

## **Clean Development Mechanism Small-Scale Programme of Activities project development document (CDM-SSC-PoA-DD)**

### **A. General description of small-scale programme of activities (PoA)**

#### **A.1 Title of the small-scale programme of activities (PoA):**

Production of biogas from animal manure for rural household, Sudan

#### **A.2. Description of the small-scale programme of activities (PoA):**

##### **1. General operating and implementing framework of PoA**

The small-scale Programme of Activities (SSC-PoA) will construct biodigester to households in Northern Sudan. at least for the time being the only source of revenue from the proposed SSC-PoA for the Coordinating/Managing Entity or any CPA Implementer is the sale of certified emission reductions (CERs). Several banks have been approached to finance the project through soft loans but this has not yet been settled.

biodigester recipients will submit to the monitoring requirements as specified by **AMS-III.R** aims at rural households, and further described in this PoA Design Document (PoA-DD) and the relevant CDM Programme Activity Design Document (CPA-DD).

Details concerning biodigester performance, distribution, and assembly will be provided at the CPA level. For each CPA under the proposed PoA biodigesters will have a unique serial number. The GPS coordinates of each biodigester will be recorded after installation in the project area. Data collected during construction and monitoring of each CPA will be stored in an electronic data management system, or monitoring database, for a minimum of two years past the crediting period. From this data, the emissions reductions of each CPA in the PoA will be determined. This system will be available for review by the Designated Operational Entity (DOE) during the validation and verification of the PoA and each CPA.

A thorough stakeholder engagement process will be undertaken for each of the CPAs under the proposed PoA, ensuring that potential biodigester recipients understand the installation agreement, are trained in the usage of the biodigester, and able to give adequate feedback on their usage.

##### **2. Policy/measure or stated goal of the PoA**

The SSC-PoA will distribute biodigesters to households in Northern Sudan. The use of efficient stoves aims to reduce carbon emissions by allowing families to cook the same amount of food using less non-renewable biomass.

Additionally, the programme will yield sustainability benefits besides reduced carbon emissions.

**3. Confirmation** that the proposed PoA is a voluntary action by the coordinating/managing entity.

In Sudan, there is no law or policy that requires the use of biogas or other means of reduced fuel wood consumption. It follows that the SSC-PoA is a voluntary action.

#### **4. Contribution to sustainable development**

The proposed SSC-PoA contributes to the sustainable development of the Sudan economy in a number of ways:

##### **i. Environmental**

- The PoA will significantly reduce Sudan's greenhouse gas emissions over its lifetime.
- The PoA will reduce the use of non-renewable biomass from Sudan forests, assisting the maintenance of existing forest stock, protecting natural forest eco-systems and wildlife habitats.
- The protection of standing forests will ensure the maintenance of watersheds that regulate water table levels and prevent flash flooding.

##### **ii. Social**

- Smoke-free and ash-free kitchen, so women and their children are no longer prone to respiratory infections; Women are spared the burden of gathering firewood;
- Keeping manure and waste in a confined area reduces the amount of pollutants in the immediate environment and increases sanitation;
- Households no longer need to extract wood for cooking, which can reduce deforestation levels where people heavily rely on woodfuel;
- The sludge remaining after digestion is a good fertilizer,
- Buying (fossil) fuel resources (e.g. kerosene, LPG, charcoal or fuel wood) is no longer needed

Switching from traditional biomass resources or fossil fuels to biogas improves security of energy supply as the feedstock can mostly be acquired locally, The release of methane is avoided thus contributing to

climate mitigation. A single, small scale biodigester reduces between 3 and 5 tCO<sub>2</sub>-eq./year,

### **iii. Economic**

- The PoA will help develop a section of the Sudan rural economy; in the manufacturing of the biodigeter, their installation, maintenance and monitoring.
- Costs incurred in the purchase of fuel will be reduced through increased thermal efficiency.

The long-term contributions to sustainable development in Sudan, listed above, will not exist without carbon finance.

