHAPTER



ENGINEERS WITHOUT BORDERS-USA  
PITTSBURGH PROFESSIONAL CHAPTER



ENGINEERS WITHOUT BORDERS USA  
PHILADELPHIA PROFESSIONAL CHAPTER

ENGINEERS WITHOUT BORDERS



**PennState**  
Harrisburg



ENGINEERS  
WITHOUT  
BORDERS  
USA

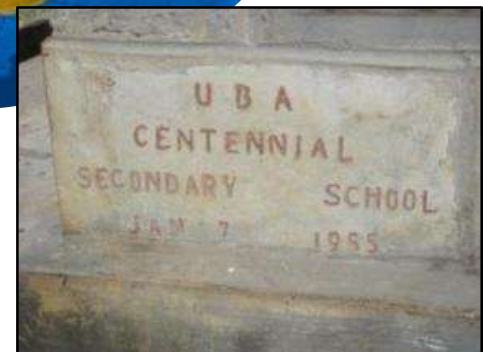
Drexel  
Penn  
Villanova  
Widener  
Temple



# Centennial Secondary School

1200 students, 7th – 12th grade

Mattru Jong, Sierra Leone, West Africa



# Sierra Leone

## Blood Diamonds... and Civil War

### 1991-2002



# "Five" Year Mission to Rebuild



**Feb 2010 Trip**  
Data collection,  
Scope development,  
Relationship building

**Feb 2011 Trip**  
Rebuild latrines  
Plan water options  
Scope classroom  
lighting

**Nov 2011 Trip**  
Solar PV  
classroom  
lighting,  
finalize water  
source, locate  
drilling  
equipment

**April 2012  
Trip**  
Drill well and  
install hand  
pump

**Jan 2013 Trip**  
Sanitation and  
water prep

**May 2013 Trip**  
Solar pump  
and water  
distribution

**March 2014  
Trip**  
Science  
building  
roof



**EBOLA in West  
Africa**

**March 2016  
Trip**  
Admin  
Building  
Electric

**Sustainable infrastructure for education**

**NOVEMBER  
2011**

