Agricultural technology transfer (ATTS) mission to El-Fahir

ATTS was asked by Ms Odette the program officer at WFP to come to El-Fahir to assess biogas units imported to Sudan to be used for school cooking purpose. A team of manager of ATTS (Professor Muna Ahmed) and a technical biogas expertise engineer Faisal Gouzoli (Bicon Company) came to El-Fahir during 28 – 1 April for this specified mission. A meeting was held at the office of Mr. Meygag the WFP coordinator and head of area office where ATTS delivered two presentations that included ATTS profile and an overview of the biogas technology. Engineer Faisal presentation illustrated details about biogas technology and experience so far he carried in Sudan. The task of the team as requested by Mr. Meygag was to:

- Look into the warehouse where equipments and appliances pertaining to biogas technology application already imported and to see how to make the best utilization for school implementation
- Make a technical assessment of a unit already installed in one of the schools at El-Fashir which was not working and give advice about how defects could be treated.
- Make a cost of one biogas unit and install it as a demonstration
- Make cost of 398 of biogas unit.

Warehouse visit

Looking at the different equipments and appliances imported, it was shown that they belong to Puxin Company meant for biogas purpose. The numbers were given by the WFP store keeper. It showed that there are:

1- 12 moulds of different sizes, 6 moulds to fit for 6 cm3 and 6 to fit 10 cm3.

2- 399 gas cooker suitable for households.

3- Connecting tubes and accessories (exact numbers are not given) suitable for households connection.

4- 399 glass fiber domes and accessories for gas collection

5- 399 rice cookers of size not suitable for schools

6- 399 lamps with accessories

School visit

Biogas unit installed at one of the schools was investigated the following defects were noticed

- There were cracks on the inner side of the wall which was due to the use of thick layer of coating that caused these cracks; these might have caused the escape of the gas through these cracks.
- Testing the top of the glass fiber dome and the connecting gas tube a gas leakage was observed as seen by bubbles coming through the connection part.
- There was a bend in the tube at the point going through the hole going from the digester to the cooker which might hampered the gas flow.

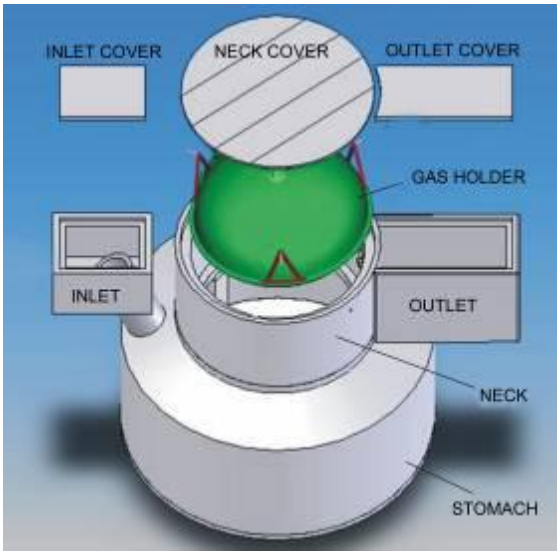
Drawbacks

- The appliances are small gas cookers are not suitable for schools the same applies for the connecting tubes and so could be used for rural areas households. The gas cooker should be replaced by larger cooker (at least two for each school).
- The lamps are not needed for daily school classes unless there are afternoon classes. It is also less practical to light all classes.
- The dome glass fiber collects 1.6 cm3 of gas which will not sustain school cooking. To increase gas volume, extra gas storage should be built.

Biogas digester modification

The available equipments at WFP warehouse Puxin Family Size biogas mainly applied to farmers home which is composed of a 6 or 10 m3 biogas plant, the pipe system, the gas purify system and the appliances. Puxin Biogas Plant is of the hydraulic pressure biogas plant type, and is composed of a concrete digester and a glass fibre reinforced plastic gasholder. The digester has a capacity of 6 or 10 cubic meters, and is constituted by a stomach, a neck, an inlet and an outlet. The gasholder is 1.6 m in diameter, 1 or 1.2 cubic meter in capacity. The gasholder is installed within the digester neck, fixed by a component; the gasholder and the digester are sealed up with water.

The working principle of storage tank is performed by the pressure, produced by water inside of tank.



The pressure is caused by the distance between water level of gasholder and water level of concrete tank. The advantages of Puxin biogas digester:

- Easy and quick to be built
- Solid organic material (straw and grass etc.) can be used