## **A.4. Technical description of the small-scale programme of activities**

### **A.4.1. Location of the programme of activities:**

Sudan

#### **A.4.1.1. Host Party(ies):**

Sudan

#### **A.4.1.2. Physical/ Geographical boundary:**

The geographical boundary for the proposed PoA is Sudan. All CPAs included in the PoA will be implemented in Sudan:

### **A.4.2. Description of a typical small-scale CDM programme activity (CPA):**

The maximum number of biodigeter limitation is dependent on the project baseline and will vary by CPA. The baseline as described in **AMS-III.R** Version 1 will be determined separately for each CPA. Each CPA will involve the installation of efficient cooking stoves. Each CPA will comprise the manufacture, installation, and monitoring of the biodigesters over the crediting period.

#### **A.4.2.1. Technology or measures to be employed by the SSC-CPA:**

The project will provide biodigesters to rural households. The biodigeter capacity may vary by CPA according to the number of animals. The user-friendly design delivers high thermal efficiency and is built partly from locally sourced materials. This simple technology reduces the amount of biomass required in day-to-day cooking by 100 per cent as compared to the traditional three-stone, open-fire method of cooking or equivalent conventional system.

**A.4.2.2. Eligibility criteria for inclusion of a SSC-CPA in the PoA:** The following criteria must be met by each CPA to ensure its eligibility under the PoA:

1. The geographical boundary of each CPA will be within the geographic boundaries of Sudan, consistent with that set in the PoA.
2. Each CPA will be uniquely defined by a range of GPS coordinates and current administrative maps to define the project boundary.
3. Each CPA will ensure double counting of emission reductions is avoided, through the GPS tracking and identification of each biodigester with a unique identification number.
4. Each CPA will involve the construction and installation of biodigester to households cooking with firewood on a traditional stove for domestic purposes. The specifications of the technology will be included with each CPA-DD.
5. Documentary evidence will be provided with each CPA-DD to demonstrate the start date of the CPA, and ensure it is in compliance with the 'glossary of CDM terms.'
6. Each CPA will be in compliance with the latest version of **AMS-III.R: Energy Efficiency Measures in Thermal Applications of Non-renewable Biomass.**
7. Each CPA will demonstrate additionality by establishing that in the absence of CDM, the implemented CPA would not occur. This will be done using Barrier Analysis to prove additionality. It will be carried out as per the most recent version of the Tool for the Demonstration and Assessment of Additionality.
8. Each CPA will conduct a stakeholder consultation and provide documentation.
9. Each CPA will be covered by the Environmental Impact Analysis requirements at PoA level.
10. There will be no public funding or ODA for any of the proposed CPA's.
11. Each CPA will follow the sampling requirements specified in the latest version of General Guidelines for Sampling and Surveys for Small-Scale CDM Project Activities.
12. Each CPA will adhere to the small-scale threshold criteria and remain within that threshold throughout the crediting period.
13. Each CPA will show that it is not registered as another project activity.
14. Each CPA will not be a de-bundled component of another CDM programme or project activity. The requirements for a debundling check as

outlined in Guidelines on Assessment of Debundling for SSC Project Activities will be met.

A.4.3. Description of how the anthropogenic emissions of GHG by sources are reduced by a SSC-CPA below those that would have occurred in the absence of the registered PoA (assessment and demonstration of additionality):

- (i) The proposed PoA is a voluntary coordinated action;
- (ii) If the PoA is implementing a voluntary coordinated action, it would not be implemented in the absence of the PoA;

The additionality is demonstrated using the UNFCCC Methodological Tool: *Tool for the demonstration and assessment of additionality Version 05.2*. The *Tool for the demonstration and assessment of additionality* is applicable to the demonstration of the additionality of a Programme of Activities and to small-scale CDM activities using methodology **AMS-III.R** Version 01. Specifically under paragraph 6 of the methodological tool, regarding Scope and Applicability, it reads: “The document provides a general framework for demonstrating and assessing additionality and is applicable to a wide-range of project types.”

The policy of the government of Sudan for the energy sector promotes energy efficiency and renewable energy resources and to protect the environment. The General Directory for Energy Affairs (GDEA), Energy Research Institute (ERI) and National Energy Administration (NEA), evaluated the Chinese Biogas units installed in different parts of Sudan during 1992 and 1994. They recommended that government policy towards environmental health and sanitation has to encourage the adoption a combination of biogas digester/latrines that will contribute towards improving the present deplorable sanitary situation in the poor urban sector as well the vast rural area.

