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Policy Briefing Paper

Bioenergy in the Palm Oil Processing Sector in Ghana

SUMMARY

The residues generated by Ghana's large palm oil sector offer significant potential for producing bioenergy.

The country's six largest palm oil processors (Figure 1)[1] meet the bulk of their heat and electricity requirements from combustion-based combined heat and power (CHP) plants, fuelled with solid oil palm residues. There is further potential to use palm oil mill effluent (POME) to generate biogas using anaerobic digestion (AD), to provide additional heat and power.

Suitable technology for POME-based AD has been fine-tuned by specialist companies such as Biotec, Solmax and Veolia. POME-based AD for heat production shows good economic prospects if a mill has its own oil refinery, by saving on the costs of heat generation from fossil fuel boilers. Wider adoption of AD within the industry is constrained, however, as most mills lack refineries, so have no additional heat requirements, beyond that which can be supplied by combustion-based CHP using solid oil palm residues. At the same time, a substantial over-supply of electricity on Ghana's national grid means there is currently no opportunity to sell excess power that could be generated from these palm oil plants to the grid. The prospects for wider uptake of AD for heat and power in the palm oil industry are, therefore, currently limited.

Major droughts significantly reduced Ghana's hydroelectricity output in the early 2000s, resulting in emergency investment in fossil fuel generation to meet the shortfall. This resulted in an over-supply of electricity equal to nearly twice Ghana's current electricity demand. This effectively halted government support for renewable electricity for the grid, other than small amounts generated by households and small commercial entities through 'net metering'.[2] In 2018, Ghana's Energy Commission (the electricity regulator), ceased licensing new renewable electricity projects selling to the grid. Thus, while Ghana has regulated feed-in-tariffs for bioenergy to help attain its national renewable energy target of 10% of all electricity generation, in practice, most independent producers cannot sell renewable electricity to the grid. This presents a major obstacle for the development of bioenergy for electricity generation in the oil palm sector. It is hoped that the new National Energy Policy[3] will break this bottleneck, by supporting bioelectricity generation into the grid, particularly in areas where the network is weak and supply is unreliable.

This paper analyses the policy, legal and regulatory frameworks that govern the management of biomass residues and the production of heat and power in Ghana's oil palm sector, with policy recommendations to support wider adoption.

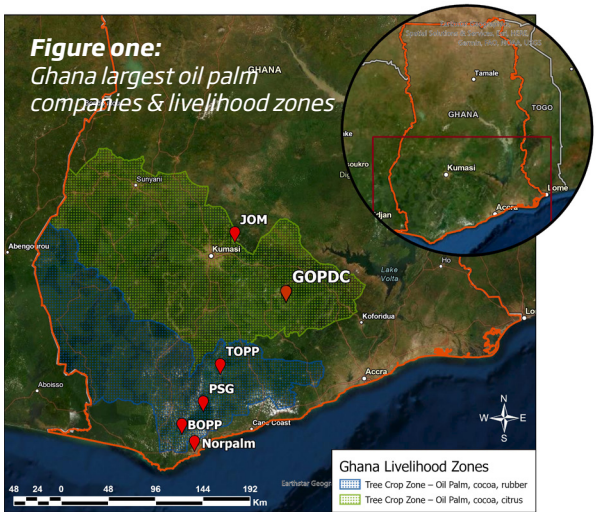


Figure one: *Ghana largest oil palm companies & livelihood zones*

[1] Ghana Oil Palm Development Corporation (GOPDC), Plantations Socfinaf Ghana (PSG), Benso Oil Palm Plantation (BOPP), Norwegian Oil Palm Ghana (NorPalm), Twifo Oil Palm Plantation (TOPP), Juaben Oil Mills (JOM) and Plantations SOCFINAF Ghana (PSG).

[2] Net metering, in Ghana's case, specifically refers to a household or small business that generates renewable electricity (generally solar PV) being credited by the grid operator for any electricity they supply to the grid when they generate a surplus beyond their own demand, and then being able to take the equivalent amount of electricity from the grid at no cost when they have a shortfall in meeting their own needs from their own electricity generation.

[3] The current Ghanaian National Energy Policy was published in 2010.

SECTOR OVERVIEW

African oil palm (*Elaeis guineensis*) has been a major edible oil source and one of the most important crops in West Africa for centuries.

The most suitable areas for oil palm in Ghana are in the southern third of the country, particularly the southwest. Small-scale growers account for more than 80% of production. They generally operate in the informal sector, outside the tax and regulatory framework. Larger producers, particularly estates and their contracted out-growers, cultivate and process oil palm within a formalised institutional, market and regulatory framework.