**LIGHT**

# Classroom Lighting

Highest  
priority for  
students

Evening  
activities and  
study time for  
exams



# Classroom Lighting

## Off-the-Grid Photovoltaic Power System



Two 185W Solar Panels

Charge Controller & Remote Display



225Ah Deep Cycle Battery

Inverter  
12V DC →  
220V AC



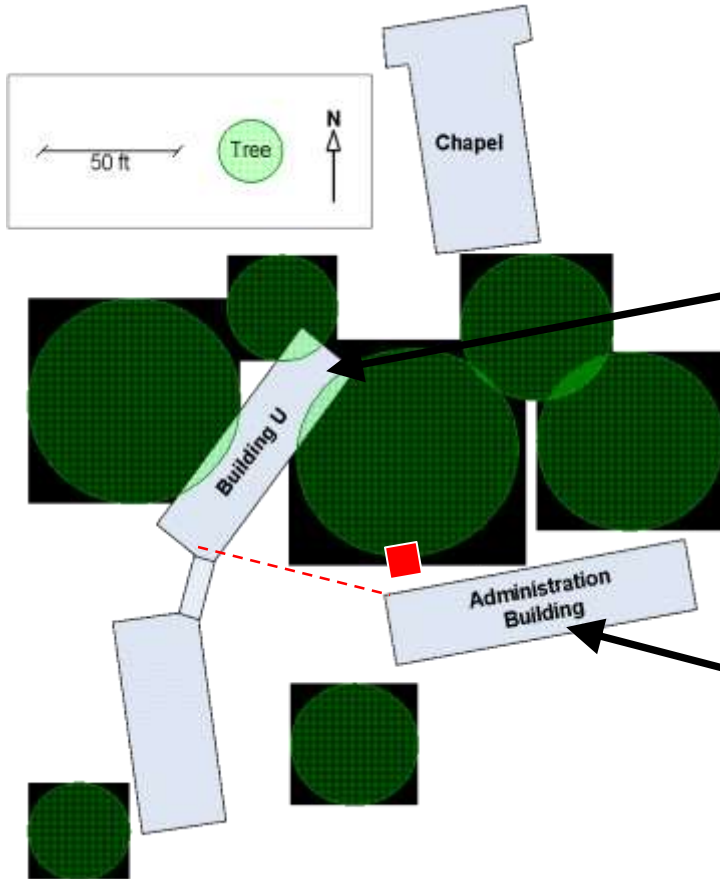
Circuit Breakers

CFL Lighting



*dimensions not to scale!*

# Classroom Lighting

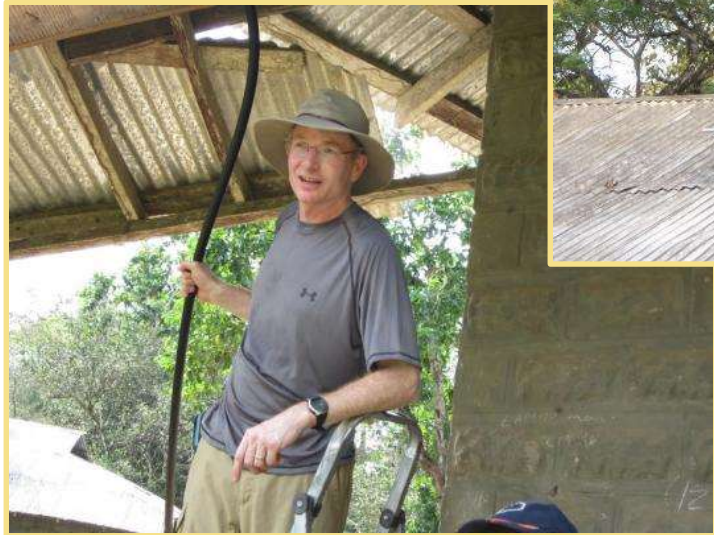


# Classroom Lighting Construction





# Classroom Lighting Construction



# School Lighting Ceremony

Nov. 23, 2011







# Lights in Use Every Night!





# APRIL – MAY 2012

# WATER



EDAL

EDAL

EDAL DRILLING COMPANY LTD. 35th MAIN MOTOR RD. CONGO CROSS FTOWN. MOB. 076.204816

FUEL

















# Clean Water for Classrooms





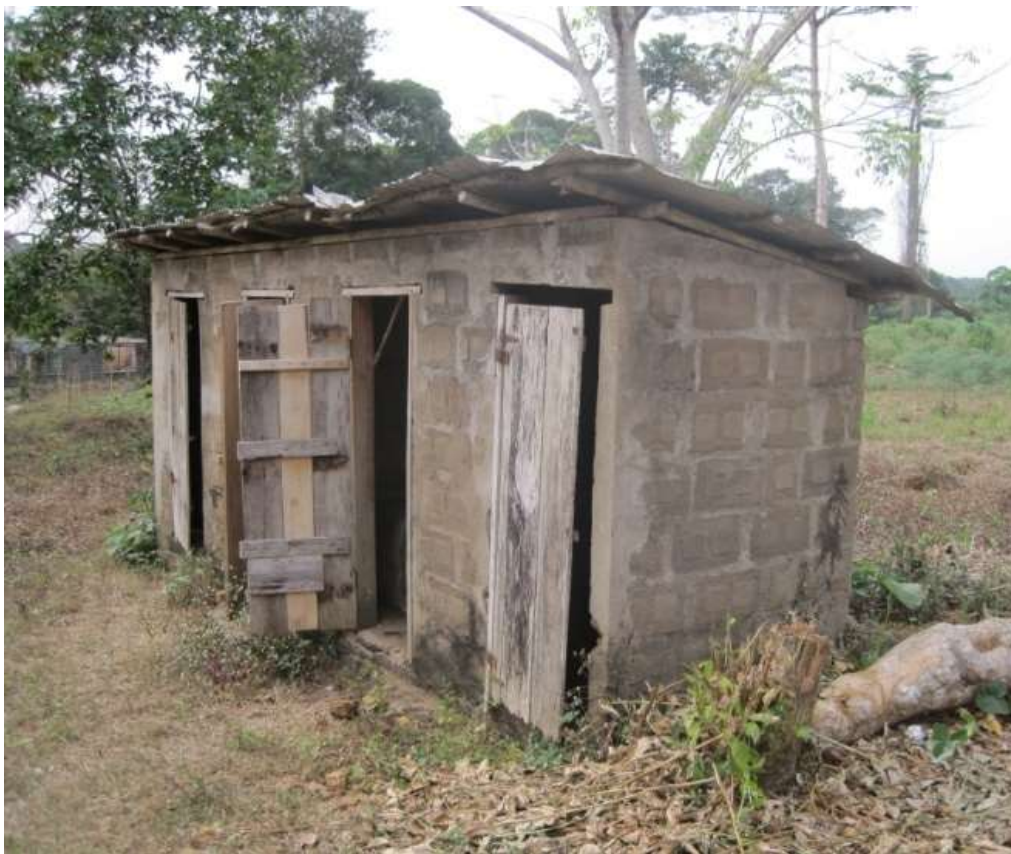
# **FEBRUARY 2013**

# **SANITATION**

# Sanitation, Water and Structures

- Bucket flush toilets for the students
- Ground guttering around the bathhouses
- Inspection of water tank and planning for re-piping
- Layout for the location of water distribution lines and solar array enclosure