To construct domestic biodigestors cost-free to rural households in Sudan, on the scale the proposed PoA is suggesting, without the benefit of carbon finance, would require a large donor, or government-led initiative. The General Directory for Energy Affairs (GDEA), Energy Research Institute (ERI) and National Energy Administration (NEA), evaluated the Chinese Biogas units installed in different parts of Sudan during 1992 and 1994. They recommended that government policy towards environmental health and sanitation has to encourage the adoption a combination of biogas

digester/latrine that will contribute towards improving the present deplorable sanitary situation in the poor urban sector as well the vest rural area. All projects of this type require donor-funding, This is evidenced by the poor penetration rate of fuel-efficient, wood-fuel cooking stoves in rural Sudan and the continuing high deforestation rates in the country.

There are no plans for the government to implement a biodigester programme in Sudan, the donor sector does not have the resources to do so and the private sector is unlikely to shoulder these costs. It is only through the application of carbon finance that a programme of this size may be implemented.

The continuation of the current situation in Sudan is the continued use of open, three-stone fires for cooking. The rural poor will not afford paying for a biodigester which cost 1,000 US\$. The cost is too great for families to manage within the household budget. There is also no economic incentive to install a biodigester, as wood is collected mostly for free.

### **Step 2: Investment Analysis**

Investment Analysis has been forgone. Step 3: Barrier Analysis will be used to demonstrate the additionality of the proposed SSC-PoA.

### **Barrier Analysis**

#### **A- Lack of information**

Habitual use of traditional stoves imposes a very strong influence on the baseline scenario, resulting in continuation of use of traditional three stone fires. There have been some efforts to introduce improved cook-stoves in Sudan in urban areas, mainly limited to urban dwelling charcoal users. Households in rural Sudan do not have access to the market to obtain information about the existence and effectiveness of biodigestors. The proposed SSC-PoA will see the widespread education of households to the benefits of using the biodigester: wood fuel savings, reduction in indoor smoke pollution, reduced wood collection time etc.

#### **2- Systemic market failure**

A further barrier is the lack of any other programme to disseminate biodigester in Sudan on the scale proposed here and therefore the proposed SSC-PoA may be regarded as a “first of its kind”.

#### **3- Financial barriers**

##### **Lack of financial incentive**

The project baseline determined through surveys showed that a large portion of rural households collects fire wood in place of paying. In summary, the most relevant barrier to the proposed project activity is the financial barrier. The financial barrier to the project activity covers the lack of income

available to households to invest in the efficient technology to be provided by the programme. In addition to the lack of capital, surveys showed that households lack a financial incentive to invest a significant portion of household income in biodigestor, although some would buy charcoal.

**Operational, management and monitoring plan for the programme of activities (PoA):**

**A.4.4.1. Operational and management plan:** monitoring of the proposed PoA.

The CME will provide formal notification to the CPA Implementer that the proposed CPA activity is part of the PoA. The CPA Implementer will submit the following information to the CME which will be stored in an electronic information management system operated by the CME. The data to be collected is the following:

i. Data from Construction

a. Upon construction of each biodigestor in the SSC-CPA, the collection of monitoring data will include:

i. A unique serial number for each biodigestor

ii. A GPS tag

iii. The name of a representative of each household

iv. Mobile number of household representative (where possible)

v. ID number of household representative (where possible)

vi. The address of each household (where possible)

vii. Date and time of installation

viii. A signed contract confirming the exchange of the stove in return for rights to the CERs

b. This data will be collected in a hard copy format from passed to the CME for input into the PoA electronic database

ii. Data from Monitoring and Maintenance

a. The on-going monitoring of the performance of the biodigestor in each SSC-CPA will be the responsibility of CME.

b. A sampled group of biodigestors, as identified in a monitoring plan, will be assessed every year by the CPA Implementer for their emissions reduction performance. The data from the monitoring is delivered to the CME and made available to the DOE during verification.

Furthermore, the following items will be addressed by the CME in the implementation of each CPA under the PoA:

i. A record keeping system for each CPA under the PoA:

Data will be collected for each SSC-CPA according to a monitoring plan. Initial data in the construction phase will be collected hard copy by the CME for each CPA. The data will then be uploaded into the PoA electronic database. This will ensure that each biodigester and its owner is identified and logged for monitoring and verification purposes. Annual monitoring reports and CER calculations will stem from this data.

