ATTACHMENT 204
STUDY TOUR TO CUMMIS’ 12MW COGENERATION POWER PLANT GASIFIER
COGEN FOR AFRICA PROJECT
Compiled by
AFREPREN/FWD
2017
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1.0. Introduction

1.1. Background of Cummins Cogeneration Limited

Cummins Cogeneration Limited (CCL) is a global joint-venture between USA-based Cummins and UK-based Gentech, an engineering, procurement, and construction contractor. CCL has four subsidiary special project vehicles, each with a specific geographic focus. CCKL is a project development and investment vehicle for CCL in Kenya.

CCKL developed a 12MW biomass-fueled, on-grid electricity generation project in Baringo County, Kenya. The project is CCKL’s first project in sub-Saharan Africa. In the late stage of the development of the project, the Power Africa team has worked with CCKL to address key constraints. The Power Africa team facilitated power purchase agreement negotiations with Kenyan authorities as well as helped resolve issues with the grid connection, helping bring the Cummins project to fruition. The Power Africa team was also instrumental in project preparation analysis, including a feasibility study.

Facts about the project

- The power plant uses modular units, allowing project sizing to match local opportunities or constraints. Generation units can be designed, constructed, and commissioned quickly.

- CCL uses a biomass gasification technology that converts biomass into three components: electricity, waste heat and residual char. Electricity is fed to a grid (either isolated mini-grid, national grid) or captive customer; waste heat can be used in various processes, including those related to agriculture; the residual char can be used as a water filtration medium and as a fertilizer. The technology has very limited water requirements, and water that is used is recycled.

- CCKL proposed to use mesquite wood as the source of biomass. From 1973, massive plantings of mesquite wood – known in Kenya as “mathenge weed” – were started around the Baringo County area, in an attempt to eradicate desertification of the land. However, as an invasive weed, mathenge weed invades agricultural and
pasture land, watercourses, roadsides and wasteland, if left unmanaged. The use of mathenge weed means that the CCKL project will not compete for land versus agricultural use, and will actually open up land for pastoralists and agriculture – a link being established with the Feed the Future initiative.

- Cummins efforts align with those of the Kenya Forestry Research Institute to control mathenge weed through improved utilization. This involves a number of activities, including using the plant for local charcoal production; using the pods and leaves as livestock feed, and using it as biomass for electricity production.

- Biomass based power generation is a form of renewable energy that has lasting socio-economic impacts, as the fuel is sourced from local communities. A 1 MW plant utilizes yields from over 800 farmers. Cummins is in the process of training local populations to gather mathenge weed and is providing workers with the tools for farming. The Cummins project provides opportunities for job-creation for women, as it expects that women will form the majority of workers harvesting the plant.

- Power Africa in Kenya supports the efforts of the Government of Kenya to build on the substantial accomplishments to date. Power Africa’s goals align very closely with the Government of Kenya’s goals to provide high-quality, reliable, and affordable energy for the Kenyan people. The project is replicable in Africa where bio-mass is available. CCKL has a planned pipeline of 18 projects in Kenya.

- This project is priority project under Power Africa, an initiative announced by President Obama in June 2013, aims to add more than 10,000 Megawatts of cleaner, more efficient electricity generation capacity in six focus countries by 2020.
BIO POWER SYSTEMS Limited is a Renewable Energy (RE) Technology enterprise committed to development and diffusion of renewable energy and waste management technologies in East African region and beyond.

BIO POWER has the primary objective of carrying out business of designing, installation and maintenance of solar electric systems, anaerobic digesters, wastewater management, fuel substitution and energy conservation. Energy baseline surveys and energy audits are carried out to form a basis for system design and advice to the client on energy situation. It also undertake a training programme for its clients on use and post installation maintenance of systems for a longer service. The company has pioneered in the development of anaerobic wastewater treatment systems where biogas is generated from wastewater and re-use of reclaimed wastewater. In this sector it has implemented unique integrated-closed-loop wastewater management systems.

The principal behind this company is a holder of B.Sc. in Mechanical Engineering, from the University of Nairobi. He is a Registered Engineer and a Member of Institution of Engineers of Kenya (IEK). He has been involved in the field of renewable energy technologies consistently with a lot of experience in system design, energy audits, pre-feasibility and feasibility studies, site evaluation, materials selection and procurement, installation, commissioning and post installation follow-up and documentation.