Ghana produces about 2.6 million tonnes (Mt) of oil

Figure two:
Biogas plant at GOPDC, Kwae. (Source: Alex Bulnes, 2017)

palm fresh fruit bunches (FFB) per annum, grown on approximately 370,000 ha of land, from which 312,530 t of palm oil is produced. Some 88% of the oil palm area is under smallholder management, with the balance produced mainly on six large estates with monoculture plantations and on-site mills. A large number of smallholders act as out-growers for the six large processors, where they are sufficiently close (<50 km) for economic delivery of FFB. Such out-growers are often given extension advice, agricultural inputs and other support, especially when partnered with estates that have Roundtable on Sustainable Palm Oil (RSPO) certification. There is also a large number of independent farmers who harvest fruit from wild groves or scattered palm trees.

The processing of FFB generates large quantities of solid residues (empty fruit bunches, fibre and palm kernel shells/PKS) and liquid residues known as palm oil mill effluent (POME). Ghana generates around 1 Mt of solid residues and 1.4 Mt of POME per annum. Bioenergy applications using anaerobic digestion (AD) can add value to these residues though conversion of POME to electricity and heat, while avoiding disposal costs and pollution risks. The solid residues are suitable for thermal conversion and the POME is an appropriate feedstock for biogas production.

While all large palm oil mills require heat and power, the opportunity for generating bioenergy from residues lies mainly with the larger mills. Small- and medium-scale poducers face constraints such as, (i) insufficient feedstock (oil palm residues) to sustain a bioenergy investment (e.g. AD); (ii) standardised boilers designed for >10 t/hr processing capacity, with customisation for smaller sizes being prohibitively expensive; and (iii) lack of skilled labour and capital to operate and maintain bioenergy systems.

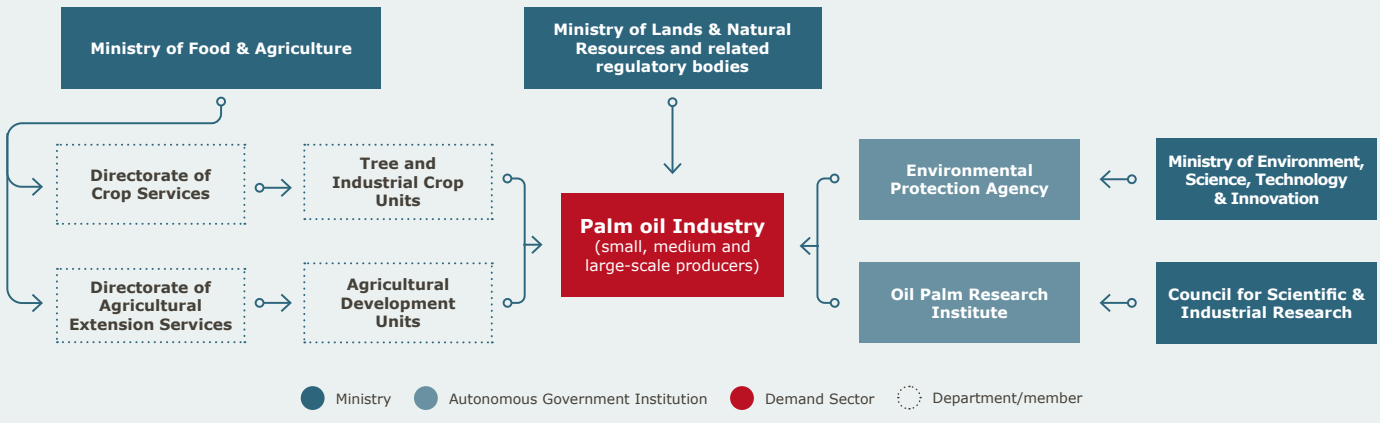
The six largest palm oil mills in Ghana have installed combustion-based CHP plants. These plants use solid oil palm residues for generating electricity for their factory operations, administration functions and staff housing, as well as heat for processing palm oil. The remainder of their power requirements are met from grid electricity and back-up diesel generators (due to the unreliability of the grid in many rural areas). Combustion-based CHP is viewed as a straightforward and economically viable solution to meeting these needs at larger mills. Industrial-scale palm oil production also generates large quantities of highly polluting POME, which is traditionally treated aerobically in open lagoons, then usually used for irrigation on the estates' own plantations. GOPDC uses POME as the primary fuel for an AD biogas plant at its Kwae facility, to generate steam for its palm oil refinery operations.

KEY INSTITUTIONS - AGRICULTURE

The national government institution responsible for supporting and managing palm oil production is the Ministry of Food and Agriculture (MOFA), primarily through its Directorate for Crop Services/DCS and Directorate for Agricultural Extension Services/DAES (Figure 3).