- Easy to maintain
- Durable
- Excellent safety feature

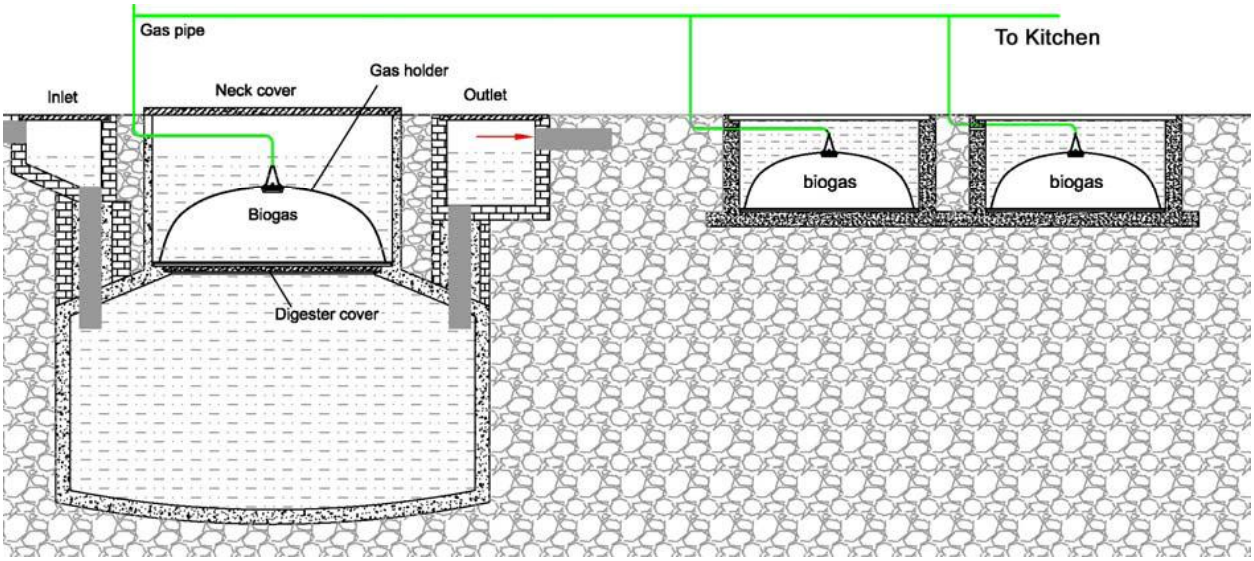
Disadvantages to be used for school purpose

1/ Gas holder volume is too small

2/ Fiber glass gas holder life time is shorter than digester life time

3/ Gas holder fittings are coated steel.

Modifications required to suit school propose depending on number of students in each school within the range of 1.5-2 m3/h or 3-4 m3/h In this case a 10m3 digester is required to provide 5-6m3/d. this could be done by multiplying the gas holder, by using one or two gas holders, depending on school size, as shown below. It is found that it is cheaper to use this design than building a storage chamber.



Budget

To arrive to a genuine budget we were confronted by some uncertainties

- Schools' location and distribution, whether there will a number school at one location, how close and far away?
- Number of schools benefiting from biogas as this will be limited by the fiber glass as more than two to three fiber glass to be used
- A 100 units number is chosen but could be increased according to the situation
- Fluctuations in dollar rate in the black market, makes it difficult to fix an offer date.

Budget

	Unit	Cost of 1 unit volume excavated (SDG)	Total volume excavated	Cost of total volume excavated (SDG)
EXCAVATION				
1- Digester excavation	m3	22	200	4400
2- Outlet excavation	m3	2	200	400
3- Back filling	m3	24	75	1800
CONCRETE WORK				
sand basement	m3	**13.4**	**50**	**670**
// // bottom concrete	m3	**1.5**	**2980**	**4470**
// // wall concrete	m3	**2.2**	**2980**	**6556**
// // dome concrete	m3	**1.5**	**2980**	**4470**
gas holder wall concrete	m3	**1.3**	**2980**	**3874**
// // // concrete cover	m3	**0.3**	**4000**	**1200**
more gas holder on site	**unit**	**3**	**6500**	**19500**
in & out let bottom concrete	**m3**	**0.25**	**2980**	**745**
// // // wall concrete	**m3**	**0.45**	**2980**	**1341**
// // // cover concrete	**m3**	**0.35**	**2980**	**1043**
in & out let 6 inch PVC pipe	**unit**	**2**	**800**	**1600**
SEALING				
SEALANT PAINT	**m2**	**30**	**80**	**2400**
APPLIANCES				
3 big gas cooker + protection wall	**unit**	**2**	**1750**	**3500**
1/2" & 9mm biogas pipe & fittings	**m**	**50**	**50**	**2500**
In & outlet dung and sludge collector	**unit**	**2**	**400**	**800**
Test for fermentation and unit operation (3 weeks)				**10000**
Total for unit in case of installing 100 units				**71269**
TOTAL for 100 units (average cost)				**7,126,900**
Atts fees for each biogas 100 units				**200,000**
Grand total				**7,326,900**

Cost for the demonstration unit

The details for the cost of the unit is shown in the above table, additional cost will be for transportation, accommodation and work of the team at El-Fashir which is 40,000 that is the total cost for one unit is **111,269 SDG.** The time spent for installation and operation is 45 days

For the 100 units, the installation and operation will take 30 units per month that is about 3 months. 6 teams will work at a time utilizing the 6 frames already available in WFP warehouse.

Material and equipment transportation cost are the responsibility of WFP.

This offer is valid for two weeks and could be modified according to construction materials price.