Biogas application in schools at North Darfur

Introduction (Rationale)

Sudan is characterized by high dependence on biomass energy (fire wood, charcoal, and agricultural residues), it constitute 78% of total energy consumption. It is composed of 69% fuel wood (firewood and charcoal) and 9% residues. Households consume about 60% of total energy consumption and 72% of total biomass energy. Sudan is facing real environmental degradation due to combine factors (drought, desertification, over-grazing expansion of agricultural land, firewood/charcoal production, etc) and depletion of forest resources. The increase in time and effort for collecting firewood is a damaging factor to the health of women in rural areas. Installation of biogas units at schools will spare women the drudgery of collecting wood to provide the breakfast meals for their children.

Technical description of appropriate biogas plant

A biogas digester is a physical structure, commonly known as a biogas plant. As various chemical and microbiological reactions take place in the digester, it is also known as bio-reactor, biogas generator or anaerobic reactor. The main function of this structure is to provide anaerobic conditions within it. As a chamber, it should therefore be air and water tight. It can be made of various construction materials and in different shape and size. Fixed dome Chinese model biogas plants were built in China as early as 1936 and in the currently known round shape since the 1970s. It consists of an underground brick masonry compartment (fermentation chamber) with a brick dome, concrete or prefabricated plastic dome on the top for gas storage. In this design, the fermentation chamber and gas holder are combined as one unit. This design eliminates the use of expensive steel gas holder which is susceptible to corrosion and depends on metal workshop and transport facilities. The availability of at least 20 kg dung per day allows running of a small bio-digester two cows or seven small ruminants provide enough fuel to meet the daily cooking needs of a rural family. At the end the slurry residue out of the digester is no waste but a valuable fertilizer.

Biogas Appliances

Biogas is a clean gas that can, in principle, be used like other fuel gas for household and industrial purposes, especially for: gas cookers/stoves, biogas lamps, radiant heaters, incubators, refrigerators and engines.

Project implementation

WFP at north Darfur intends to maintain a biogas unit already installed at Alsanousi School and also to construct a new one as demonstration using the Chinese fixed dome

Project management

Agricultural Technology Transfer Society (ATTS) through subcontracting with Bicon company who will be implementing the installation of the biogas units. Training will be carried by ATTS for those who are going to operate the digestor.

Project budget
Chinese FIXED DOME

Biogas Unit calculations		10m3		
		D=2.7 H=2.32 H'=1,22 F'=0.6 F''=0.5		
ITEMS	**Unit**	**Cost of 1 unit volume excavated (SDG)**	**Total volume excavated**	**Cost of total volume excavated (SDG)**
EXCAVATION				
Digester excavation	m3	30	130	3900
Out let excavation	m3	10	130	1300
Back filling	m3	34	75	2550
CONCRETE WORK				
Digester sand leveling	m2	13.4	20	268
// // bottom concrete	m3	1.2	3417	4100.4
// // wall concrete	m3	1.3	3417	4442.1
// // dome concrete	m3	1	3417	3417
Out let sand leveling	m2	7.1	20	142
// // bottom concrete	m3	0.7	3417	2391.9
// // wall concrete	m3	1.13	3417	3861.21
// // rove concrete	m3	0.75	3700	2775
SEALING				
Dofa Sealant Paint	m2	41.1	120	4932
Dofa Sault Resistant Cote	m2	41.1	30	1233
APPLIANCES				
manhole cover + in out let & fittings	unit	1	3000	3000
gas burner room	//	2	1750	3500
In & out let dung and sludge collector	unit	2	300	600
Testing after feeding dung & Operation	//	1	10000	10000
TOTAL				52413
Transportation from Khartoum to Fashir and Accommodation at Fashir				40000
TOTAL COST				**92413***

*It should be noted that the total cost DOES NOT INCLUDE TRANSPORTATION cost of our frame. THIS would facilitate the modified Pusin in installation of the rest of biogas units at Fashir

Using PUXIN frame modified to be used for the fixed Chinese dome

Biogas Unit calculations		10 m3		
AL- FASHIR PRICE				
D=2.7 H=2.32 H'=1,22 F'=0.6 F''=0.5				
ITEMS	Unit	**Cost of 1 unit volume excavated (SDG)**	**Total volume excavated**	**Cost of total volume excavated (SDG)**
EXCAVATION				
Digester excavation	m3	18	130	2340
Out let excavation	m3	15	130	1950
Back filling	m3	10	75	750
CONCRETE WORK				
Digester sand leveling	m2	13.4	20	268
// // bottom concrete	m3	1.2	3247	3896.4
// // wall concrete	m3	2.2	3247	7143.4
// // dome concrete	m3	1.2	3247	3896.4
Out let sand leveling	m2	7.1	20	142
// // bottom concrete	m3	1.14	3247	3701.58
// // wall concrete	m3	1.9	3247	6169.3
// // rove concrete	m3	0.63	3700	2331
SEALING				
DOFA SEALANT PAINT	m2	43	120	5160
DOFA SAULT RESISTANT COTE	m2	43	30	1290
APPLIANCES				
manhole cover + in out let & fittings	unit	1	3000	3000
gas burner room	//	2	1750	3500
In & out let dung and sludge collector	unit	2	300	600
Testing after feeding dung & Operation	//	1	10000	10000
TOTAL				56138
Transportation from Khartoum to Fashir and Accommodation at Fashir				40000
TOTAL COST				96138

Alsonosy Biogas Unit maintenance and operation

			Cost (SDG)	Cost (SDG)
digester area leveling	unit	1	1500	1500
repair in out let chamber	unit	1	1000	1000
build additional gas holder	unit	3	5000	15000
in out let dung & slurry collector	unit	2	300	600
Withdraw all unit slurry + cleaning	unit	1	3000	3000
Withdraw all sealant paint	unit	1	1500	1500
A new up layer bottom concrete (7 cm)	unit	1	1500	1500
Sealant paint	m2	40	120	4800
gas pipe and fittings		unit	1000	1000
gas cocker + protection wall		2	1500	3000
Test +dung coll.+ preferment.+ Feed + Operation		1	5000	5000
Total cost				37900

Training component

Atts will carry out training for people who will be held responsible for operation the biogas units. This could be done for two days after biogas operation and can later make monitoring for three months with frequent visits every two weeks if you request. The cost is 1,000 for each day excluding travel and accommodation. We can add these costs later as soon as we get the real cost.