

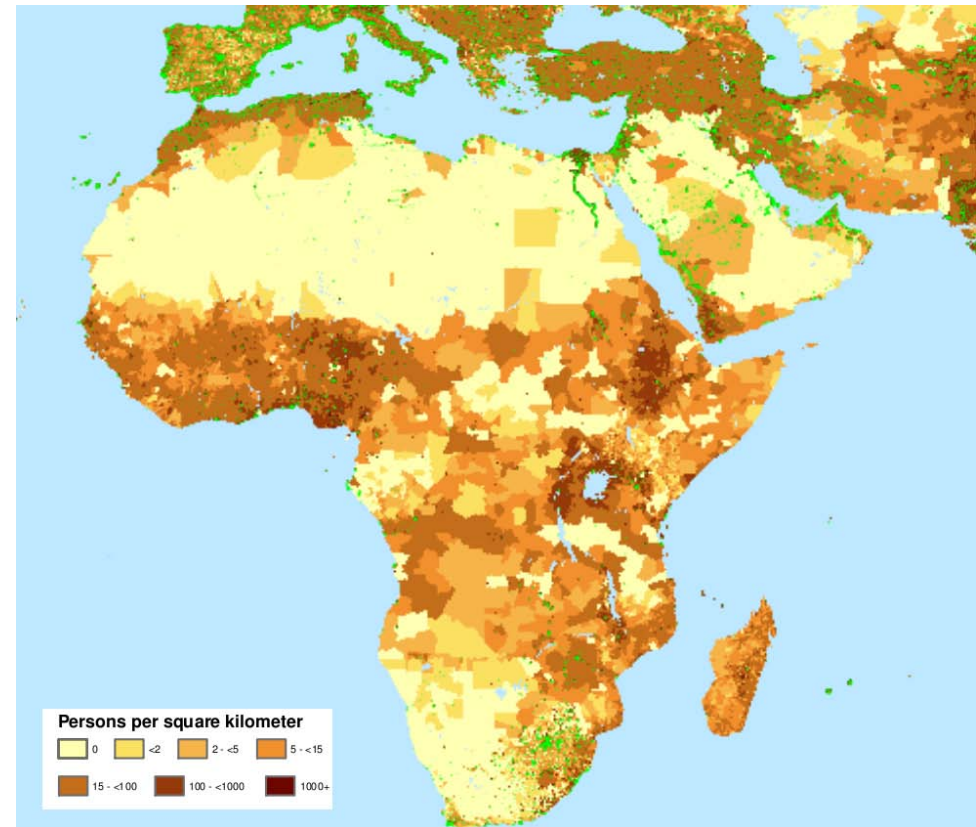
# Experiences Developing Household Lighting for Rural Villages

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How We Got  
Started

# Lighting Statistics

- 1.6 billion people had little or no access to electricity in 2002
- 1.4 billion projected in 2030
- Primarily occurs in Africa, Asia and Latin America



# Costs of Fuel Based Lighting

- 77 billion liters of fuel consumed per year for lighting
- Worldwide cost of \$38 billion per year
- Results in \$77 per household per year



# Goals of the Lighting Project

- **Safety**
  - Risk of burns
  - Fires
  - Protection
- **Improves health**
  - Reduce smoke inhalation
  - Eyesight
- **Extend the day**
  - Education
  - Economic
  - Vocational

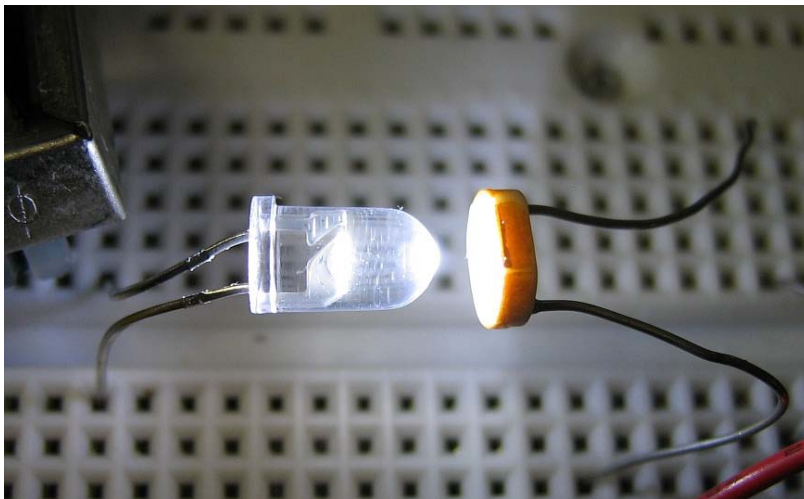
# Two Methods of Obtaining Electricity

- **Grid connected**
  - **Economical**
  - **Not widely available in Sub-Saharan Africa**
- **Off-grid power generation and redistribution**
  - **PV Solar**
  - **Wind**