# Before



# After



# Final Product-Gutters/ Trenches



# Parents inspecting the renovated toilet facilities



**APRIL  
2013**

**WATER Part II**



Well

0602

0791

0552

0592

0582

0622

0692

0662

0672

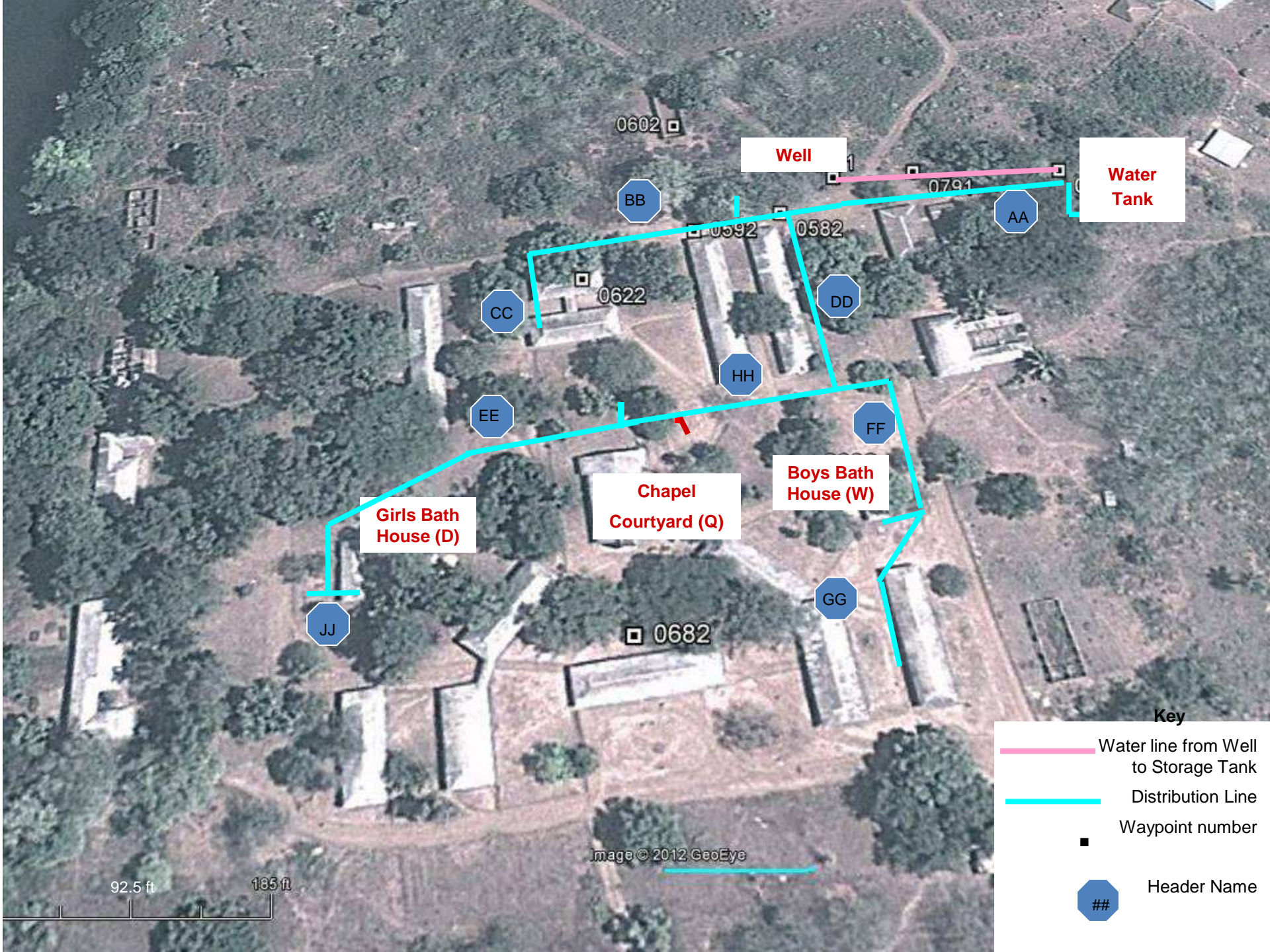
0682

185 ft

Image © 2012 GeoEye

Google  
0702





Well 1

Water Tank

0602

BB

0791

AA

0592

0582

0622

CC

DD

HH

EE

FF

Girls Bath House (D)

Chapel Courtyard (Q)

Boys Bath House (W)

