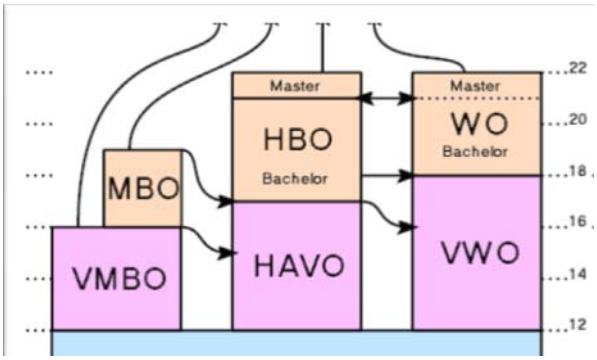
# Options for technical cooperation between Dutch students and the SASOL Projects from a Mechanical Engineering viewpoint. Draft version 29th October 2007

Wilbert te Velde- The Hague University (Haagse Hogeschool/THRijswijk Academie voor Engineering, Mechanical Engineering Department)b

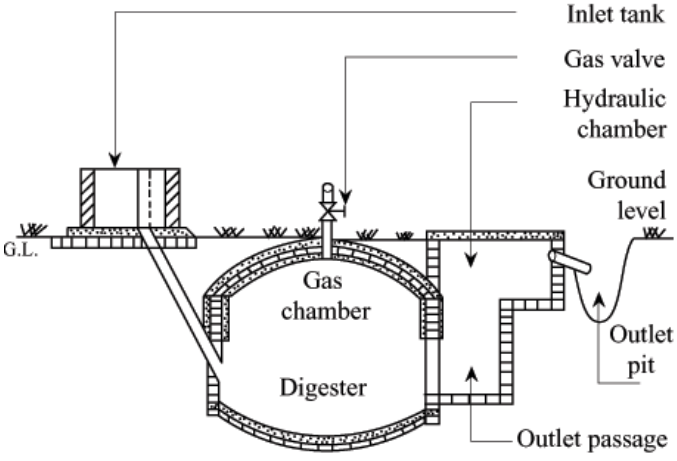
## 1 INTRODUCTION

The October 2007 visit by teachers from several technical schools and disciplines in the Netherlands has produced new subjects for future student internships, but also for research in the Netherlands. From my view as Mechanical Engineer with a specialization in Renewable Technologies I have produced an extensive list which I have discussed with Onesmus and Sam Mutiso from SASOL. This has ended in my promise to work out these subjects into a proposal for future internships. I will also propose at what level (HBO or MBO) I think the research should be done and whether the work should be done in Kenya or in the Netherlands. The figure on the left shows the Dutch Educational system after primary school with on the right hand side the age scale[1]. The VMBO-MBO pathway is more practical whilst the middle and right hand pathway are more theoretical.




## 2 SUBJECTS

### 2.1 Biogas




Biogas has already been introduced in Kitui District. The system used has a sheet metal floater that guarantees a steady gas pressure. Other systems work without a floater but with a brick dome as can be seen on the left hand figure. This may be more reliable. A possible assignment Building Technology at HBO level could do a desktop analysis into different systems with the aim to verify whether it is viable to test other technologies. This study can be performed in the Netherlands.

[1] http://upload.wikimedia.org/wikipedia/commons/b/b5/Dutch_Education_System-nl.svg

## 2.2 Solar PV

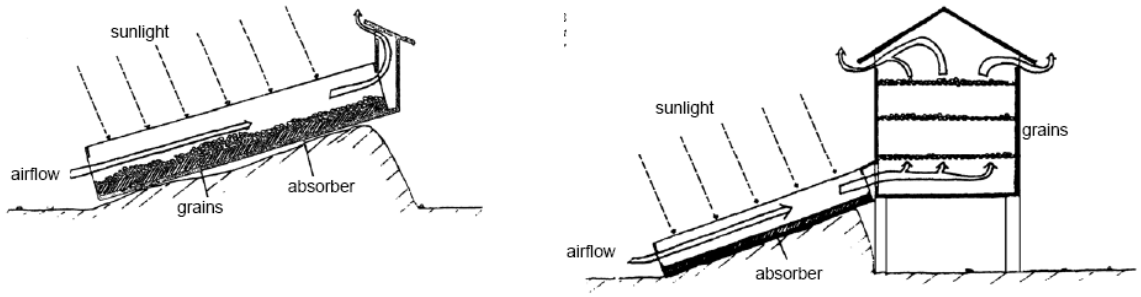
Both amorphous and crystalline solar panels are available in Kenya. So are solar batteries and inverters. SASOL reports to have little knowledge of this subject whilst requests from schools for this technology are multiple. Haagse Hogeschool/THRijswijk Ac. v. Engineering has a large test field for solar panels and long term experience in system design. Aim of an assignment by HBO students from the Electrical Engineering Department should be to gain experience in system design and functioning. Tasks:
- seek or write a computer program to estimate system size and price (both commissioning and maintenance)
-design two pilot systems which should be installed by a Kenyan installation company
-design and build a performance monitoring system.
-write an educational program which teaches local maintenance engineers about the different systems and how to maintain the batteries
-give training to maintenance engineers

## 2.3 Food preservation

Two food preservation technologies lie in the range of work of our students:

### 2.3.1 Solar Crop Drying

The WOT, Working Group on Development Technologies of Universiteit Twente (http://www.wot.utwente.nl/information/general.html ) has a demonstration field for renewable technologies for developing countries.




