



# Trans-SEC

Innovating pro-poor Strategies to safeguard Food Security using Technology and Knowledge Transfer

## Investigation of Anaerobic Digestion Backed by Solar-Wind System for Production of Clean Energies in Rural Areas

Yusto Mugisha Yustas<sup>1</sup>, Valerian C.K. Silayo<sup>1</sup>, and Siza Donald Tumbo<sup>1</sup>

### Introduction

Rural communities in Africa are facing discouraging challenges of sustainable supply of their energy needs as well as the low soil fertility. Improving energy accessibility and source of soil nutrients in rural areas will essentially require strategies which will facilitate the utilisation of the locally available cheap and low value materials and resources e.g. biomass (cowdung), solar and wind. Integrated system consisting of renewable energy resources is suitable for energy generation and a source of soil nutrients (nutrient cycling). This may facilitate improvement of Food Value Chain (FVC) components, mainly being Natural Resources and Production; Processing and Consumption in rural areas especially in Tanzania. Therefore researching on this system is important.

### The Study

The Study aim to investigate the anaerobic digestion backed by solar-wind system for production of clean energies (biogas and renewable electricity) and bioslurry in rural areas of Tanzania (e.g. Chamwino).

### The concept

To realize the goal of the study a strategy of combining, optimally, solar and wind systems to produce heat for keeping anaerobic digestion system temperature ideally constant, and electricity for households is formulated and implemented.

The biogas and bio-slurry from the Anaerobic Digestion system will be used only for cooking and supply of soil nutrients to the farm/kitchen gardens respectively.

Model based on inputs (weather, feedstock, heat) and output (bioslurry, biogas, electricity) will be obtained. Fig. 1 illustrates an overall conceptual framework of the study.

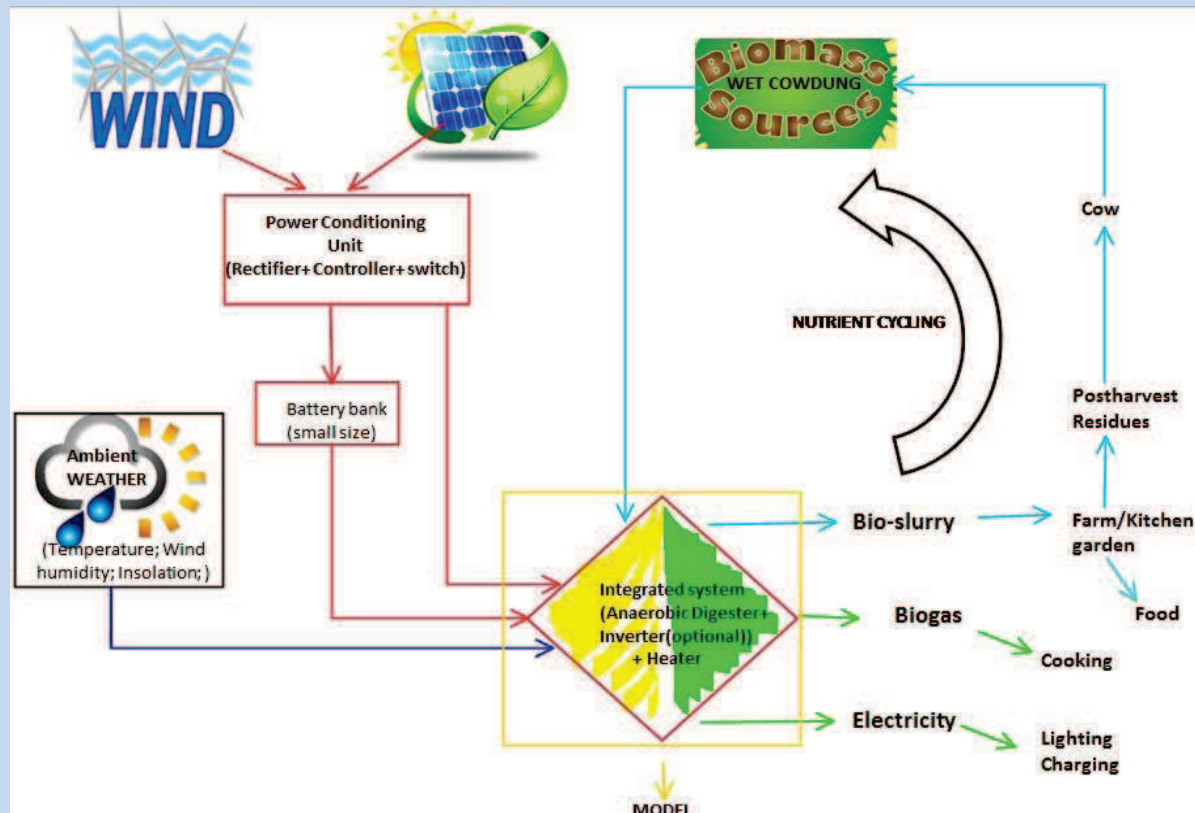


Fig. 1 Overall Conceptual Framework of the Study.

### Study Approach

- The study approach will involve primary and secondary data collection from experiments and literature as well as the data mining(modelling) plus use of optimising tools. The prototype of integrated system involving solar-wind-biomass will be produced and tested at the study sites.
- The procedure to be followed will include the following:
  - characterise the available renewable energy resources (biomass/cowdung, wind and solar) and rural households energy demand;
  - designing the integrated solar-wind energy and anaerobic digestion system;
  - developing a model for predicting the efficiency of integrated solar-wind energy and anaerobic digestion system, and
  - techno-economical appraising of integrated solar-wind energy and anaerobic digestion system

### Preliminary Results

For semi arid rural areas in Tanzania, Chamwino district inclusive, have:

- Average annual availability of wind and solar energy of 6 m/s and 4.7 kWh/m<sup>2</sup>/day, respectively.
- Decreasing rate of fuel wood sources of 0.68 % per year since 2007 comparing with that of 0.23 % per year from 2001 to 2007.

### Expected Results

- Report on characterization of renewable resources and energy demand in case study site.
- Designed integrated system with digester temperature control mechanism
- Model for efficiency of integrated anaerobic digestion-solar-wind system
- techno-economic analysis results of the system in question

BMBF



BMZ



Email: omukama.mugisha@gmail.com

<sup>1</sup> Sokoine University of Agriculture, Dept. of Agric. Engineering and Land Planning,