JJ

0682

GG

Key

Water line from Well to Storage Tank

Distribution Line

Waypoint number

Header Name

92.5 ft

185 ft

Image © 2012 GeoEye

# At the Well Head



# Solar Array and Enclosure

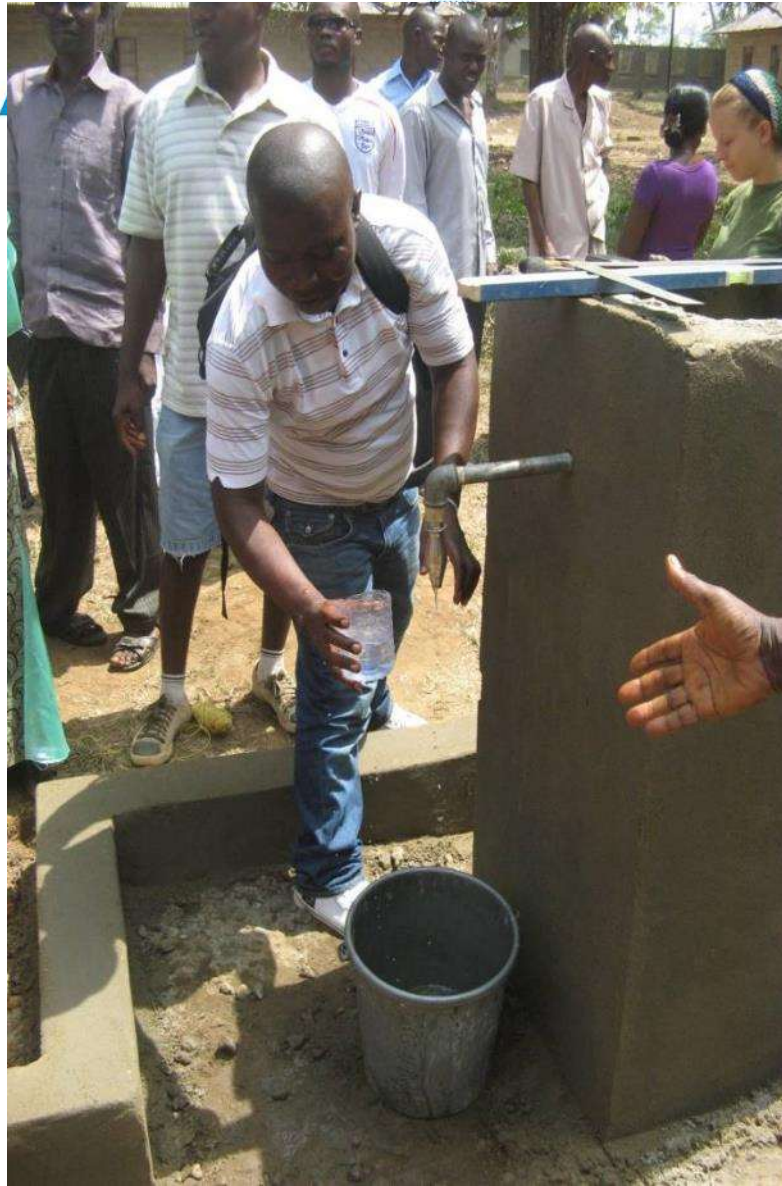


# Digging trenches for the water piping













# MARCH 2014

# Building Improvements

# New Roof & Ceiling in Chemistry/Physics Building



# New Roof & Ceiling in Chemistry/Physics Building



# New Roof & Ceiling in Chemistry/Physics Building



# Community Ownership Infrastructure Improvement Board



CENTRAL PRIMARY SCHOOL  
2014-15

NAME	AMOUNT	DATE	REMARKS
1. [Name]	10,000		
2. [Name]	10,000		
3. [Name]	10,000		
4. [Name]	10,000		
5. [Name]	10,000		
6. [Name]	10,000		
7. [Name]	10,000		
8. [Name]	10,000		
9. [Name]	10,000		
10. [Name]	10,000		
11. [Name]	10,000		
12. [Name]	10,000		
13. [Name]	10,000		
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27. [Name]	10,000		
28. [Name]	10,000		
29. [Name]	10,000		
30. [Name]	10,000		
31. [Name]	10,000	10,000	
32. [Name]	10,000		
33. [Name]	10,000		
34. [Name]	10,000		
35. [Name]	10,000		
36. [Name]	10,000		
37. [Name]	10,000		
38. [Name]	10,000		
39. [Name]	10,000		
40. [Name]	10,000		

M-11-12  
M/S/11

- School now pays 5% for each new project
- School Infrastructure Fee
- Maintenance Technician Hired
- School also provides labor for all projects