Among the available technologies are chests for crop drying, see figure above.
An even larger system consists of a greenhouse of transparent plastic supported by a framework of wooden/bamboo arcs which lies on a slope so that a natural airflow occurs which dries crops within the greenhouse.
The assignment on MBO-level direction Meubelmaken (furniture building) could be to get plans from the WOT and to build these driers in Kitui for a demonstration project.

### 2.3.2 Cooling Technology

Reliable low tech cooling technology other than by constant evaporation of water does not exist as far as I know. Solar cooling can be done by:
-solar (electrical) panels in combination with a compressor cooler
-a solar (thermal) collector in combination with an absorption cooler
Both technologies are very expensive and I do not consider them feasible at present.

## 2.4 Solar Battery Charging

Lead acid batteries can easily be charged by solar panels. It requires merely an under and over voltage control system which can be bought in Kenia.

Mobile Phone and Laptop Computer batteries however are of the Lithium-Ion type and they are very vulnerable to overcharging. A company that charges these batteries was found (but not visited) in Mutomo town. A possible assignment in the Netherlands for HBO students Electrical Engineering is to design and build an electronic solar battery charger for Lithium Ion Batteries.

## 2.5 Solar Water Heating

The WOT has a solar hot water system designed by Bart Deuss in the 1980's. These systems are built all over the world for distant schools, hospitals, clinics, revalidation and training centres in developing countries. They replace existing wood burning hot water systems. The construction is simple and locally available materials are used. Local craftsmen are trained in producing the solar collectors and building and maintaining the systems. The pipe bending tools to make the collector can be brought from Holland.
An assignment for HBO or MBO-Mechanical Engineering students can be to learn how to make a Deuss system from the WOT and to export this technology to Kitui and Mutomo districts.

## 2.6 More pump technology

The demand for cheap and reliable pumps to raise water from river bed uphill is increasing with the amount of dams built. The human powered Approtech/Kickstart Super Moneymaker is a good pump for this purpose and can hardly be improved.
Possible new pump systems should be based on pumps from the WOT field. This requires investigation in the Netherlands by someone (not a student) who has knowledge and experience to estimate which pump could be subject of improvement.

## 2.7 Boreholes

A 4" borehole with a plastic tube lining is large enough for a rope pump. In sand beds these boreholes can be drilled by hand with a ground drill. This may be a much faster way than the traditional dug well. An assignment for Civil Engineering students HBO can be to investigate the different drilling technologies, to test them and to export the knowledge and experience to Kenya.

## 2.8 Modification of Maito Brick Press

The brick press at Maito Community Building construction site can produce around 140 bricks per day. This is a small amount which acts as a brake on the construction. If a cartridge system, for instance made of latex or polyethylene, were designed that can be filled outside the press a much larger yield could be attained. An advantage could also be that the bricks do not get into direct contact with the oiled press. If the centre of the bricks is kept as a hollow cavity a large amount of material can be saved.
The shape of the cavity can be designed by HBO Building Technology students and the cartridge system by HBO Mechanical Engineering students. Both assignments to take place in the Netherlands.

## 2.9 Wind monitoring Programme

With an average wind speed of 2 m/s Kitui and Mutomo Districts are inappropriate for wind energy. An exception could be local micro-climates. However wind energy is only feasible if the local wind speed is monitored for at least a year. Such monitoring equipment is expensive, should remain on location and is very vulnerable to theft. Advise: do not invest in monitoring equipment.

## 2.10 Disinfecting of drinking water

Reliable and cheap methods for disinfecting drinking water could be surveyed. This can be done as a desk top study in the Netherlands by Students from Water Management studies (Wageningen, Leeuwarden)

## 2.11 Kitui Map

A good map of Kitui and Mutomo districts is a big wish of Sasol and Ex-Change. My school cannot be of any help but since this subject interests me personally I offer my time to investigate at Map Rooms of KIT Amsterdam/Africa Museum Tervuren and map making schools and institutions. Such should be done after consulting Mutinda Munguti and Henk Haring who are also working on the subject.

## 2.12 Large Water Towers

A request for a larger and stronger water tower by Sasol can be directed to our Mechanical Engineering Department. Within our regular curriculum time can be found to calculate the tower. It can be extra attractive to students to work on a subject that will have a real application.

## 2.13 Chopper for Cattle Food

A chopper for maize leftovers etcetera to destine it as cattle food. Several requests from farmers in the region have reached Sasol. Such a chopper exists but appears very expensive. Although it can't be estimated whether our mechanical engineering department can be of help a pre-study can be made to map existing systems and put up a requirements list for a new design. Mechanical Engineering HBO level, internship in Kenya.

## 2.14 Fundraising video

A documentary about the work of Sasol and the functioning and effects of sand storage dams made for Dutch television or for display in local societies with the aim to raise funds for new dams. Since this requires a professional approach it should be done by final year students from for example the Film Academy in Amsterdam. I am willing to investigate the possibilities.

# 3 FOLLOW UP

As soon as Sasol has decided which items are priority, a more detailed description of the assignment can be written. I offer to do that and await a request by Sasol.

Wilbert te Velde +31615080953
w.tevelde@planet.nl