Bringing Communication to Kenya

The Fighting Koalas:
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Problems

- Much of Kenya is without reliable communication
- People cannot relay emergencies quickly
- Outside of big cities, cell phone usage is as remote as the locations
- Long distance communication can become inconvenient

- We plan on lessening and even solving some of these problems

Our Solution

- Buna – remote village along Laga Har River in northeastern Kenya
- Build a green cell phone tower run by renewable energy also powered by GE's new prototype battery
- We hope to improve the villagers' quality of life, bring income to the area, and bring communication abilities to a larger portion of Kenya than there was before

Our Initial Thoughts

Location

- Along the river next to the village?
  - Optimal for hydro energy
- On the open plains near village?
  - Open area best for solar energy
- Far from the village up in the hills?
  - Elevated area allows greater usage of wind

Type of Energy

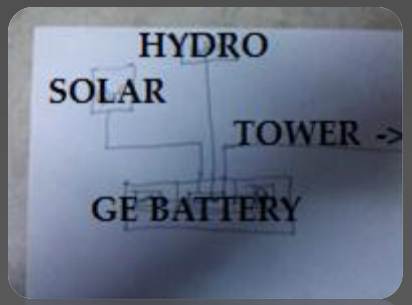
- At first, we thought wind and solar would be good choices
- We also looked into hydro energy and fuel cell technology
- We decided that, after research, we could find the optimal cost vs. production rate for our energies

Research and Development

Type	Cost	Maintenance	Life	Energy Production
Hydro	4 cents/kWh	Occasional part replacement at minimal cost	Record is 200 years. Usually 50-100 years	Largest in the world produces 13,320 megawatts
Fuel Cell	Depending on size, $200-$5000	Minimum	One type is 7300 hours under normal cycling conditions	5-6.5kW
Solar	$13,000-$27,000	Panels require occasional cleaning	~25 years	1-3kW
Wind	1 cent/kWh for actual power	Could be common, and can get expensive at about 20-25 cents/kWh	~20 years	Largest is 7.58MW, with 10MW in production

- Our major decision making process
- We found through location research:
  - Laga Har is reliable, rainy seasons help
  - Our area is not especially windy
- We found that hydro energy would be best for our location, solar would make good backup
- Fuel cells could be costly to replace
- Final decision: major use of hydro with small solar

Final Design Forming



- An early layout sketch of how we wanted our station to look
- To accommodate the 1.2 kWh need, we downgraded to a small pico-hydro station and a few solar panels
- Will produce enough energy to run station, charge the GE battery and have left over to delegate how we want

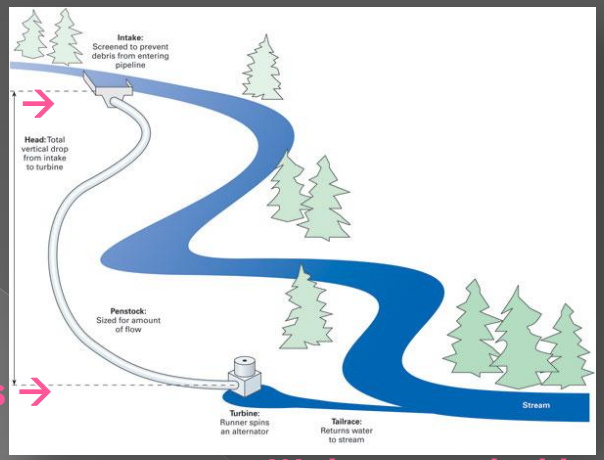
Our Final Design

PICO –HYDRO STATION

- Optimal production rate of 5 kW, however ours will be smaller
- Will be the main source of power for our station
- Will pump out about 2 kW of usable energy constantly
- Water comes in underground, runs turbine, then recycled back into river