## Times Have Changed at Centennial School!

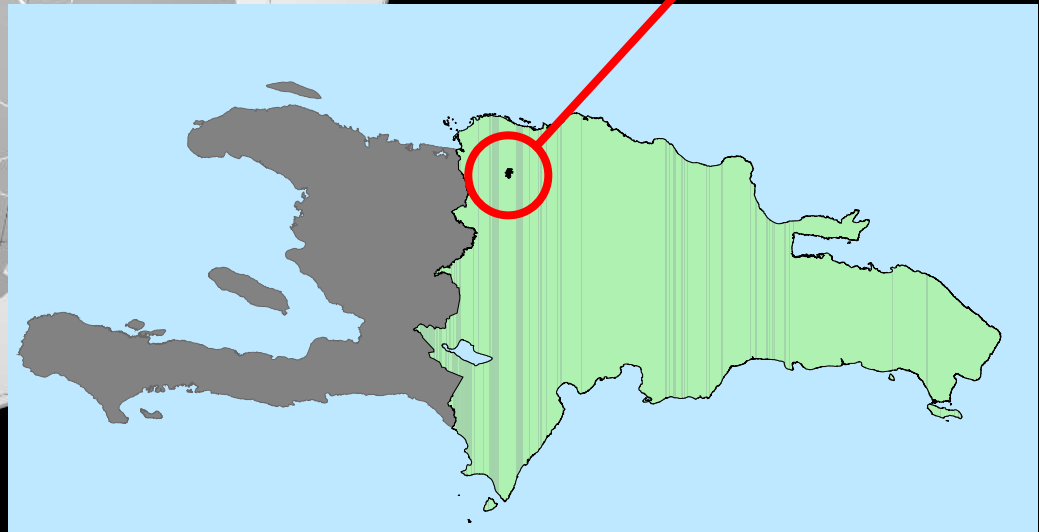
- Extra-Curricular Activities
  - Ceremonial uniform reinstated
  - Sports
  - Brass band
- Teaching
  - In-service training for teachers
- Parent Involvement
  - Active PTA involvement for school matters
  - Good parent and school relationship
- **National Exam Scores – from 0% to 85% passing**

# Engineers Without Borders New Water Project

**Dominican Republic**



**Communities of  
Machete and  
Cabeza de Toro**



## Why chemical engineers?

- qualifications
- professional development

## What can you do?

- Hands on
- Educate and inspire
- AIChE Leadership





# ChE Qualifications

- Heat and mass transfer
- Water solutions
- Energy systems
- Biotechnology
- Sustainability
- Systems approach
- 
- 



- **Worldview**
- **Multi-disciplinary teamwork**
  - Other engineers
  - Other non-engineers
  - Other cultures
- **Project execution experience**
  - Incomplete data
  - Limited time
  - Limited resources
  - Unreliable communications
  - Serious consequences

## Hands-on

Active participation in a structured program through a non-profit organization or NGO

- [Engineers without Borders – USA](#)
- Habitat for Humanity
- Faith groups
- Rotary
- Peace Corps



# Kelly Barb

## Peace Corps – Guinea 2013-2014



## Educate and Inspire Youth

- K-12 outreach
- Student Chapter or Local Section activities
- STEM focus AND global focus