All records will therefore be kept, in electronic and hard copy, centrally by the CME.

ii. A system/procedure to avoid double-counting e.g. to avoid the case of including a new CPA that has been already registered either as a CDM project activity or as a CPA of another PoA:

Double-counting of emissions reductions will be avoided by the specific tagging and logging of biodigester under each CPA. The unique references of biodigestors under each CPA will prevent double counting:

a. GPS references: each biodigester will have a unique GPS-referenced location. During the verification process the DOE will be able to check the existence stoves related to this GPS tag.

b. Unique reference numbers: each biodigester will also have a unique reference number that is imprinted on the side of the stove. This will further prevent double-counting and the DOE will be able to check this during the verification process.

c. Name of household representative, ID number, address, or mobile number: a final check of double-counting may be made against the, afore mentioned, personal information of each user ascribed to each biodigester. This may be checked during the verification process.

The CME of the PoA is responsible for operating each of the SSC-CPAs. Therefore, if other entities are operating the CPAs, they will be legally contracted to the CME. Component manufacturers and construction contractors will have contracts specifying this. There will also exist a contract (in English and Swahili) between each household and the CME that confirms the user's involvement in the PoA.

#### **A.4.4.2. Monitoring plan:**

The CME will operate a monitoring plan during each verification period. As per **AMS-III.R** Version 01, monitoring will consist of checking the efficiency, of a representative sample of efficient biodigester at least once every two years. Monitoring shall ensure that continued wood fuel use with

the baseline technology will be assessed through a representative sample of Kitchen Performance Tests performed as per the Partnership for Clean Indoor Air. All representative sampling performed during monitoring will satisfy the requirements of the methodology to be a statistically valid sample. For biennial monitoring, parameters determined through representative sampling will satisfy the 95 per cent confidence interval and 5 per cent margin of error requirement. For annual sampling the requirements are 90 per cent confidence interval and a less than a 10 per cent margin of error. In cases where the 95 or 90 per cent confidence interval and the 5 or 10 per cent margin of error are not achieved, the lower bound of the 95 or 90 per cent confidence interval will be chosen if the representative sampling is not repeated. Parameters determined through a representative sample will perform sampling as specified by the

*General Guidelines for Sampling and Surveys for Small-Scale CDM Project Activities, EB 50 Annex 30.*

**Sampling Objective:** to determine the average number of appliances in use, average efficiency of the appliance, and average wood use on the baseline technology during the verification period. The parameters will be assessed using a 90/10 confidence/precision if assessed annually and a 95/5 confidence precision if assessed biennially.

**Field Measurement Objectives and Data to be collected:**

The objective of the field measurement is to:

- a) Visually assess if the appliance is present and operational. The data collected is a photo of the appliance with unique stove ID clearly visible.
- b) Perform a Water Boiling Test on the appliance to test thermal efficiency. The data collected is the thermal efficiency of the stove.
- c) Perform measurements of wood used exclusively on the baseline technology, if existing. The wood measurements will be in the form of a KPT as directed by the PCIA. The data collected is the daily mass of wood used on the baseline technology for at least 3 consecutive days.

**Target Population and Sampling Frame:** The target population is the complete list of appliances distributed and recorded in the electronic database during project construction. The sample of appliances checked will be randomly selected from the complete list of distributed appliances.

**Implementation:** Staff of the CPA Implementer conducts the sampling. The CME will determine the sample size and randomly select the households to be sampled from the electronic information management system. The CME will inform the CPA Implementer which appliances is part of the sample. The CPA Implementer will perform any required staff training as recommended by CME. The remuneration of the personnel conducting the

sampling will in no way be related to the CERs awarded to the project as a result of the monitoring.

**Starting date of the programme of activities (PoA):**

As per EB 59 Annex 12, the effective date of registration for the PoA shall be the date the DOE submits a complete request for registration. The start of the crediting period for any CPA under the proposed PoA shall be the date of its inclusion to the PoA. As per EB 55 Annex 38, the starting date of any CPA under the PoA cannot be prior to the commencement of validation, i.e. the date on which the PoA-DD is first published for global stakeholder consultation.

