Policy Briefing Paper

Bioenergy in the Horticulture Processing Sector in Kenya

SUMMARY

This policy brief analyses the policy, legal, regulatory, institutional and market set-up and framework for investment in anaerobic digestion (AD) for electricity and heat in Kenya's horticulture processing sector.

Kenya's horticulture sector is extremely diverse, producing a wide range of products, selling into numerous local, regional and international markets, and involving a wide range of companies of all scales who are dispersed over a wide geographical base.[1] Large quantities of residues are generated during grading, cleaning and processing of fruits and vegetables for sale to local and international markets.

While solid residues are generally composted and returned to the land or fed to livestock, liquid residues present an opportunity for AD, as both a residue management solution and a source of bioenergy for heat, power or combined heat and power (CHP). Opportunities for AD are particularly good in the mango, pineapple, avocado (oil) and potato sectors, as their processing generates suitable residues for AD with high moisture content at centralised facilities. However, there is only one significant commercial operator in large-scale avocado oil production, while mango processors tend to be in peri-urban locations where grid electricity is available and there is little demand for alternative sources of power. Further, fruit producers tend to send their stock to urban and peri-urban areas where almost all processing facilities are located.

The diversity of the horticulture sector also makes it difficult to develop a standard technical package for

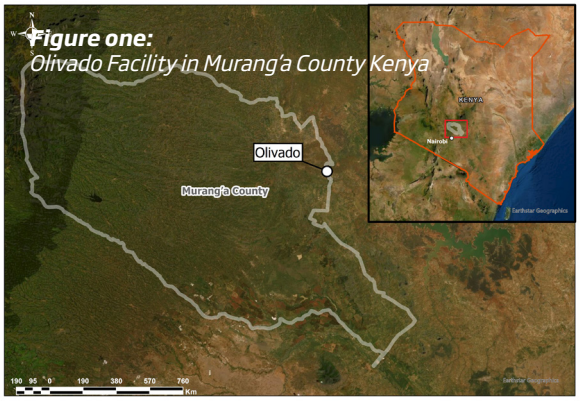


Figure one:
Olivado Facility in Murang'a County Kenya

bioenergy, or for government and industry associations to support standardised bioenergy solutions that could be suitable across the range from niche suppliers of value-added products servicing specialised markets, to larger-scale growers marketing a whole range of horticultural products. Kenya's light-touch environmental regulatory framework for horticulture residues also means that there are few strong environmental drivers to utilise horticultural residues to develop replicable bioenergy solutions.

On the energy side, electricity generation from horticulture processing residues through AD facilities could accelerate development of one of Kenya's fastest-growing sectors by increasing the ERPA biogas electricity feed-in tariff to at least USD 0.20 per kWh, as opposed to the current USD 0.10 per kWh, which is far too low to stimulate investment. Further, eliminating tariffs and import duties for biogas AD equipment, as has been done with solar PV and wind, could significantly boost the horticulture sector's bioenergy production as well as improve Kenya's competitiveness in the sector, and increase electricity supplies for and from the sector.

SECTOR OVERVIEW

Agriculture is the main economic sector in Kenya, contributing 26% to the gross domestic product (GDP) and employing over 40% of Kenya's entire population and 70% of its rural population.[2]

Some three quarters of Kenyan farms are small-scale, with an average size of 0.47 ha per farm.[3] In 2018, about 198,000 ha were under vegetable production and 185,000 ha under fruits.[4] Horticulture production is a major industry in Kenya and directly employs over 200,000 people in centralised production, processing and shipping, and up to 2 million in the sector as a whole.

The horticultural sub-sector is experiencing rapid growth, generating important employment opportunities and income for small-scale farmers, given that 80% of horticultural products are produced at small scale.[5] About 95% of horticultural products are sold into domestic markets, and about 5% are exported - though exports generate 60% of sector revenue.[6] Approximately 74% of this export revenue come from flowers, 18% from vegetables and 8% from fruits.[7] Exports comprise both fresh produce that requires little processing and packaging, and a growing share of ready-to-eat and ready-to-cook products that have been prepared for higher-value markets, and which generate significant residues during processing.

