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Solar Applications in Chad

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Advisor: Professor Kent Rissmiller (Social Science)

1. Abstract:
This project uses photovoltaic technologies for the applications of water pumping and lighting in the rural villages of Chad, providing people with greater development opportunities. Research reveals that 70% of the population does not have access to electricity, and most people have to travel at least 2.5 miles to get access to a source of drinking water. Since 80% of the people live below the poverty line, external funding would be necessary to make this project feasible. If funding is provided, this project can be a success in providing affordable lighting and clean water, and can be used as a model for other developing nations.

2. Background of Chad:
- **Electricity:** Production: 100 million kWh (2008 est.), World Ranking: 194
  - Consumption: 93 million kWh (2008 est.), World Ranking: 194
- **Only 50%** of population has access to a source of potable water.
- **People in some villages need to walk 2.5 miles to get clean water.
- **Climate:** tropical in south, desert in north, dry in nature.
- **Population below poverty line:** 80% (2001 est.).
- **Literacy** (people age 15 and over that read and write French or Arabic): 25.7%.
- **Mobile phone usage:** 2.686 million of 10.8 million (24.97%) (2009), World Ranking: 119.

3. Project Goals:
To effectively use photovoltaic technologies to provide the people of Chad with access to clean drinking water and electricity; thus increasing the quality of life of the people, and providing them with self-development opportunities.

4. Research Methodology:
**Background Investigation:**
- **Selecting Chad:**
  - Location: gets large amounts of unobstructed sunlight
  - Extremely low Human Development Index rating (183)
  - Politically stable
- **Geography:**
  - Typical village setup
  - Current energy sources and technologies
  - Current consumption levels of water and electricity
- **Technological Facts:**
  - **How much power actually required**
  - **How to minimize cost and maximize the efficiency of the photovoltaic cells**
  - **Basics of solar lighting, LED lights, and solar powered water pumps**
  - **The output of an LED light, size of PV cells, storage of the solar energy after conversion, lifespan of the devices, maintenance requirements of the system**
  - **Most importantly, the conversion and storage efficiency**

**Marketing Strategies:**
- Visually appealing and easy to use design
- Seminars and advertisements
- Training sessions extremely useful
- Work with local authorities

5. Results:
In a small mock village of about 200 people, assuming an average family size of 4.

**Solar System**
- **Solar Panel(s):** 2 panels at 250 Watts each
  - Dimensions: Approximately 40”x65”x2”
- **Lanterns:** 50 LED lanterns

**Pump:**
- **Model:** Quad Solar Pumps: 535440-BL40Q
- **System Power:** 24V DC
- **Pumping Head:** 92” (40 PSI)
- **Pumping Period:** 10 hours
- **Amount of Water:** 1800 gallon/6813 L

**Filter:**
- **Pelican Filter System:** PC600
  - Dimensions: 18”x18”x49.5”
  - Operating Pressure: 25-80 PSI
  - Max flow rate: 10 GPM
  - Connection size: 1”

**Storage Tank:**
- **American Tank Co:** 2500 gallon Cone tank
  - Weight: 889 lbs (without water)
  - Dimensions: 89” wide X 96” tall

**Cost Breakdown:**
- **Pump (with solar panel):** $1,770.00
- **High Level Cutoff Regulator:** $125.00
- **2500 gallon Cone Tank:** $2,200.00
- **Carbon Filter:** $750.00
- **Piping and other materials:** $500.00
- **Solar panels (for lighting):** $900.00
- **Solar System:** $1500.00
- **Wiring and charging materials:** $300.00
- **Total:** $8045.00

6. Conclusions:
To implement this project successfully, organizations need to provide funding and must:
- Hold systematic demonstrations and instructional programs on the use of the technology, with special emphasis on training women.
- Conduct seminars to convince people that technology will help them in their daily routines by adding more hours to their day to complete other tasks.
- Explain to the people the benefits of time, education, better health, electrification, and easier access to water.
- Make the people understand that this project leads to small scale enterprise development in the long run.
- Train the villagers to undertake small scale maintenance of these systems, even though the proposed technology has an extremely long life span.
- Establish lines of communication with the company providing the equipment, so that the company can be contacted if technical assistance is required.
- Work with the village authority to ensure the security of the photovoltaic system.

7. Sources:
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