**Length of the programme of activities (PoA):**

28 years

Each CPA will distribute biodigestor to rural households using conventional, three-stone stoves. Each SSC-CPA under the programme will meet the environmental requirements of the Environment Management Coordination Act (EMCA) of 1999. To this effect a project report will be prepared for each SSC-CPA for review and approval by NEMA. In summary, environmental analysis is done at the SSC-CPA level.

Local stakeholders will be invited to participate in a consultation for the implementation of each CPA. This will comprise of a meeting within the local community of the CPA's designated geographical boundary. The consultation will invite local community leaders and representatives, NGOs etc.

**1. Invitations**

- a. Public Invitation: a newspaper notice, placed in a local newspaper before the stakeholder meeting.
- b. Personal Invitation: an individual invitation made to a sample of stove beneficiaries, often delivered by hand depending on the situation. Individuals are identified through working with community leaders or representatives.

A 'Tracking List' of invitations will be established for each stakeholder meeting to ensure that invitations are monitored and logged for responses.

**2. Meeting Preparation**

The following must be in place prior to the actual meeting:

- a. Non-technical summary: a simple description of the project that stakeholders will understand.
- b. Minute taker: an individual responsible for taking detailed notes of the meeting findings.
- c. Participation forms: participants must sign this form to confirm their attendance.
- d. Evaluation forms: to be completed by all stakeholders. A simple evaluation form asks each stakeholder to write down their feelings and concerns about the meeting and the proposed CPA.
- e. Agenda for the meeting.

### **3. Meeting conduct**

The meeting will largely follow the agenda specified according to a common approach:

- a. Opening: introductions, goal of meeting, participation form
- b. Explanation of PoA: understanding CPA process, who is involved, project phases and timelines
- c. Questions & Answers: for clarification of key points
- d. Closure: complete evaluation forms and thanks

#### **Summary of the comments received:**

Comments will be received via the evaluation forms and the minutes collected from the meeting.

Comments will be analysed and evaluated and a report will be written highlighting the positive and negative impacts of the proposed CPA indicated by the local community.

**Report on how due account was taken of any comments received:** The meeting report will be further followed by a report indicating how stakeholders comments received have been incorporated into the CPA design. This will enable the CPA to be tailored specifically to the community in which it is being proposed and ensure buy-in from users at the implementation stage.

#### **Application of a baseline and monitoring methodology**

This section shall demonstrate the application of the baseline and monitoring methodology to a typical SSC-CPA. The information defines the PoA specific elements that shall be included in preparing the PoA specific form used to define and include a SSC-CPA in this PoA (PoA specific CDM-SSC-CPA-DD).

## **Justification of the choice of the methodology and why it is applicable to a SSC-CPA:**

**AMS-III.R** (version 01): In the application of AMS-III.R, annual emission reductions at each household are limited to **5 t CO<sub>2</sub>e**. The amount of anaerobically decayed manure has to be determined by an **ex-ante survey**. The projects in the pipeline using **AMS-III.R** show that one could generate nearly **3.5 t CO<sub>2</sub> reductions per year with 2 to 3 cattle**. On one hand, the emission reduction range points out that the AMS-III.R threshold of 5 tCO<sub>2</sub>e/a is sufficiently high to accommodate normal domestic biogas programmes. On the other hand, it shows that a PoA must involve a large number of households to generate a significant amount of CERs. The project size ranges from **10,000 to over 30,000** involved households (UNFCCC 2008). Due to reasons of conservatism the methodology applies a **default factor** for the physical leakage rate of the bio-digester of **10 %**. **The monitoring** of bio-digesters is conducted with a sample group. This sampling approach implicates that not all the bio-digesters have to be **equipped with monitoring devices**, but just a **small number of randomly chosen bio-digesters**.

## **Annex 1 Area of the project**

### **1. Location of Abu Hamad locality**

Abu Hamad is the north most locality of Nahr an Anil State. The geographical coordinates are 19° 32' 0" North, 33° 19' 0" East It lies within the desert ecological zone and rainfall is low and erratic. May and June are the hottest months (mean monthly temperature 47° C) and the coldest month is January (7° C). Wind is blowing throughout the year, combined with the high summer temperatures, leads to average high annual evapotranspiration. Because of its desert climate and soils combined with large areas with no or very sparse vegetation the area is subject to wind erosion. Moving sand severely affects cultivated areas and results in sand encroachment. Protection measures, such as stabilization of dunes by vegetation, plantation of shelter belts and wind breaks are needed.

