

# A feasibility study and installation of 1 MW power generation from biogas in MSAB, Botswana

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Green energy solutions and sustainable development

# Project Objective

- This proposal is a feasibility study to produce clean power from renewable sources available in Mmamashia (MSAB) village and its surrounds. It will focus on the capture of methane from waste as well as processing of biomass substrates for transformation into alternative energy. It is also anticipated that, if proven viable the development of the project will act as a show case model (pilot) which will be replicated in other parts of the country.
- The pilot is currently developed through EEP support – EEP is Energy and Environment Program sponsored by the Finland Government

# The project aims to;

- design a biogas system that will generate biogas for heating and also to generate electricity at the abattoir
- promote green energy and reduce GHG emissions
- create more employment opportunities
- find out the possibility of exploiting the carbon trade facility
- improve the energy security of the country

# Location Map MSAB Gaborone



# NewGen

## Anaerobic digester/Wastewater Treatment Plant

- The EKO GEA NewGen digester was chosen as it is the most suitable digester for the project.
- All digesters draw on a mixture of the properties and we believe the NewGen Anaerobic Wastewater Treatment Plant combines all the superior qualities of the other digesters;

## NewGen compared with Convention Type Digestion Systems

Operating Costs	Plug Flow	Complete Mix	Modified UASB	NewGen
Operating Temperature	Mesophilic (up to 35°C)	Thermophilic (55°C or 70°C)	Thermophilic (55°C or 70°C)	Ambient
Mixing	Low-HC	High	Baffle System	Micro Filtration
Power consumption for digestion	Medium	High	High	None
Operating Costs	Medium	High	High	Low

Capex Costs	Plug Flow	Complete Mix	Modified UASB	NewGen
Installation	Simple	Complex	Complex	Simple
Foot Print	Very Large	Large	Large	Small
Gas Scrubbing	Complex	Complex	Complex	Basic
Capex Costs	Medium	High	High	Low

# Different Modules of Digesters

## Effluent Quality

Effluent Quality	Plug Flow	Complete Mix	Modified UASB	New Gen
Hydraulic Retention Time (HRT) *Can reduce HRT by increasing size	30-60 Days	30 Days	30 Days *	24 Hours
WW Post Discharge Treatment	Yes	Yes	Yes	No
Grease & Fats	No	Possibility	No	Yes
Biological Ion Exchange	No	No	No	Yes
Organic Sludge	High	Medium	Medium	None Complete Digestion
Effluent Quality	Medium +	Medium	Medium	High

# Performance of different Digesters

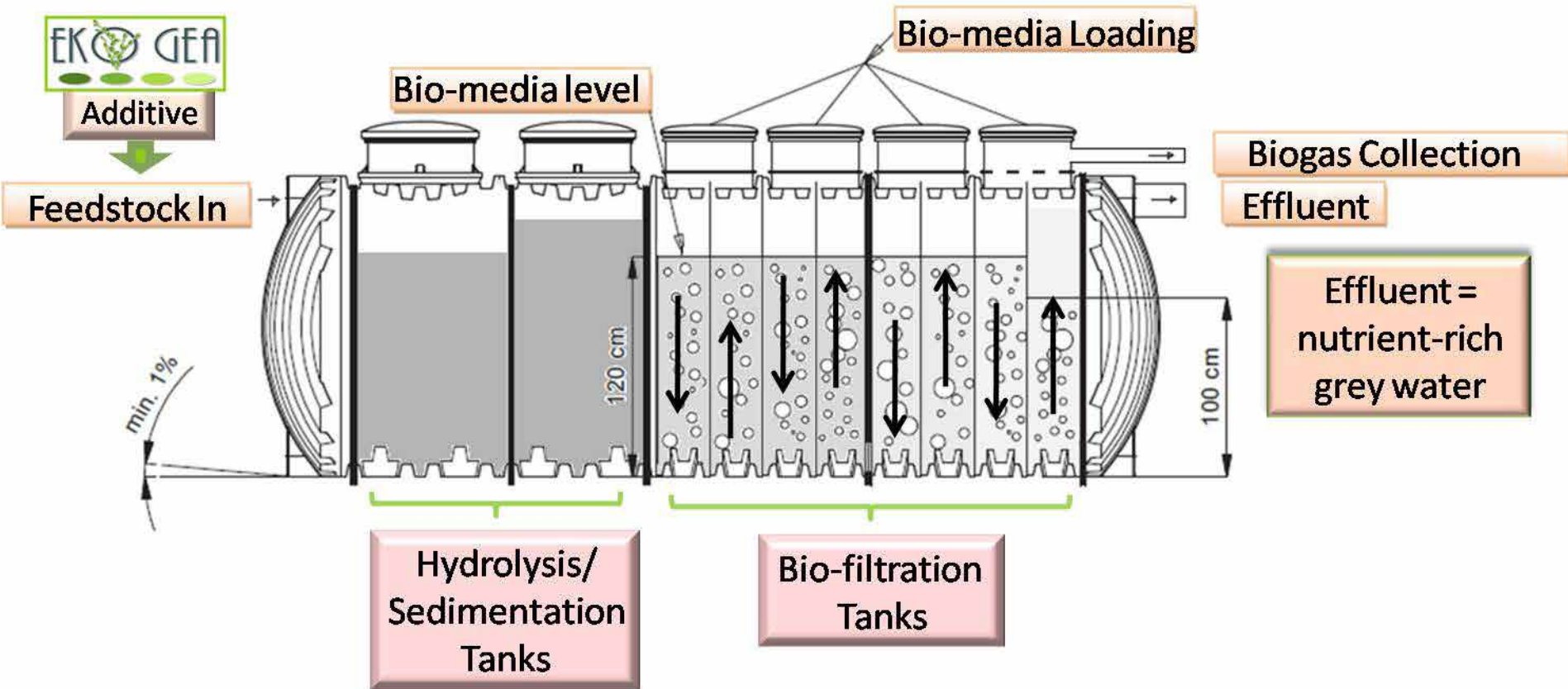
Performance	Plug Flow	Complete Mix	Modified UASB	NewGen
Organic Matter Digestion	50%	<60%	<60%	98%
Methane Content	<50%	<60%	<60%	>70%
Process Stability	Medium	Low	Low	High
80kW Generator Running Time (hrs)	8	12	12	18
Performance Index @ Best Benchmarked at NewGen	<50%	<60%	<60%	100%