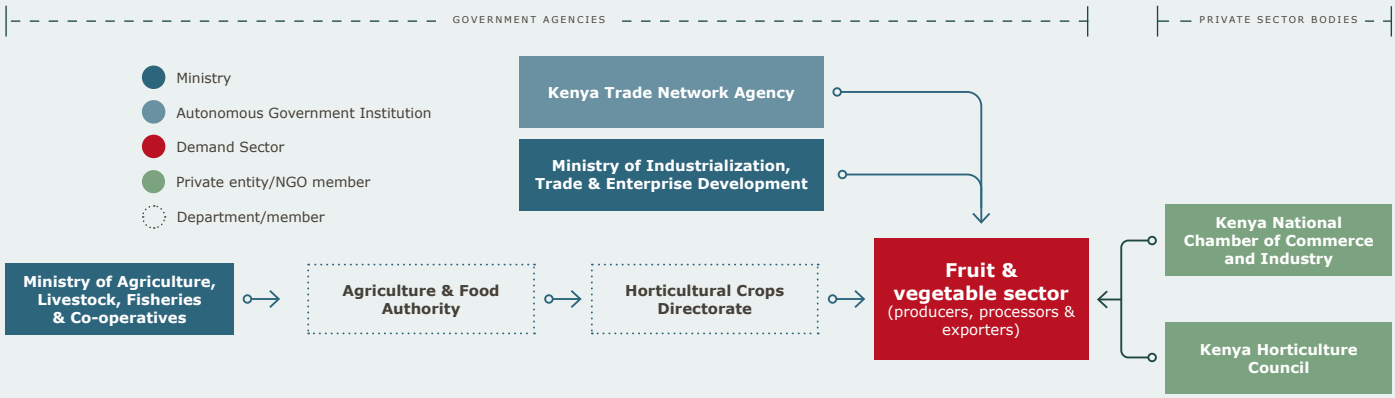
As important, Kenya's domestic market for high quality fruit and vegetables, and the market for processed produce is rapidly growing. Approximately 10% of domestically-consumed horticulture products are now frozen, canned, juiced or otherwise processed, generating residue streams of organic residues that potentially can be used for bioenergy.[8] Nonetheless, with both export and domestic demand for high quality fruit and vegetables rapidly increasing, only one biogas project is operational and profitable.

INSTITUTIONAL SET-UP OF THE HORTICULTURE COMMERCIAL AND EXPORT SECTOR

The institutional set-up for Kenya's horticulture sector includes private sector and government bodies (Figure 2).

While the private sector manages production and processing, government bodies are responsible for policy, regulatory, environmental and quality support. The Ministry of Industrialization, Trade and Enterprise Development and the Kenya Trade Network Agency (KenTrade) are the primary bodies regulating the industrial (e.g. processing) and commercial (e.g. marketing) aspects of the horticulture sector and exports. The Kenya National Chamber of Commerce and Industry (KNCCI) is a membership-based trade support institution that works to promote commercial and industrial interests of the Kenyan business community, including in the horticulture sector. KNCCI has offices in all 47 countries and its membership constitutes enterprises of all sizes, including over 250 horticulture companies and industries.[9]

Figure two: *Kenya horticulture industrial, marketing and export promotion institutional framework*



Kenya's horticulture industrial, marketing and export promotion institutional framework starts with the Ministry of Agriculture, Livestock, Fisheries & Cooperatives/MoALF&C (Figure 2) which is responsible for policy making, technical, legal and financial support, promotion and advocacy for the sector. Its Horticultural Crops Directorate (HCD) is the main support and regulatory body for horticulture, and provides 'farm to fork' training geared towards sustained traceability. The HDC is part of the Kenya Government's Agriculture and Food Authority (AFA), which supports a number of research agencies and institutes in the horticulture sector.

Under the Horticultural Crops Regulations (2019) the National Horticulture Technical Working Group is the paramount stakeholder forum that brings together public and private horticulture stakeholders to promote private-public sector dialogue, provide capacity building, accreditation of business support facilities, awareness raising, development of common strategies, risk assessment, adoption of international codes of practices, regulations and market diversification (Figure 3). The national Working Group supports County Horticulture Technical Working Groups (HTWG) to accelerate horticulture activity in Kenya. Further, it provides support to the Ministry of Agriculture, the Horticultural Research Institute (under the AFA) and the Kenya Agriculture and Livestock Research Organisation (KALRO) to provide technical support to the horticulture sector.

[1] Successful development in Africa: case studies of projects, programs, and policies, World Bank, 2019, http://documents1.worldbank.org/curated/en/500981468767679512/pdf/multi-page.pdf

[2] FAO. 2021. The agriculture sector in Kenya. Available at Kenya at a glance | FAO in Kenya | Food and Agriculture Organization of the United Nations (last sighted on 18 March 2021).