Some of the previous experiences of the company are as summarized in the table below;
<table>
<thead>
<tr>
<th>Project</th>
<th>Client</th>
<th>Services Provided</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detailed Feasibility Study for Biogas capture and sales from sewerage works at Nyahururu</td>
<td>Northern Water Services Board</td>
<td>Inception, market study, design and cost estimation for the proposed biogas capture and sale for NYAHUWASCO</td>
<td>May 2016 to August 2016</td>
</tr>
<tr>
<td>Design of Solar Water Pumping system</td>
<td>Mr. Solomon Kogo – Ilbissil Kajiado County</td>
<td>Design of 7Kw solar pumping for 130m borehole pumping 40M³/day for irrigation</td>
<td>July 2016</td>
</tr>
<tr>
<td>Design of Solar Water Pumping system</td>
<td>Mr. Johnbosco Mululu-Matuu-Machakos County</td>
<td>Design of 6Kw solar pumping for 150m borehole pumping 30M³/day for irrigation</td>
<td>July 2016</td>
</tr>
<tr>
<td>Upscaling Biogas Use at Este Farms</td>
<td>Este Farms-Kamwangi-Kiambu County</td>
<td>Design of biogas upscaling, biogas production and use measurements, waste heat recovery, milk refrigeration general advisory on renewable energy options and fertilizer sales options</td>
<td>March 2016</td>
</tr>
<tr>
<td>Energy Audit</td>
<td>Sports View Hotel Kasarani</td>
<td>Analysis of data on energy usage, proposing saving and renewable energy options available for the hotel.</td>
<td>August 2015</td>
</tr>
<tr>
<td>Consultancy Services: Technical pre-feasibility study for Coffee Waste to Energy technology in the Kenyan coffee sector.</td>
<td>UTZ Certified – Netherlands</td>
<td>Technical pre-feasibility study to determine the potential of biogas recovery from waste arising from coffee processing in Kenya.</td>
<td>Nov. 2013 to March 2014</td>
</tr>
<tr>
<td>Design of Solar Water Heating Systems</td>
<td>PJ Dave Flowers</td>
<td>10M³ solar water heating system to replace kerosene</td>
<td>August 2013</td>
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</table>
2.0. Profile of key personnel from Bio Power Systems

The study was carried out in accordance with internationally recognized standards. The team has vast experience in conducting comprehensive renewable energy feasibility studies coupled with the ability to design, supply, install and commission study recommendations in a diverse range of facilities and industries. The project team comprised of the following experts:

<table>
<thead>
<tr>
<th>Key Staff</th>
<th>Qualification</th>
<th>Proposed Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Eng. Peter Okwany</td>
<td>BSc Electrical Engineering</td>
<td>Power Systems Analyser and Master Planner</td>
</tr>
<tr>
<td>4 Godfrey Maina</td>
<td>BSc IT</td>
<td>IT Expert</td>
</tr>
</tbody>
</table>


Eng. Peter Gichohi has an uninterrupted renewable energy experience spanning thirty years. Over these years he has been involved in a wide range of renewable energy projects. As a consultant for the Ministry of Energy and Petroleum (2010-2013) he developed, designed and supervised the biogas project at PJ Dave Flowers. As the Ministry’s Biogas Consultant, he was the principle behind the 125KVA biogas-electric project at the farm. He was a team member of the Consortium that undertook the Update of the Rural Electrification Master Plan for the Ministry of Energy and Rural Electrification Authority (REA) which was concluded in April 2009. In the Master Plan, he was an Environmentalist, Renewable and Thermal Energy Expert. His responsibility was to make an assessment of the potential for generation of power from a wide range of biomass, hydro, solar and wind resources in the country. This background gives him a very clear understanding of the objective as described in the Terms of Reference. Having designed the biogas project at PJ Dave, this offers him a great strength since he understands how best this project can be expanded.
Eng. Gichohi is a Mechanical Engineer, Registered and validly licensed by Engineers Board of Kenya. He is also registered and licensed by NEMA as a lead EIA/EA expert. He will be the team leader providing guidance on the type of data and information to be obtained in the study in respect to the whole scope of renewable energy and other areas indicated in the TORs.

2.2. Eng. Peter Okwany - Power Systems Analyser
Eng. Okwany is a Electrical Engineer, Registered and validly licensed by Engineers Board of Kenya. He served at KPLC for about twenty years rising through the ranks from an Apprentice to Commercial Manager. He then served Securicor Kenya Limited as a General Manager responsible for Technical Services which included electrification through Photo Voltaic Solar Systems. Since, then he has been a Consultant in Energy Management and Electrification. In 2005-2007 he worked as consultant in the Ministry of Energy where his responsibility was to advice the Ministry on various levels of rural energy. In 2008-2009, he was the Local Team Leader for the Rural Electrification Master Plan Project in association with MVV Decon, a German consultancy firm. In this exercise, he coordinated the team consisting of ten local consultants who were experts in diverse fields. He will analyse power supply and demand patterns, load factors, power factors and propose financially viable renewable energy options. He will also be responsible for master planning the energy future scenarios at PJ Dave Flowers.

Eng. Gichungi has a twenty six year experience working in the power sector in the employment of Kenya Power. Over these years, he was in charge of thermal stations and was instrumental in the design and implementation of solar/diesel hybrid stations in Kenya. Between 2015 and 2016, Eng Gichungi Worked with SMA Sunbelt of Germany as a business development manager in charge of hybrid solutions in Kenya. This gives him a very good understanding of the task ahead where different forms of renewable energy will be applied at PJ Dave. He will specifically be responsible for the design, equipment selection and development of cost estimate for a solar PV system for PJ Dave.

Eng. Gichungi is a Mechanical Engineer, Registered and validly licensed by Engineers Board of Kenya.
3.0. Mission/ Study tour to Cummis Cogeneration Ltd (CCL)

On 20\textsuperscript{th} April, 2017- Team from Bio Power Systems embarked on a study tour to Cummis 12MW cogeneration power plant gasifier at Marigat-Baringo County. The project is owned by Cummins Cogeneration Kenya Ltd and utilising prosopis (mathenge) tree. The purpose of the visit was for Bio Power Systems to gain more insight on the operation of the gasification power plant and the challenges encountered in order to be fully informed and form opinion in respect to their initial thoughts on the surfeit of biomass at PJ Dave.