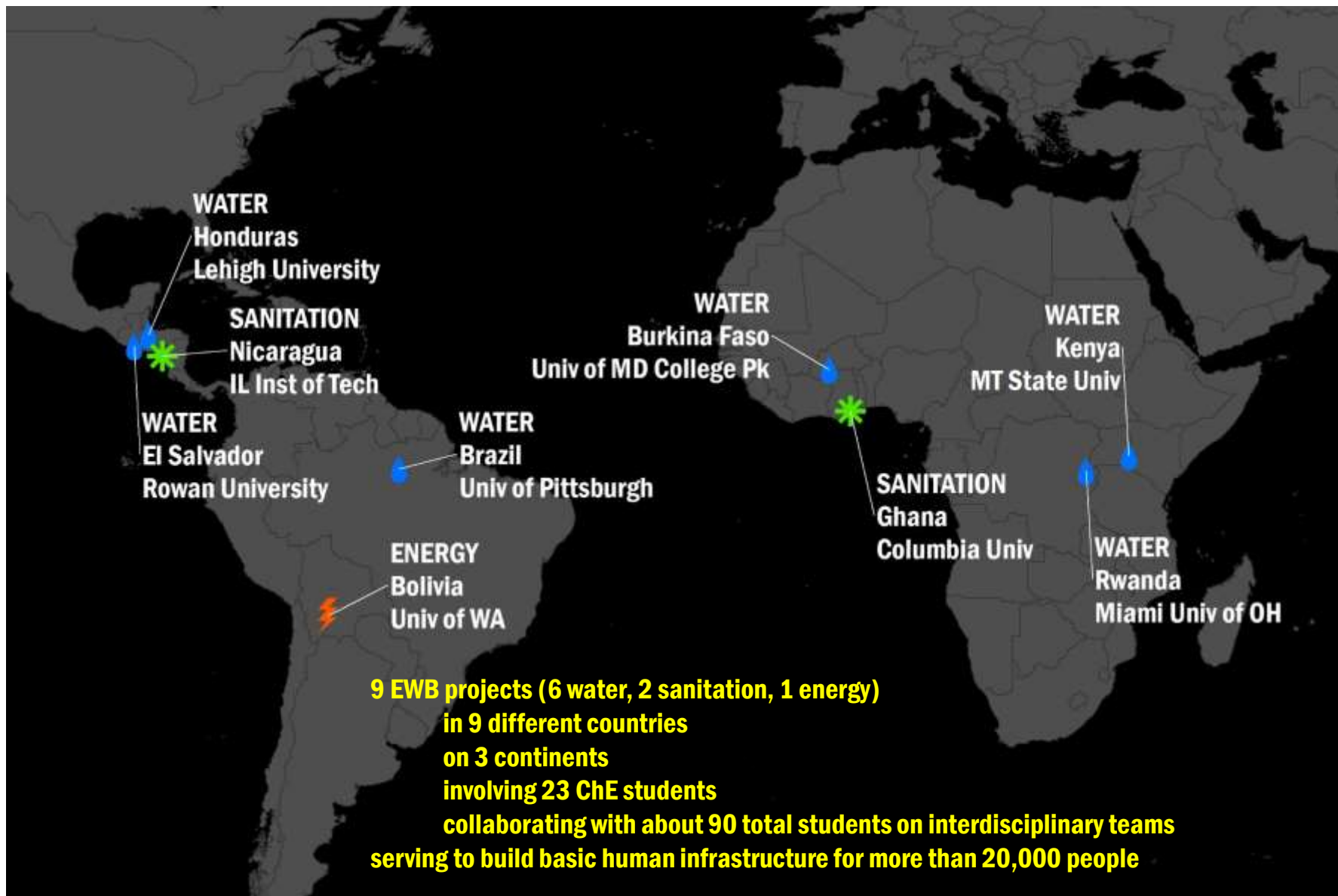


## AIChE Leadership

- Global Societal Initiatives Committee 
- K-12 Outreach
- Societal Impact Operating Council
- Young Professionals/Local Sections
- International Committee
- International Student Chapter Partnerships
- Center for Energy Initiatives
- International Society for Water Solutions
- Institute for Sustainability
- Sustainable Engineering Forum
- Youth Council on Sustainable Science and Technology

# AIChE-EWB Grant Program

managed by the Global Societal Initiatives Committee  
funded by the AIChE Foundation



# AIChE



The Global  
Home of  
Chemical Engineers

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Spatial Analytics

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