[3] Rapsomanikis, G. 2015. The economic lives of smallholder farmers An analysis based on household data from nine countries. FAO, Rome, Italy.

[4] Agriculture and Food Authority (AFA). 2021. Overview of Horticultural Crops Directorate. Available at Overview (agricultureauthority.go.ke) (last sighted on 18 March 2021).

[5] Janlango, J. Anyango, 2016. Economic analysis of smallholder farmers' participation in domestic high-value markets for indigenous vegetables in Siaya county, Kenya. Master's thesis. Department of Agricultural Economics, University of Nairobi.

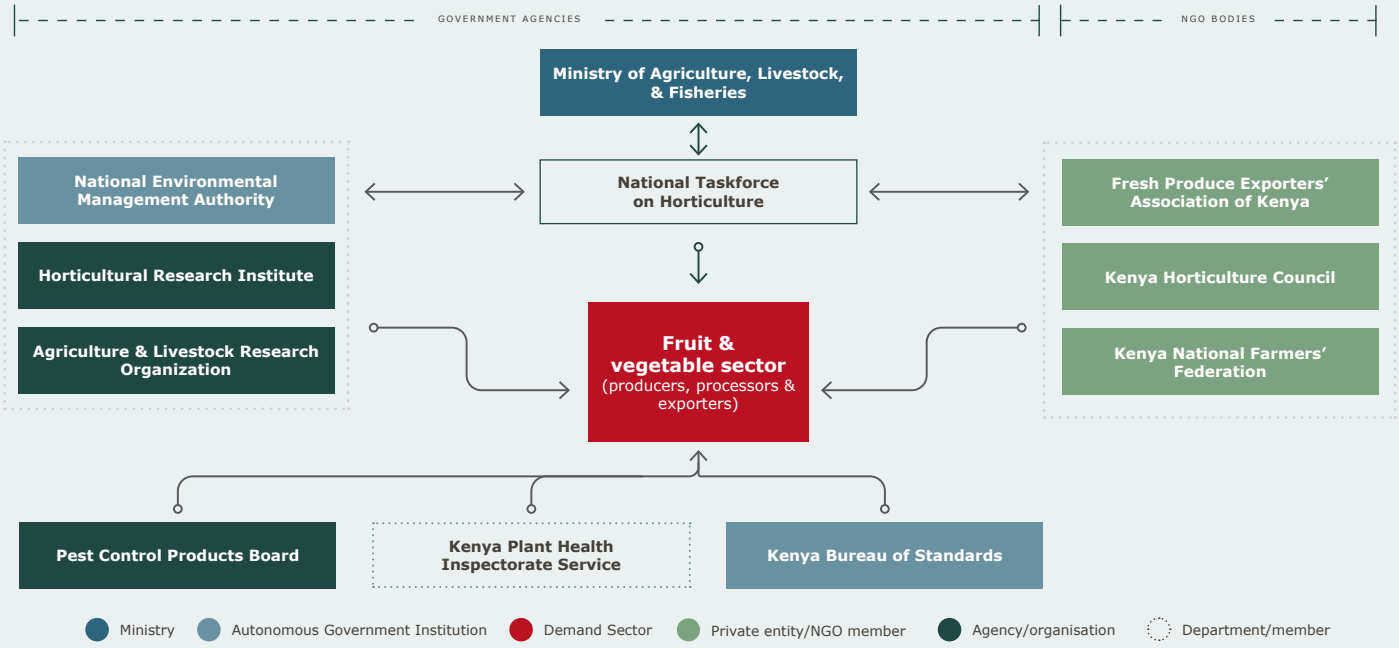
[6] Research Solutions Africa (RSA) Limited. 2015. Report of a study on fresh vegetables market in Kenya. Ministry of Economic Affairs, Agriculture and Innovation, the Netherlands.

[7] AFA 2021, ibid.

[8] RSA, ibid.

[9] Source: www.kenyachamber.or.ke

Figure three: *Kenya horticulture research, quality, standards & health institutional framework*



The Kenya Plant Health Inspectorate Service (KPHIS) and the Pest Control Products Board (PCPB) are autonomous bodies jointly responsible for enforcing regulations and standards for ensuring quality and hygiene in the sector. The Kenya Bureau of Standards (KEBS) is Kenya's national standards body, and has developed standards for the horticulture sector, particularly the Horticulture Industry Code of Practice, developed with the Society of Crop, Agribusiness Advisors of Kenya (SOCAA), namely the Kenya Standard.[10]