The key support agency within the DRS is the Tree & Industrial Crops Unit, which works through regional and district Agriculture Development Units (ADUs). DAES has responsibility, at a national, regional and district level (through ADUs) to support palm oil growers and producers to improve their stock and silviculture practices. Ghana's Environmental Protection Agency (EPA), established

Figure three: *Agricultural institutional framework for bioenergy in Ghana*



through Environmental Protection Agency Act (1994), under the Ministry of Environment, Science, Technology and Innovation (MESTI), regulates environmental aspects of the industry through the issuance of Environmental Permits.

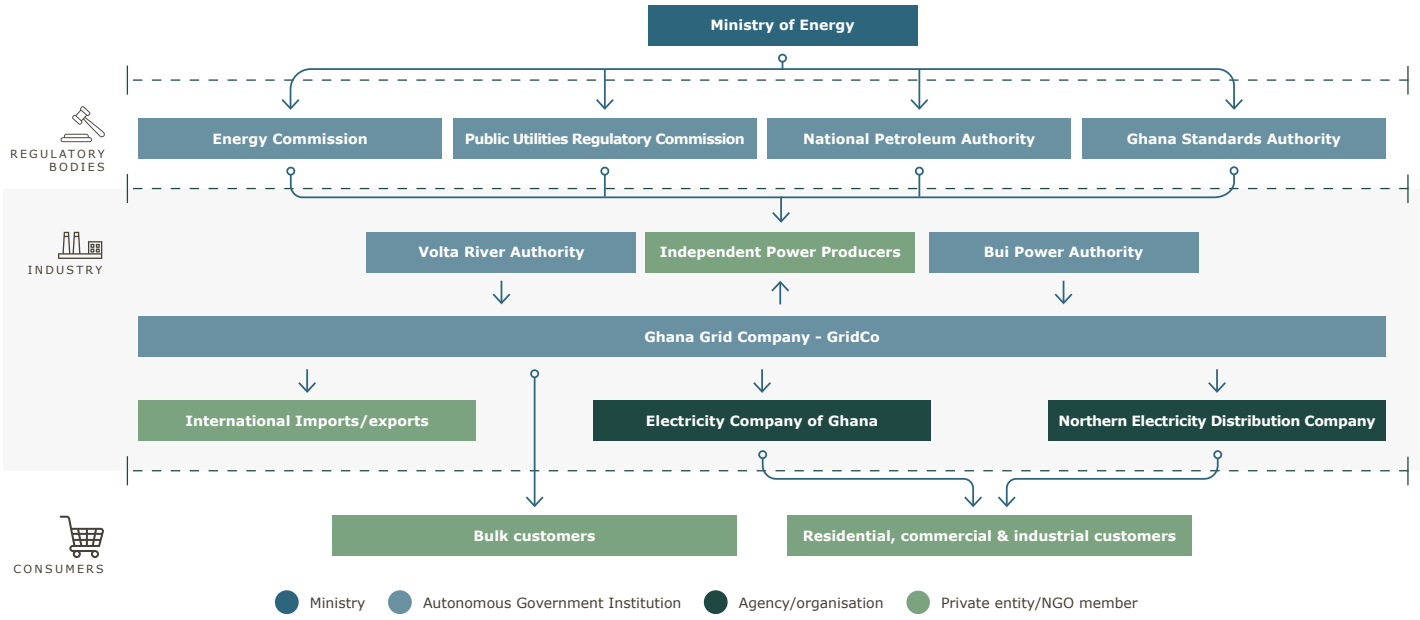
The Oil Palm Research Institute (OPRI) of Ghana is one of the 13 Institutes of the Council for Scientific and Industrial Research (CSIR) and carries out research on oil palm and coconut palm. OPRI also offers technical backstopping to oil palm industries. More specifically, it develops capabilities to generate marketable technologies for sustainable production of palm oil. It supports the efficient exploitation of palm kernels through downstream processing and biomass utilisation (e.g. for energy production), as well as developing technologies to manage wastes from oil palm processing. The Ministry of Lands and Natural Resources, Lands Commission, traditional authorities, the Administrator of Stool Lands, and town and country planning authorities are the main institutions responsible for land for oil palm. Other relevant legal authorities include the Registrar General's Department, metropolitan, municipal and district assemblies, the EPA, traditional authorities, the Food and Drugs Authority, the Water Resources Commission and the Plant Protection and Regulatory Services Directorate (PPRSD).

KEY INSTITUTIONS - ENERGY

Ghana's Ministry of Energy (MoE) is responsible for formulating, implementing, monitoring and evaluating policies, programmes, and projects in the energy sector (Figure 3).