# Light Sources

- Incandescent
- Linear fluorescent and compact fluorescent
- Light emitting diodes (LED)



# Light Efficacies

<b>Light Source</b>	<b>Typical Luminous Efficacy (lm/W)</b>
Incandescent	10-18
Halogen incandescent	15-20
Compact fluorescent (CFL)	35-60
Linear fluorescent	50-100
Metal halide	50-90
Cool white LED 5000K	45-59
Warm white LED 3300K	22-37

Light output as a function of bulb type  
([http://www.netl.doe.gov/ssl/PDFs/energyEfficiency\\_oct25\\_06.pdf](http://www.netl.doe.gov/ssl/PDFs/energyEfficiency_oct25_06.pdf))

# Cost

Lighting Method	Cost (\$/1000 lux-hours)
Solar LED: 1 W w/ focusing lens (NiMH batt.)	\$0.01
15 Watt CFL (grid connected)	\$0.04
60W incandescent lamp (grid connected)	\$0.07
Solar-LED: 1W w/ diffuser (NiMh batt.)	\$0.16
Thermoelectric generator with 15 Watt CFL	\$0.23 - \$0.60
Grid recharged lead-acid battery with 15 Watt CFL	\$0.34 - \$0.57
Solar-LED: 1W no optics (NiMH batt)	\$0.90
Pressurized kerosene lamp (mantle)	\$1.04
Solar-5W compact fluorescent lantern (NiMH batt.)`	\$1.20
Hurricane Kerosene Lantern (wick)	\$3.69
Simple kerosene lantern (wick)	\$5.81
6W compact fluorescent lantern (alkaline batt.)	\$7.08
Candles	\$28.59
Incandescent 0.74W flashlight (alkaline batt.)	\$59.72

# Implementing a Solution

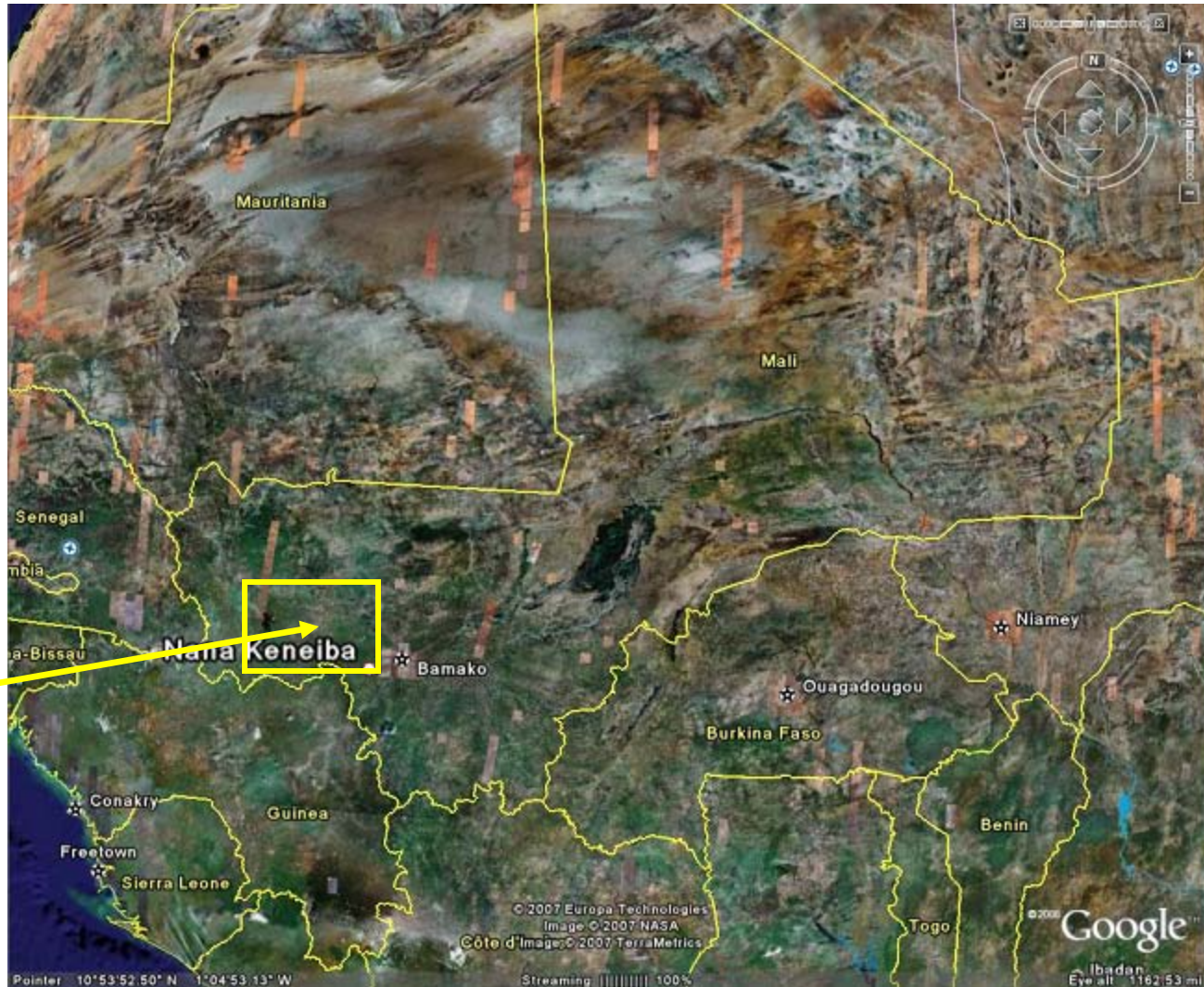
- The solution must be obtained through intercultural dialogue to ensure its quality and effectiveness