Kenya also has an extremely active private sector horticulture research, standards, promotional and support system (Figure 3). The Fresh Produce Exporters Association of Kenya (FPEAK), the paramount trade association for growers, exporters and service providers in the horticulture industry, works closely with a number of government agencies and institutions, lobbies and advocates on behalf of over 100 industry members; provides marketing support and information, capacity building and technical support; and ensures standardisation of practice and quality compliance.[11]

The Kenya Horticulture Council (KHC) is the apex government body founded by the Kenya Flower Council (KFC) and FPEAK, whose mandate is to foster compliance with the Horticulture Industry Code of Practice, standards set by KEBS, KPHIS (Kenya Plant Health Inspectorate Service), the Pest Control Products Board (PCPB) and international horticulture export standards, to lobby on behalf of the Kenya horticulture industry for horticulture product exports. The Kenya National Farmers' Federation is an umbrella organization of all farmers (including those who grow fruits and vegetables), representing the interests of farmers through lobbying and advocacy, capacity building and promotion of sector stakeholders' cohesiveness in dispensing uptake of agricultural innovations.

INSTITUTIONAL SET-UP FOR THE HORTICULTURE BIOENERGY SECTOR

The institutional set up for electricity and heat generation by Kenya's horticulture processing includes bodies from both the environment and energy sectors. Energy sector bodies (Figure 4) define the framework for bioenergy (particularly electricity) generation and sales from AD.

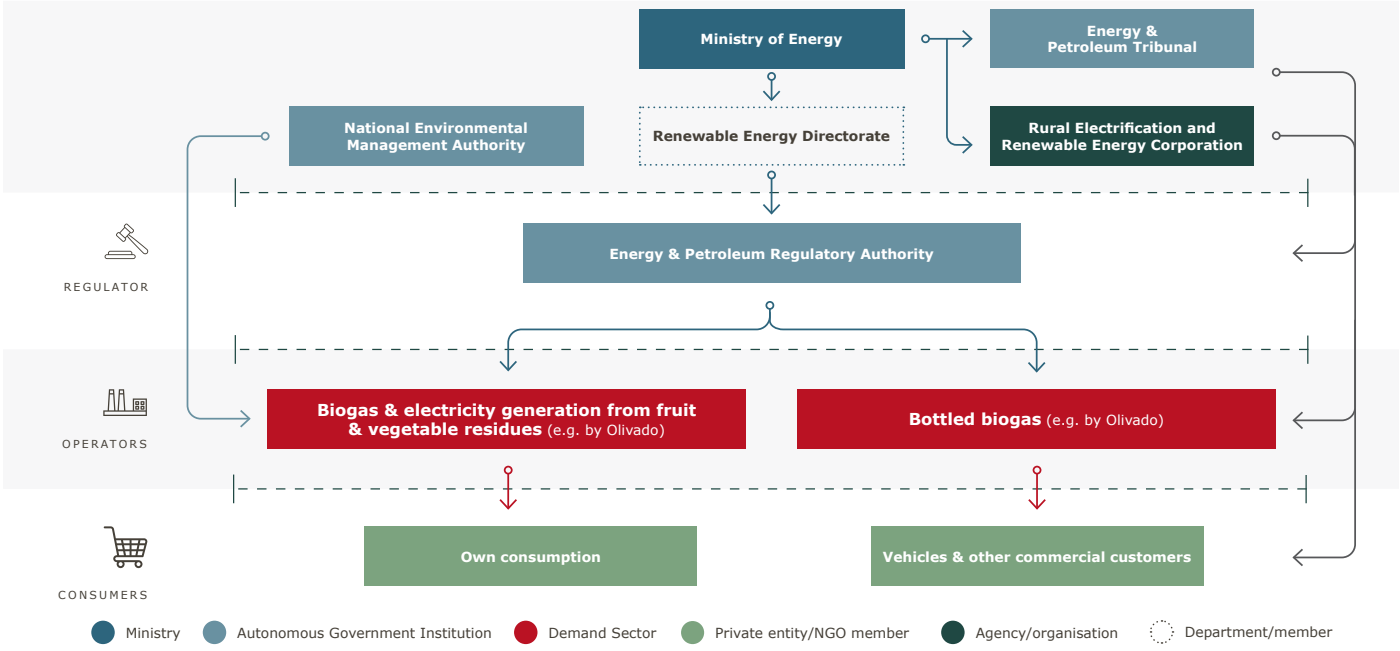
Environmental bodies regulate and support horticulture production as a source of bioenergy (Kenya government energy management institutional framework in the horticultural sector).