All sector entities are overseen and regulated by the Energy Commission of Ghana (EC) which is the electricity regulator which licenses, sets technical standards and undertakes planning the electricity sector, including renewables. It oversees the electricity sector including the Bui Power Authority/BPA, Volta River Authority/VRA and Independent Power Producers/IPPs, the Ghana Grid Company/GridCo (established in 2006 as a national electricity transmission monopoly) serving the Electricity Company of Ghana/ECG, the Northern Electricity Distribution Company/NEDCo, Enclave Power, the mines and several parts of the Volta River Authority (VRA). The ECG and NEDCo are effectively Ghana's primary distribution entities. The Public Utilities Regulatory Commission (PURC) was set up in 1997 to regulate the provision of utility services in the electricity, gas and water sectors. It provides oversight, and legal and services to the Volta River Authority, NEDCo, GridCo and ECG. The National Petroleum Authority (NPA) is responsible for determining the proportion and price of biofuel in the biofuel blend for vehicles, in accordance with the prescribed petroleum pricing formula. The Ghana Standards Authority (GSA) is responsible for developing standards for renewable energy technologies and biofuels (Figure 4).

Figure four: *Ghana's Electricity Institutional Framework (Source: Author's own compilation)*



ENVIRONMENTAL REGULATIONS

The EPA Act (1994) and the Environmental Assessment Regulation (1999) require oil palm processors to undertake environmental impact assessments and obtain EPA permits for dealing with wastes, particularly POME.

Other applicable environmental regulations include the Water Use Regulation (2001), Water Resources Commission Act, Land Planning and Soil Conservation Act, and Land Planning and Soil Conservation (Amendment) Act. The Hazardous and Electronic Waste Control and Management Act (2016) also applies to oil palm industries, as POME can be toxic.

One of the most critical regulatory issues for the palm oil sector concerns environmental regulations. In practice, there is little enforcement over thousands of small-to-medium palm oil producers or the six large companies to ensure that the discharge and treatment of POME follows the EPA and other regulatory requirements. Provisions that exist to control pollution from the palm oil industry are not consistently applied, so there is little incentive to invest in technology such as AD to treat or valorise POME. Most POME undergoes little or no treatment and is discharged, untreated, into the surrounding environment. POME, therefore, remains a major environmental problem and is only utilised for AD in one facility (GOPDC), both to address environmental concerns and to provide feedstock for generating heat for self-consumption.

The problem is exacerbated by the large number of small, artisanal producers, who control more than three-quarters of the country's oil palm crop. They produce up to 80% of palm oil output and are responsible for generating a significant share of Ghana's POME. However, they are generally so small and informal that regulating them is difficult. Hence, the vast majority operate without environmental permits.

ENERGY REGULATIONS

Ghana has set high targets for renewable electricity and bioenergy for electricity.

The Renewable Energy Act (2011) and the Strategic National Energy Plan/SNEP (2006-2020) set a target of 10% of total electricity generated on the national grid, to be sourced from renewable energy sources. Government has set a target to generate 20 – 26 MWh of utility-scale capacity based on biomass and waste alone. Under the Renewable Energy Act (2011), the PURC established a feed-in-tariff for electricity generated from renewable energy sources in 2013 (amended in 2014). A draft National Bioenergy Policy was developed in the early 2010s but has not been approved. Key aspects of this policy have been merged into a revised National Energy Policy, which is awaiting cabinet approval.

IMPACT OF POLICIES ON ADOPTION OF BIOENERGY WITHIN THE OIL PALM SECTOR

Despite a strong enabling policy framework for renewable energy, Ghana's outlook for renewable electricity (including bioenergy) has changed dramatically over the past decade.

Following a major crisis in electricity supply in the early 2000s, Government encouraged significant investment, indeed, over-investment in fossil-fuelled electricity generation. Today, as noted above, Ghana has double the electricity generation capacity than needed. Due to this over supply and improved water levels for hydroelectricity generation, the country's electricity sector cannot support any sizeable investment in renewable electricity. This has led Government to restrict almost all purchase of renewable electricity from any source other than households and very small commercial entities. The current policies of the PURC do not allow electricity to be sold by Ghana's large oil palm industries, either to the grid or to third parties (e.g. local communities, industries, municipalities). This is the major impediment to investment in new or expanded bioenergy projects in the oil palm processing industry in Ghana.

RECOMMENDATIONS

A **stronger regulatory framework for POME management** would promote its use as a feedstock for bioenergy electricity and heat generation in large palm oil mills. This would not only lead to better disposal and treatment of POME but would provide sustainable, embedded rural electricity generation in a number of rural areas where Ghana's electricity distribution networks are weakest.

Investing in AD for biogas to generate heat and electricity would reduce current significant POME treatment and disposal costs. Were the option available to sell electricity generated by using POME to produce biogas for energy production, this would incentivise companies to invest in this clean renewable energy technology, make them more profitable and reduce POME waste disposal costs.

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This material has been funded by UK aid from the UK government via the Transforming Energy Access programme; however, the views expressed do not necessarily reflect the UK government's official policies