VSBK Extrusion Implementation
Well-water Extraction and Utilization Via Brushless DC Drive Pump

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Abstract

During ten weeks in Lilongwe, Malawi four engineering students on ETHOS managed construction of a workshop to mechanically implement equipment to mix and extrude clay for use in a large-volume clay firing system called a vertical shaft brick kiln. The students also built a sustainable water pump and reservoir system using only local resources and a solar powered pump.

Introduction

- Malawian bricks used for general building are typically fired using rudimentary local supplies
- Vertical Shaft Brick Kiln (VSBK) offers a sustainable solution
- VSBK technology is energy efficient

- 780 million people lack access to clean water [1]
- Common practice is to create a simple well
- Capital cost must be low and end product must be maintainable
- Possible solution involves a small, localized well that uses a solar panel and small pump

Project Description

- Acquired proper hardware and equipment to move heavy machinery
- Mixing and extruding equipment was transported to the VSBK site
- 4-8 on-site workers for chiseling, lifting, bricklaying, concrete mixing, and mechanical tuning

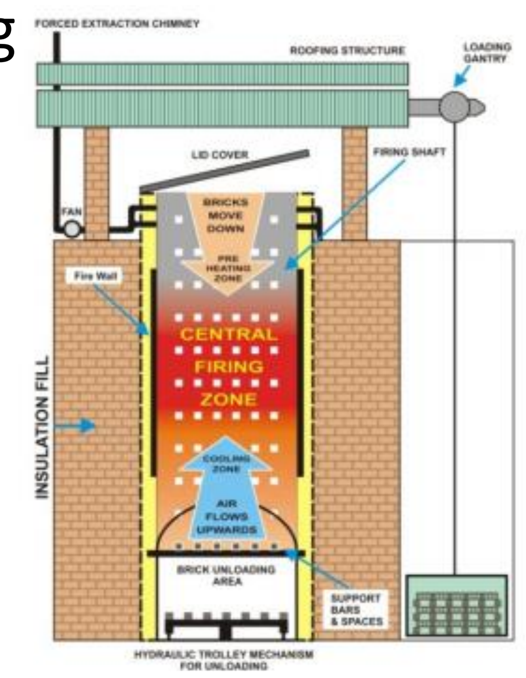

Figure 1: Vertical Shaft Kiln

- Designed and implemented a well water pump and reservoir system

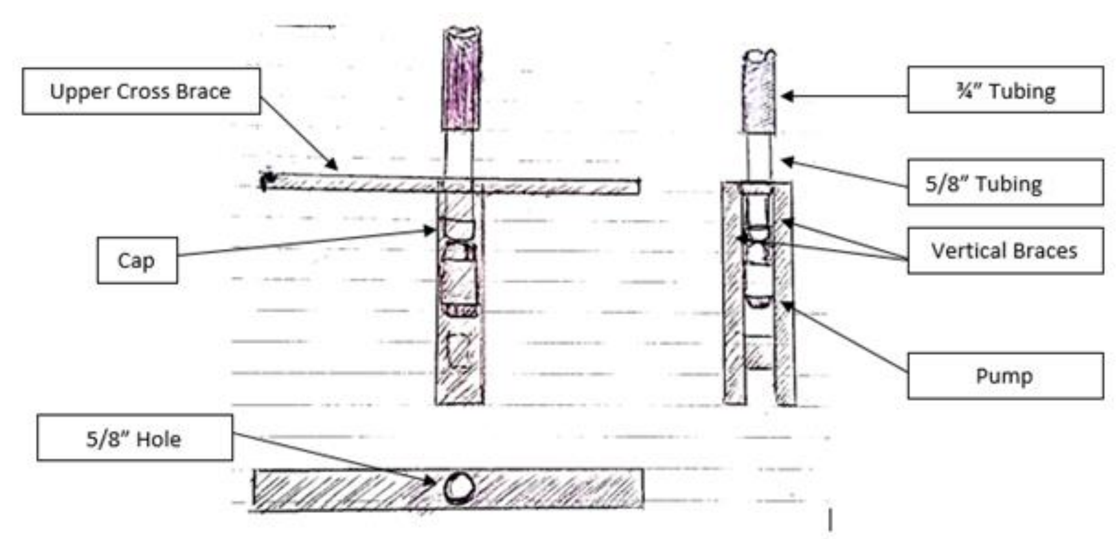

Figure 2: Solar Water Pump System

- Used a 30W solar panel, brushless DC water pump, and available materials in rural areas (i.e. bamboo, industrial 50 gallon barrels, and used tires)
- System ran in standard sunlight conditions for all seasons
- Vertically pumped water more than 4.5 meters

Results & Discussion

- Progress in workshop with management
- Foundation set and equipment moved in
- 90% of mechanical setup completed
- Lacking electricity for extrusion configuration

Figure 3: Workshop Building Progression

- The electrical power is sufficient
- Max head of pumping system is 4.5m
- Electrical system controlled with an on/off switch
- Filling at 1.7 Gal/min
- Able to supply enough water pressure to fill a secondary reservoir

Figure 6: Solar Pump System Assembly

Recommendations

- Further mechanical work- anchoring and construction of the conveyor system
- Continued welding of the upper access walkway, and configuration of the piping to the vacuum pump and extruder
- Goal for the system start date is late October /early November

- Creation of drip irrigation system from primary or secondary reservoirs
- Float switch to prevent dry pumping when the well runs low as opposed to manual on and off
- Develop battery backup system
- Integrate microcontroller to activate discharge
- Electricity routing from Malawian grid

Acknowledgements

[1] WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation. (2012). *Progress on Sanitation and Drinking-Water, 2012 Update*.

[2] D. Langridge, W. Lawrance, B. Wichert, *Development of a photo-voltaic pumping system using a brushless d.c. motor and helical rotor pump*, Solar Energy, Volume 56, Issue 2, February 1996, Pages 151-160, ISSN 0038-092X.

[3] Luca De Giovanetti (luca.degiovanetti@sa-vsbk.org) , John Volsteedt. *An effective South-South Technology Transfer for climate change*

[4] GIZ (Peter Schramm, Titus Malunga)

[5] Clioma (Conor Fox)