The Ministry of Energy (MoE) is responsible for policy, planning and oversight in and at the peak of Kenya's energy sector. The Ministry's Rural Energy Directorate (RED) is responsible for renewable electricity policy formulation, review, planning, promotion, development, M&E and Feed-in-Tariff (FiT) formulation and review. Kenya Power & Light Corporation (KPLC) is the power off-taker from all power generators, including independent power producers under the Kenya Generation Corporation (KenGen), based on negotiated Power Purchase Agreements for transmission, distribution and supply to consumers.

[10] Society of Crop, Agribusiness Advisors of Kenya (SOCAA), Kenya Standard KS 1758-2:2016, Horticulture industry-Code of Practice: Quick Guide, Part 2: Fruits and Vegetables, 2018.
[11] Source: www.fpeak.org

Additionally, as shown by in Figure 4 the Electricity and Petroleum Regulatory Authority (EPRA) is responsible for regulating the import, storage, handing, transport and sale of gas, including liquified petroleum gas (LPG) and any gas that can be bottled (including compressed bio-methane). Generating biogas for own consumption and/or sale to other parties requires an EPRA-led 'Team Assessment' involving EPRA, NEMA, KEBS and relevant county/municipal authorities with a focus on safety. A new 'Strategy' for Biogas is being developed by the RED, which should be published early-2021.

Figure four: *Kenya government energy management institutional framework in the horticulture sector*



REGULATORY FRAMEWORK FOR BIOENERGY

The Energy Act, 2019, provides for the use of renewable energy resources, including bioenergy, to generate electricity and expands the scope of electricity FiTs which were first introduced in 2008.

This includes setting the framework for biogas electricity generation support through FiTs setting eligibility of bioenergy projects generating electricity between 200 kW and 10 MW. This was replaced by the Energy Act, 2019, which also created the EPRA to cover petroleum, natural gas, biogas and 'syngas' regulation. It expanded the scope for bioenergy generators to sell their electricity to third parties, and to use the national grid to 'wheel' (transport) renewable electricity on the national grid from point of generation to point of consumption, upon payment of a 'wheeling charge.

The 2019 Energy Act created two FiT programmes, one for projects that generate from 0.2 to 10 MWe (which includes biogas), and one for generation above 10 MWe (which does not include biogas). Projects with generation greater than 1MW require licences from the EPRA, whether for own consumption or for sale to the grid. However, electricity generation below 1 MW for own consumption does not require an EPRA licence. Any electricity generation below 1 MW for sale to third parties requires a license from the EPRA with a tariff that is approved by the EPRA. Tariffs and licenses for sale to Kenya Power require an EPRA licence which is granted as part of the FiT process covering electricity sales between 200 kW and 10 MW. All electricity projects above 200 kW generation must be registered with EPRA for the purposes of data collection.

EPRA sits on the FiT Committee, alongside other government parastatals and public sector players. The FiT Committee sets tariffs for sale to Kenya Power. The FiT policy outlines the process from application to licencing. Tariffs for direct sales of electricity to 3rd parties other than KPLC must be approved by EPRA, and licences for 3rd party sales can only be granted after tariff approval. This FiT process is currently being reviewed for simplification by a national committee set up to operationalise third party electricity sales and 'wheeling' on the national grid (authorised under the 2019 Energy Act).

INSTITUTIONAL AND REGULATORY FRAMEWORK FOR RESIDUE MANAGEMENT IN THE HORTICULTURE SECTOR

The National Environmental Management Authority (NEMA) is Kenya's paramount environmental enforcement agency.

NEMA has offices in all 47 counties[12] and is responsible for licensing and enforcing regulations concerning air quality, air pollution, water quality and the management and disposal of residues from horticulture production, processing, storage and transport. NEMA's ESIA (Environmental and Social Impact Assessment) Department (and its country-level inspectorates) is responsible for overseeing ESIA development and compliance. NEMA's Strategic Plan 2019-2024 focuses on "Green Economy for Sustainable Development" which is intended to support the use of renewable energy, production of crops using organic fertilizers and pest control methods, where possible, to improve the sustainability of horticulture production for Kenya's domestic and international markets.

Several aspects of government policy and regulation relate to the handling of residues from horticulture processing, including (i) residue treatment and residue disposal, generating biogas for own consumption or sale to other parties, (ii) generating electricity for own use or sale to other parties, including to the grid (i.e. Kenya Power), or to third parties utilising the grid, and (iii) producing bio-fuels (e.g. compressed biogas) for transport, cooking or other uses. Most of these policies are set and enforced at a national level.