## **2. Farming in Abu Hamad locality**

### **2.1. Field and horticultural crops**

Agriculture in Abu Hamad locality mainly confined to a narrow strip along the Nile. Most land is privately owned. Recent agricultural development focused on the utilization of higher terrace soils .

There are three distinct agricultural systems, classified according to the means of irrigation. Old pumped schemes are now run and managed by farmers; there are now both private and co-operatively managed schemes, and farmers are using small diesel pumps to provide Nile water to their fields on the lower terraces. Farmers pump water out of the Nile with small diesel pumps. In Gerif irrigation, residual moisture in the loamy soils in long strips on the banks of the Nile and on the islands is utilized, and agriculture is low-cost, but highly risky, as late floods may devastate the crops.

In most areas agriculture is characterized by very small farms of from 1.25 to 1.55 ha growing a diversified mixture of high-value cash crops and staple food crops. Winter crops include alfalfa fodder ,wheat ,beans ,vegetables, and spices .Summer crops include ,alfalfa and fodder ,maize Horticultural crops include Date Palm ,Mango and ,Citrus fruits Constraints include high production costs, particularly fuel and spare parts, river flooding, weak agricultural services, desert creep, damage by birds, insects and weeds, low availability and high cost of improved seeds, limited fertilizer use, expensive credit and difficulties with marketing produce.

Synergies could arise from the development of this project, which will provide greater security of supply for key inputs, notably cheap energy source to operate water pumps, process fibrous date palm leaves to improve their digestibility as feeds for ruminant production and produce organic manure for export or local use for the production of organic foods .

Agro-Processing : As a result of the availability of ready and cheap source of energy (methane gas) all main crops will almost benefit from value-added processing to some degree before entering the further marketing chain .Examples are o farm vegetables and fruit drying.

## 2.2. Livestock

### 2.2.1. Livestock population and types

There are no grazing lands, and feed availability constrains numbers. Major incremental development will be largely resource-driven. Supporting services are weak or non-existent. Demand for animal products normally exceeds supply from local producers. Increased and improved services and supporting amenities for crop production under irrigation will increase animal production and attract services and facilities for livestock production.

Table 1: Population of livestock in Abu Hamad locality in 2008.

locality	Cattle	sheep	Goats	Camels	Total
Abu Hamad	1948	125706	186483	1470	345948

Source: Ministry of Agriculture, irrigation and animal resources, Nahr an Nil state

Abu Hamad locality has livestock population of 345948 head in 2008 dominated by goats (186,483) followed by sheep (125,706), cattle (1,948) and camels (1,470) in a descending order.

Abu Hamad is the home of the most productive types of Sudan Desert sheep that are raised along the banks of the River Nile under mixed crop/livestock system of production namely; Al Derashawi and El Baladi .and Al Dalol .Unlike migratory sheep, owned by pastoralists, sheep types raised along the banks of the River Nile are very pure and have not mixed with other types of sheep. Moreover they are very much used to feeds grown in the area including leguminous fodders and crop residues.

The most dominant local goat breeds in Abu Hamad locality are the Nubian, Desert and crossbred goats. Purebred Saanen goats are raised in some private livestock enterprises in the project area.

Cattle breeds in Abu Hamad locality are Butana, Baladi, crossbred (Friesian x indigenous cattle) and few purebred Friesian cattle.

The main camel types are found in Abu Hamad locality are pack and riding camels. Pack camels are represented by Arab camel and Rashydi (or Zeidab) camel. The Arab camel is large, heavily built beast with potential for developing a large hump. The Rashydi camel is a light pack camel .

### **2.2.2. Systems of livestock production in Abu Hamad locality**

Livestock in abu Hamad locality in few or large numbers are kept under any of the following systems of production

#### **2.2.2.1. Sedentary (village) system of livestock production**

Small numbers of animals (mainly goats, sheep or cattle) are raised by small holders in villages and towns across the state to provide the household with milk and are occasionally sold to obtain cash. The methods of feeding animals are different. The feeding management of a group animals from one single area may be assigned to a paid shepherd who takes animals (that are normally collected by their owners early in the morning in one specific agreed upon spot) to graze along the banks of irrigation canals, fallow land and stubble grazing .Lactating animals are often offered extra food at home in the form of bought in forages and/or oil meals; and also home waste. Animals are watered from the River Nile.