# Designing a Practical Light

- Attention to task and ambient lighting
- Effective use of lighting controls
- Use of most efficient technologies

# Current Projects



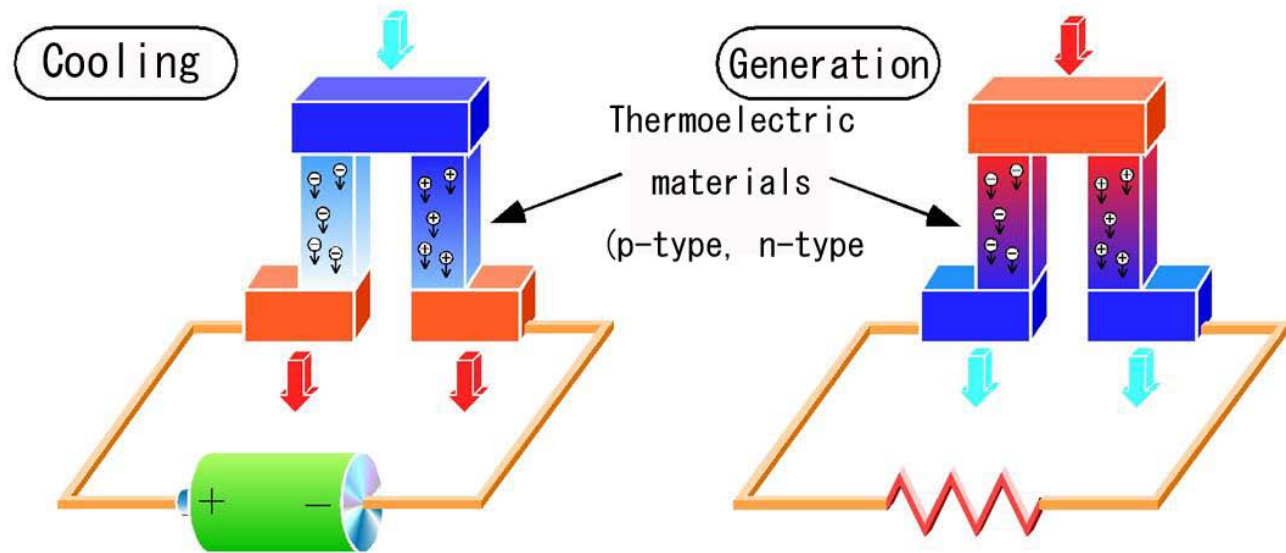
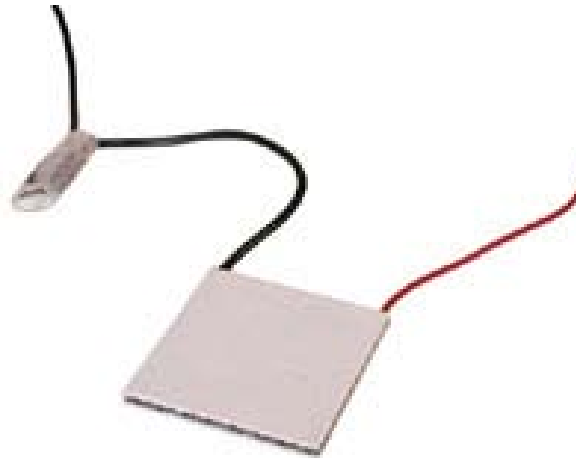
# Nana Kenieba

- Rural; population 8000 in 7 villages; subsistence farming
- Public health is central issue for welfare
- Clean water available in the past 4 years
- No lighting
- No Stoves



# Previous Lighting Projects

- Thermoelectric device lighting





# Solar Lighting Projects



# Successes

- Lighting village Mosque
- Insight for future work
- Connections with villagers



# What Didn't Work?

- Hardware
  - Batteries
  - LEDs
- Misunderstanding of needs
- Sustainability issues



# Next Step: Coupling Light and Water

- **Excess power from solar water pump**
- **Allows access to clean water and electricity**
- **Sustainable**
- **Cost savings to families**
- **Environmental Benefits**