Horticulture processing and production residues, and effluents associated with cleaning and disposing of those residues, are covered by both national and county laws and regulations primarily enforced by NEMA. The Environmental Management and Co-ordination Act (EMCA, 2012)[13] establishes legal and institutional mechanisms for the management of the environment. NEMA's Environmental and Social Impact Assessment (ESIA) Department is based in Nairobi with inspectorates in every county responsible for overseeing ESIA development and compliance. NEMA requires an Effluent Discharge License (EDL) for any facility generating effluents that could harm ground water, surface water or coastal waters, and effluent tests to ensure compliance is carried out at least annually by NEMA.[14]

IMPACT OF POLICIES ON BIOENERGY GENERATION BY HORTICULTURE SECTOR

When farms and businesses set up, they are required to undertake ESIAs under NEMA and to produce Environmental Management Plans (EMP) for any residues and effluent.

The management measures are outlined in annual audits which are undertaken to ensure compliance with the EMP. For the horticulture sector, licences issued by NEMA include: a) composting licences for management of agricultural residues; and, b) EDLs for liquid residue and waste water. Since bioresidue are considered low impact, licensing and compliance with EMPs in the horticultural sector is mostly enforced at the county level. The environmental institutional and regulatory setup is relatively neutral or agnostic about the use of horticulture residues for bioenergy, so there are no key environmental incentives or disincentives to utilise horticulture residues for bioenergy generation.

Overall, compliance on developing and adhering to ESIAs, EMPs and licences is fairly straightforward for most horticulture producers and processors. Their solid residues can usually be composted relatively easily to benefit their agricultural production and improve the quality of their land, while their liquid residues are minimal and easily dealt with. Consequently, organic residue disposal within NEMA's and county regulations is generally not very burdensome or onerous to producers and processors. For most producers and processors, AD does not, therefore, represent a highly attractive alternative to the current management systems that comply with NEMA rules, i.e. composting solids and treating liquids aerobically in ponds and constructed wetlands.

No supportive legal framework and no specific policy support are in place for producing upgraded biogas for transport, cooking or sale, although the regulatory framework exists and two small-scale biogas/bio-energy projects have been approved by the EPRA. Those interested in developing AD projects to produce gas for self-consumption or bottling for sale contact EPRA to confirm the safety and compliance requirements. A 'Letter of Adherence', 'Letter of No objection' or 'Terms and Conditions' is issued by EPRA, following a site visit by a multisectoral team comprising Kenya Bureau of Standards, NEMA and EPRA, to confirm compliance with safety and environmental standards. In the case of high-grade biogas, the current CNG (compressed natural gas) standards under the MoE apply in terms of storage,

[11] Source: www.nema.go.ke
[12] Environmental Management and Co-Ordination Act (EMCA), Chapter 387, 2012.
[13] An EDL is required under the Government of Kenya's Water Quality Regulation, Legal Notice 120, of 2006.

handling and transport, which - if found to conform - can be approved by EPRA for commercial production. A multisectoral team under EPRA's leadership may propose requirements for licensing or licences to be obtained, depending upon the extent of the operations, gas volumes and safety requirements. Thus far, while several proposed CNG projects (from natural gas) have been approved by the MoE, no biogas CNG project has been proposed to the EPRA. It should be noted that VAT was removed for biogas in the 2021 Finance Act 30 June 2021.

RECOMMENDATIONS

The following recommendations are proposed for policy, regulatory and market changes:

- The wide diversity of horticulture products, production and processing methods, and the wide geographical dispersal of producers require a flexible and technically adaptable approach to supporting bioenergy. Ideally, horticulture producers could aggregate their energy needs, from simple refrigeration to drying and packaging, to facilitate the development of relatively standardised technology approaches. This would enable economies of scale to be achieved in processing, as well as in the development of technical and technological bioenergy packages amongst producers and processors.
- Biomass remains almost absent from Kenya's electricity mix, yet power generation from horticulture processing would diversify supply and stimulate development in a sector that has seen exports and investments soar over the past two decades. It is strongly recommended that the feed-in tariff for bioenergy electricity, which is currently only USD 0.10 per kWh and not economically attractive, is reviewed to attract investment in biogas electricity generation.
- Reducing, or eliminating tariffs and import duties for AD technology (as done in the solar PV sector) would provide a significant boost for AD for biogas electricity generation and improve the competitiveness of the horticulture sector vis-à-vis Kenya's competitors.

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Transforming Energy Access

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