#### **2.2.2.2. Mixed crop/livestock system of livestock production**

This system of livestock production is undertaken by livestock owners who own land along the banks of the River Nile .Forages (Alfalfa and Abu Sabeen), pulses, wheat, groundnut, barley and zea maize are grown using water pumped from the Nile. Crop residues and forages are fed to **livestock in confinement** .Animals are also allowed stubble grazing after crop harvest and fallow grazing. Some livestock owners tether their animals to restrict their movements to a small grazing area so as not to invade and damage crop fields.

#### **2.2.2.3. Agro-pastoral system of livestock production**

This system involves feeding livestock on crop residues for most parts of the year and sending animals to distant grazing areas for two months provided that the rainy season is good.

**2.2.2.4. Stall feeding:** This usually practiced by livestock owner who keep their animals in confinement for fattening purposes or milk production. The animals are fed on bought in feeds all times.

## Target population

The locality consists of 22,000 households in 81 villages

Serial no.	Name of village	No. of population
1	El-Galla	300
2	Muraba (1)	250
3	Muraba (4,3)	100
4	Muraba (2)	50
5	El-Goze	400
6	El-Salam	300
7	El-Salim	470
8	Um-Arif	45
9	El-Ghaba	162
10	Abu-Teen Baraza	67
11	Abu-Teen	80
12	Mahzeeaa	122
13	El-Kannawia	120
14	Abu-Alalig	450
15	Hamariba	160
16	Geiref Magarat	123
17	Kasgail Bahri	228
18	Kasgail Geibli	200
19	El-Sangarat Jeem	300
20	El-Sangarat Sheen	300
21	El-Aal	434
22	El-Ashqot	189
23	El-Shamikia	400
24	El-Seleit Shmal	122
25	El-Karru	233
26	El-Zewera Shamal	140
27	Um-Marreq	210
28	Um-Sheen	200
29	El-Fedaa Kareaa 5	180
30	El- Fedaa Kareaa 5	250
31	El-Fedaa Kareat 5	350
32	El-Fedaa Kareat 5	300
33	El-Fedaa Kareat 3	313
34	El-Kadaq	226
35	Quareat El-Rahman	250
36	El-Geuerab	188

Serial no.	Name of village	No. of population
35	El-Gumeza	110
36	El-Gunfab	250
37	El-Assalia	150
38	Keer El-Selaihab	194
39	Mugal	300
40	Kagi	170
41	El-Barab	170
42	El-Sehan	150
43	Garaf El-Douma	280
44	Karkas El-Gazeira	300
45	Atmour	300
46	Karkas Gareb	450
47	El-Aeebedab	200
48	Um-Mardi	180
49	El-Geiref	198
50	Artnsu wa Um-Heigair	150
51	Nadi	300
52	El-Seilet Ganoub	150
53	El-Matra	72
54	El-Shalal	140
55	Kadeta	250
56	Showtak	250
57	Geraf El-Lubia	300
58	El-Teiwena Kandi	200
59	Garb El-Defailab	178
60	El-Gareeb	189
61	El-Arak	250
62	Angeri	200
63	El-Shareek	250
64	Karkas Sharg	400
65	Mari	450
66	Basswa	200
67	Artal	150
68	El-Bagair	350
69	El-Zewara	500
70	El-Zouma	850
71	El-Tarafaia	200
72	Abu-Hasheem	300
73	El-Geizera Maru	150
74	Amki	300
75	El-Gareeb Kagarat	150
76	Um-Gandi	250
77	El-Tura	240

Serial no.	Name of village	No. of population
78	Zumama	300
79	Spense wa Um-Sarah	350
80	El-Kadag	226
81	El-Zumama	118
82	El-Genena	150
83	Um-Ganum	300
84	El-Gabba	150

Every household consists of 5 – 7 individuals, owns about 2ha of farm land and raise about 7-10 small ruminants. About 5,000 families owns 40 animals including cattle and camels. No electricity services are provided except for some villages (5%).