- Cost: about $3000, installation included, little maintenance required

Water enters pipes →



Water turns turbine →

Water recycled to river

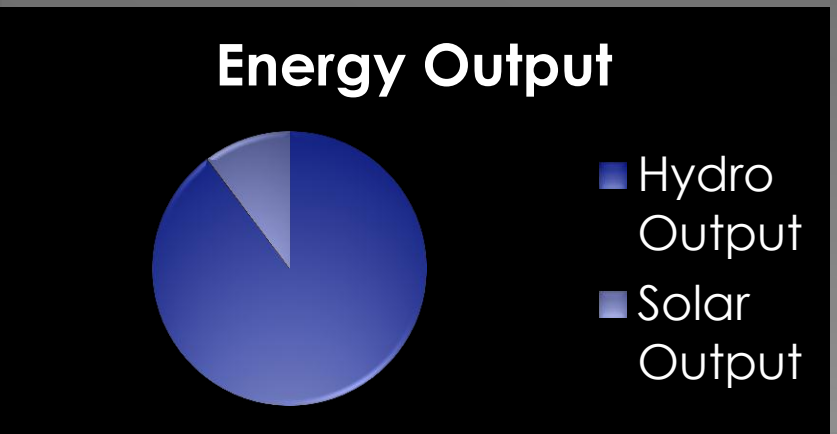
Our Final Design

SOLAR PANELS

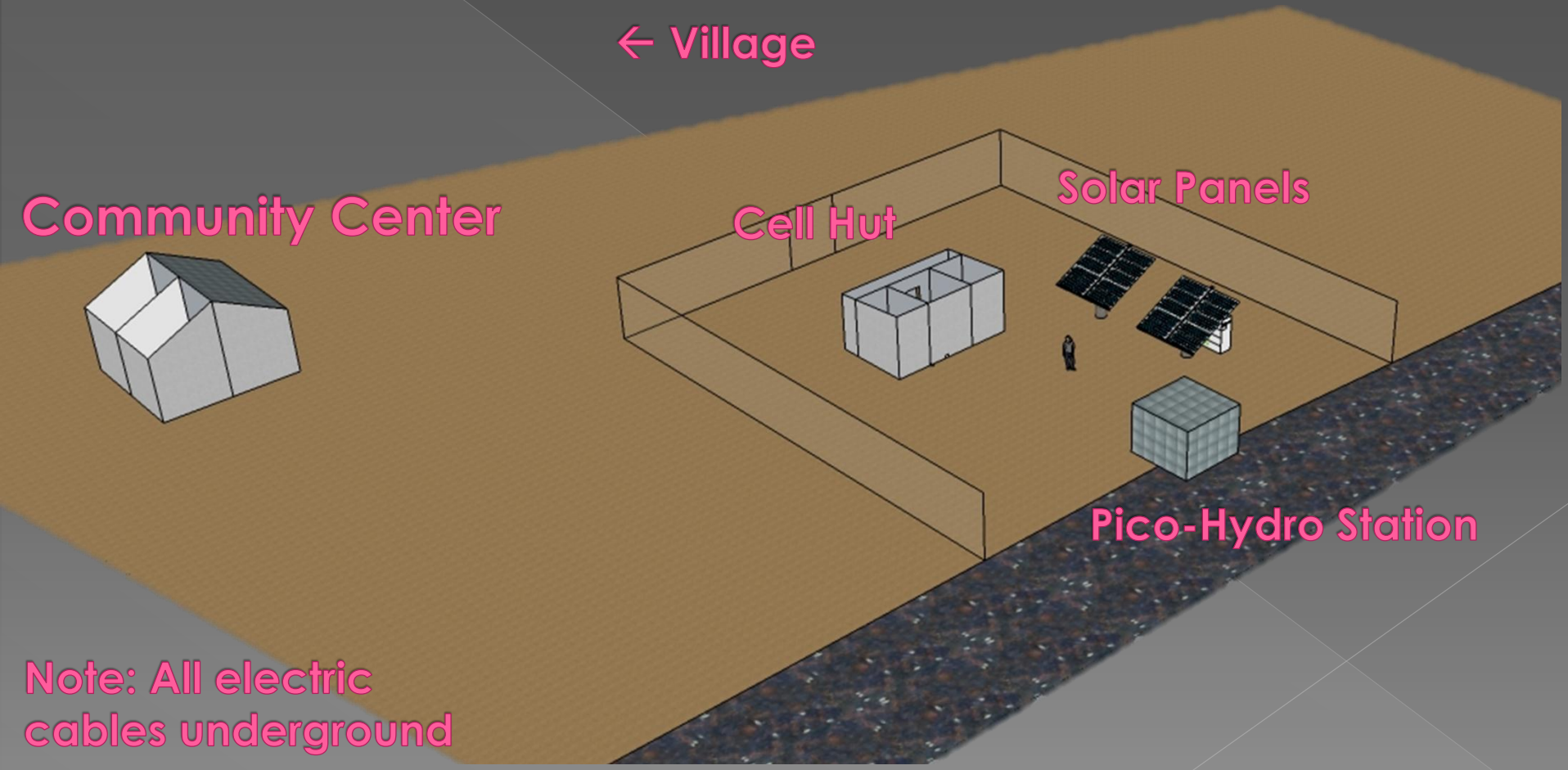
- Station will feature two 150 W solar panels
- Only one will provide power at any given time, the other serving as backup
- One 150 W solar panel can optimally produce 1kWh in daytime
- Extra power stored during nighttime hours
- We expect approx. 500 W per day
- 1 kW over ~12 hours equals 500 W over 24 hour period
- Cost: about $4400, little maintenance

Our Final Design

- We will use GE's A3 size battery, the smallest one available
- Holding 8kW of charge is more than enough for our 1.2kWh station
- Cost of station: about $110,000; add in energy kiosks, battery, misc. expenses, around $120,000
- Community Center to disperse leftover dump energy, features include:
  - Cell phone charging station
  - Water purification system
  - Outlets for villagers to plug in TV's, lights, etc.



Sketch Up Model



Note: All electric cables underground

Energy Production by Year

Hydro Output	17,520	kwh
PV output	2,007	kwh
Generator output	0	kwh
Generator fuel	0	gal
Generator hours	0	hr
Dump energy	6,728	kwh

Total energy produced by hydro and solar

Leftover energy to be used for community center

Note: Information from Excel systems model

Important Aspects

- With two $1m^2$ solar panels and a small, mostly underground pico-hydro station, our station will not take up much space
- Will leave more space for villagers, less visible aspects disturbs local wildlife less
- Cell tower will provide a large area of Kenya with previously unavailable communication
- People can keep in touch, relay emergencies by phone, and live in a more modern world

Our Favorite Features

Shawn: “the hydro station because it recycles the water back to the river”

Cody: “the addition of a community center where people can make use of our dump energy”

Brian: “the hydro station because it is compact but produces more than enough energy”

Logan: “the solar panels that can act as a backup source to the hydro power”

In Conclusion

- We learned a lot about renewable energy sources from this project
- The people that live off the grid deserve to have a better form of communication
- Working in conjunction with large corporations requires leeway
- Value of teamwork is a much appreciated commodity

imagination at work