

# Sustainable Energy Project II

The background of the slide is a vibrant landscape. In the foreground, there's a field with some green grass and patches of brown earth. A few animals, possibly sheep or goats, are scattered across the field. To the right, there's a large pile of dry sticks or brush. In the middle ground, there's a field of tall, golden-brown corn plants. Behind the corn field, there are rolling green hills covered in dense, lush vegetation. The hills recede into the distance under a bright blue sky filled with fluffy white clouds. The overall scene is bright and sunny, suggesting a rural or agricultural setting.

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# The Situation

- El Cercado, Dominican Republic
- Rural area
- Majority of population live in poor conditions
- Limited clean water and energy access
- Electricity access limited to a few hours each day
- High Fuel costs
  - Limited Electricity
  - Limited Propane Gas
  - Limited Firewood
- Forced Cold Showers
  - Bad for sick and elderly
  - Disease by lack of showers
- Power grid inconsistent/powers one section at a time



# Project Objective

To develop alternative, affordable energy generation method for residential uses to supplement the grid electricity source when it is not available or unaffordable.

# Potential Solution Concept

- Design and Assemble a community charging station with portable power capabilities
- Charging station would be pedal operated
- Portable battery recharged via charging station
- System that would benefit young and old
- Developed for center of town or for each individual household depending on budget/donations



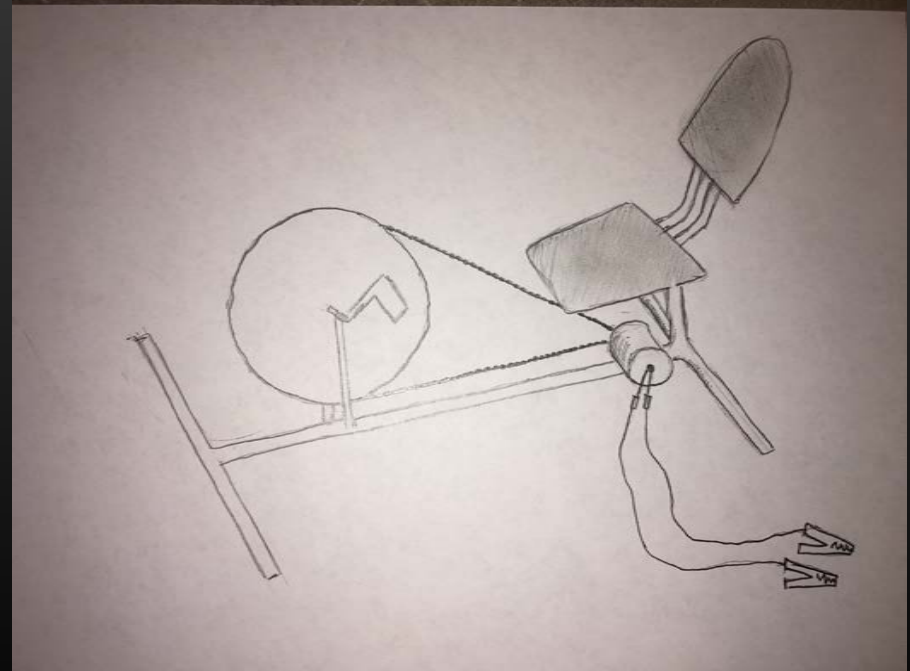
## PROS

- Simplicity in design and use
- Anyone with leg power can run the charging station
- Power supplied would benefit all
- Battery is portable which provides mobility of power
- Provides affordable, sustainable alternative energy source

# Charging Station

## Design Concepts

- Recumbent bike seat.
- Power generated through DC motor via pedaling
- DC motor voltage output spliced into car jumper cables
- Adjustability
- Simple design, basic maintenance



# Portable Battery

## Design Concept

- 2 compartment box
- Simple construction
- Size is based off the size of the inverter and battery
- Can be made out of available materials in surrounding area



# Cost Estimated

## CHARGING STATION

- Base support - apx \$15-\$50 depending on materials used
- Chain ring - \$60 + depending on size
- 24V DC motor with chain sprocket - \$60
- Attachable seat - \$45
- Jumper cables - \$20
- Crankset - \$30
- Pedals - \$15
- Bike Chain - \$10

apx \$280

## PORTABLE BATTERY

- 400W inverter 45\$
- 300W inverter 35\$
- Standard car battery 50\$-120\$
- Premium car battery 90\$-200\$
- 2 2x4's 3\$ each
- Nails 1.5" box 3\$-8\$