# EKO GEA NewGen Digester installed at MSAB



# Process Flow Diagram



# Why the NewGen Anaerobic digester/Wastewater Treatment Plant

- No heat required
- No power required (except dosage pump)
- No continuous mixing requirements
  - Only at pre-treatment stage before substrate enters the plant
- 24 hour retention time = **SMALL and FAST**
- No digestate- Complete digestion
- Up to 87 % methane



The first NewGen wastewater treatment plants come off the production line, 13<sup>th</sup> May, 2010  
Goran Đorđić (patent holder - right) and Uroš Pinter (manufacturer).

# Achievements

- Installed Biogas Digester at MSAB near Airport
- Developed PDD and CPA through Met Services' assistance
- EIA complete
- Final results to be available last quarter 2013





# Challenges

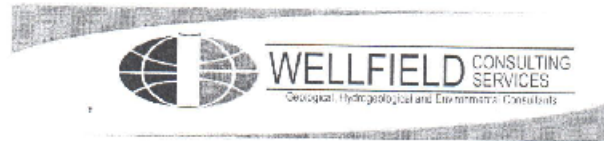
- No policy on renewable energy let alone energy in general (still a draft)
- Renewable Energy Feed In Tariffs (REFIT also being developed by Government
- Lack of awareness on biogas and renewable energy in general
- Awaiting additional equipment to fully commission project



# From Dung to clean water



# Waste water analysis



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## WASTEWATER ANALYSIS REPORT

Client : Bostrich Products International  
 Sample type : Wastewater  
 Sample Description : Biogas Digester Wastewater  
 Date sampled : 22/04/13  
 Date submitted : 22/04/13  
 Analysis period : 22/04/13 – 29/04/13  
 Analysed by : Wellfield Consulting Services (Pty) Ltd

PARAMETER	Result <i>mg/l, unless specified</i>	Botswana Bureau of Standards Irrigation Water Limits <i>mg/l, unless specified</i>
pH	8.68	6.5 – 8.4
Electrical Conductivity $\mu\text{S/cm}$	640	3000
Colour (TCU)	450	
Total Dissolved Solids	464	2000
Suspended Solids	7.5	100 (for drip irrigation)
Dissolved Oxygen	9.4	
Biological Oxygen Demand (BOD <sub>5</sub> )	4	
Chemical Oxygen Demand (COD)	107.8	
Orthophosphate, PO <sub>4</sub> -P	5.68	
Nitrate, NO <sub>3</sub> -N	0.510	30
Ammonia, NH <sub>4</sub> -N	17.10	
Sodium, Na	80	230
Potassium, K	70	
Calcium, Ca	53.6	
Magnesium, Mg	1.85	
Iron, Fe	3.56	5.0
Manganese, Mn	0.02	0.2
Sodium Adsorption Ratio (SAR)	2.92	8
Total coliforms (Bacteria) CFU/100 ml	480000	
Faecal coliforms (Bacteria) CFU/100 ml	19000	< 1000
Faecal Streptococci (Bacteria) CFU/100 ml	203000	

Note: A comparison of the analytical results obtained to the Botswana Bureau of Standard Irrigation Water Limits indicate that the chemical quality of the wastewater is suitable for irrigation but the bacterial content is too high for irrigating without disinfection.

# Installation of NewGen Biogas Digester





# Mobilisation of equipment



# Installation Process



# Inspection of Cristobalite





# Compartments



# Water Heater at MSAB



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## Office Location:

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