Apx 100\$-250\$

TOTAL COST = 380\$-530\$

# Green Engineering Design Considerations

## Green Engineering Principles:

- #1 Inherent Rather than circumstantial
  - non-hazardous
- #4 Maximize efficiently
  - Maximize energy space
  - Time efficient
- #5 Output pulled vs. input pushed
  - Use of energy and materials minimal
- #7 Durability Rather than immortality
  - Durable to last up to 10 years and replaceable (moving parts)
  - Not immortal, could be better tech in future
- #9 Minimize Material Diversity
  - Only using minimal supplies
- #12 Renewable Rather than depleting
  - Function only produces clean energy, no backlash to environment



## Considerations:

- Dependent on community funds/investors
- Accessible parts when Ready
- Availability of parts at the Capital City
- Problem if the power source fails
  - Side bad: possibly make 2 if one goes down
- # of people to obtain use at a time
- # of people who can fix and learn about machine if the parts break down



# Potential Impacts

## Environmental

- Relatively no environmental impact
- Most materials non hazardous
- Potential impact in battery malfunction/disposal

## Economical

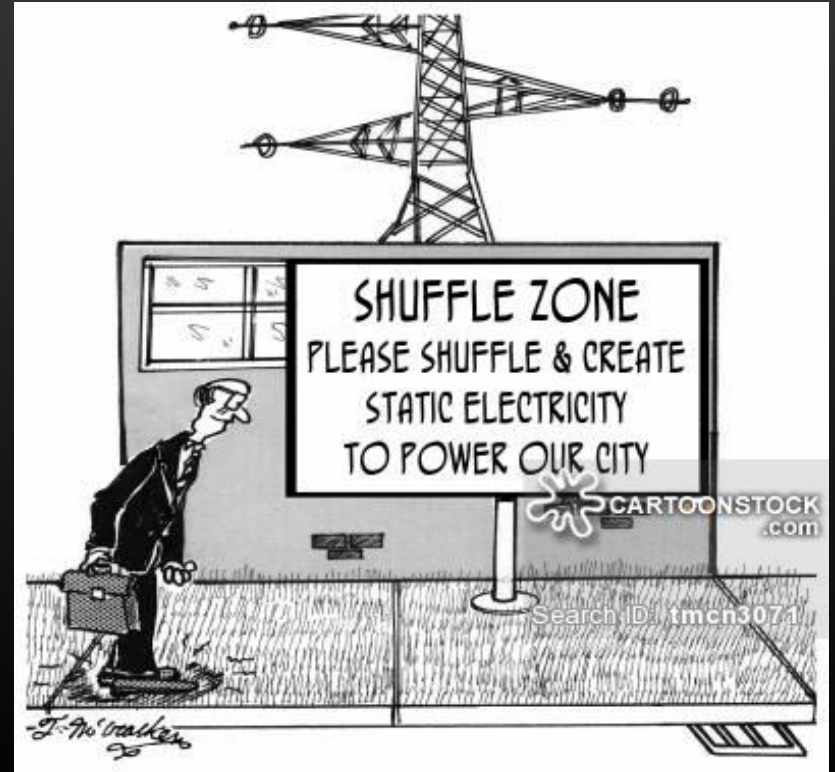
- Increase activity - more power more options
- Inherently improve conditions

## Social

- Having power brings sense of security
- Access to power will help improve conditions
- Give the user a sense of empowerment/connectivity

# Key Implications - Product Development (environmental, community, local economy, society)

- Lifestyle Changes
- Economic growth in clean energy
- Knowledge sharing Concept
- Easy to understand
- Society benefit clean energy



# Proof of Concept



Battery has a capacity of 100 amp hours, and you just want to use a laptop that uses 45 watts, you can see that you'd be able to get about 11 hours out of your battery:

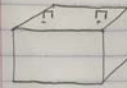
$$(10 \times (100 \text{ AH}) / (45 \text{ Watts})) / 2 = 11.11 \text{ hours}$$

## IDEA

- A portable outlet composed of a battery + outlet (inverter)
- A charging station, powered by pedaling, that can charge said portable outlet.

## PORTABLE OUTLET

Battery → more than likely a car battery



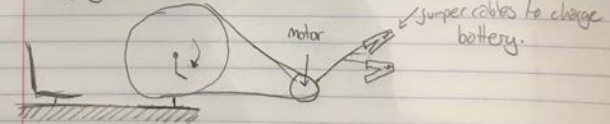
an inverter that converts the energy stored in battery into usable power



## NEED

- portable outlet design
- sizes of car batteries / inverters
- how to hook up battery to inverter
- calculate how much power the battery can hold → provide juice for outlet

## Charging station



## NEED

- charging station design
- how to construct motor to pulley
- how to attach jumper cables to motor

3 calculations