Food and Agriculture Organization
of the United Nations

BIOENERGY AND FOOD SECURITY (BEFS) ASSESSMENT AND CAPACITY BUILDING FOR ZAMBIA

February 2021

SDGs:	1 NO POVERTY, 2 ZERO HUNGER, 6 CLEAN WATER AND SANITATION, 7 AFFORDABLE AND CLEAN ENERGY
Countries:	Zambia
Project Codes:	TCP/ZAM/3701
FAO Contribution	USD 271 000
Duration:	1 August 2018 – 31 January 2021
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Implementing Partners

Ministry of Energy (MoE), Ministry of Agriculture (MoA), Ministry of Fisheries and Livestock (MFL), Ministry of Lands and Natural Resources (MLNR), Ministry of Water Development, Sanitation and Environmental Protection (MWDSEP) and Zambia Environmental Management Agency (ZEMA).

Beneficiaries

Small-scale farmers, government technical officers and policy-makers.

Country Programming Framework (CPF) Outputs

Outcome 2: To create and enhance the sustainable management of the existing agriculture related resource base, to be able to efficiently support vibrant and resilient agricultural production systems.

Strategic Objective/Organizational Outcomes

Strategic Objective: 4: Enable more inclusive and efficient agricultural and food systems.

Organizational Outcome: 402 – Country's designed and implemented policies, regulatory frameworks and institutional arrangements supportive of inclusive and efficient agrifood systems development.

Organizational Output: 40201 – Public sector organizations' capacities strengthened to design and implement national policies, strategies, regulatory frameworks and investments plans supportive of inclusive and efficient agricultural and food systems development.

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Background

In Zambia, current statistics indicate that 77 percent of the country's primary energy relies on traditional biomass, while only 4.4 percent of the rural population has access to electricity. This is compounded by the fact that 47.8 percent of the population in Zambia is undernourished and 60.5 percent lives below the national poverty line. Access to modern, affordable and reliable energy is fundamental to ensure development and food security and is directly related to the four pillars of food security. Bioenergy is a key form of renewable energy that can be sourced from a number of biomass options, including crop residues, livestock residues and sustainably managed forest resources and residues. When managed sustainably, it can provide multiple benefits, including energy provision, employment and rural development. The Government of Zambia has given high priority to developing a sustainable biomass energy strategy. However, while there are broad policy goals in place and targets have been set to tackle access to modern energy, there is insufficient evidence and knowledge to define which bioenergy pathways can contribute sustainably to the envisaged targets. To address these challenges, the Government of Zambia requested that FAO provide technical assistance to enhance capacity to analyse options for the development of a sustainable bioenergy sector in the country.

Impact

A body of evidence and knowledge was generated to support the bioenergy policy development process. This will greatly aid the Government of Zambia's efforts to identify economically viable bioenergy supply chains and ultimately develop a sustainable bioenergy sector; as well as indirectly contributing to creating income-generating opportunities for youth and rural communities (e.g. the production or selling of briquettes, supply of bioenergy feedstock).

Achievement of results

The project successfully enhanced national capacity to identify sustainable bioenergy supply chains and analyse existing options for developing a sustainable bioenergy sector in the country, through a number of interventions, as summarized below.

A set of Bioenergy and Food Security (BEFS) Rapid Appraisal Tools was provided, and numerous officers from key stakeholder institutions were trained on the BEFS Approach and on how to use the data analysis tools, enabling them to conduct rapid appraisals with relatively limited data. The BEFS Approach and tools enable the country to understand what is required to develop sustainable bioenergy supply chains, and the implications of changes in the energy sector and biomass availability.

In addition to data collection from available sources, surveys about the generation and use of wood-processing residues, agriculture, agroprocessing and livestock residues were carried out. The BEFS project team developed a crop residue module, which was incorporated as an additional section into Zambia's annual crop forecast survey. This will allow the country to collect statistics on agricultural residues and their uses for the following years.

A Bioenergy Working Group was set up to ensure a multisectorial approach throughout the project. The group members and other technical experts/stakeholders provided valuable inputs for the assessments that were conducted. These comprised a Bioenergy Assessment on Rural Energy and a Bioenergy Assessment on Transport. For the second assessment, a review of national policies and technical literature relevant for the establishment of a market for liquid biofuels production and supply in Zambia was completed. A techno-economic analysis was also carried out, involving a technical assessment of the potential for establishing ethanol and biodiesel production facilities based on the nationally produced feedstock, and an economic assessment of the financial viability of such facilities and the competitiveness of the respective products, namely ethanol and biodiesel.

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A final project report, "Sustainable Bioenergy Potential in Zambia - An integrated bioenergy and food security assessment", was prepared. The findings were reviewed by the Bioenergy Working Group members/focal points of the line ministries before the results were presented to a wider group of stakeholders during the final project workshop. In addition, the main objectives of the Bioenergy Action Plan, including the timeline and targets, were defined, and the findings of the Integrated BEFS Assessment were incorporated in the draft plan. The Bioenergy Action Plan provides evidence and knowledge that should support the process of identification of sustainable bioenergy supply chains. It is currently awaiting finalization by the Government.

Implementation of work plan and budget

The start of the project was slightly delayed. The implementation of project activities progressed, however, towards the end of the project implementation was delayed, owing to the outbreak of COVID-19. Members of the Lead Technical Unit were unable to travel for a planned training and end of project meeting because of travel restrictions. The project was scheduled to end in March 2020, but was extended at no cost until 30 November 2020, and a second no-cost extension was requested and approved, until 31 January 2021, in order to complete project activities.

The project benefited from synergies created with the previous (2015) Rural and Agricultural Livelihood Surveys (RALS) and 2019 Crop forecast survey undertaken by the Zambia Statistics Agency (ZamStats - formerly the Central Statistical Office), in collaboration with the MoA and the MFL.

Potential negative consequences to the project were identified and managed well throughout the project. Of the identified risks only one materialized, namely lack of sufficient/reliable data to perform the BEFS assessment, and therefore the planned mitigative measure of conducting technical consultative meetings was used.

Follow-up for government attention

It is recommended that follow-up activities include the following: i) focusing a more detailed analysis on the options of interest, according to the results of the project; ii) identifying regions/districts in which the sustainable bioenergy options can be deployed or piloted; and iii) establishing a wider bioenergy support mechanism, building on the lessons learned and on the evidence generated by the project.

In addition, it is advised that donor funding be sought to extend the capacity-building process implemented during the project to lower-level government structures (provinces and districts), in order to further ensure sustainability of the project.

Finally, local energy experts from stakeholder institutions now have technical capacity/ability to pursue some project activities further, as a result of the capacity that was built during the project. However, financial assistance may be required to enable them to conduct certain field activities. In this context, the BEFS Rapid Appraisal tools provided should allow them to carry out analysis on limited amounts of data, without having to conduct costly surveys.

Sustainability

1. Capacity development

The project built the capacity and enhanced the collaboration of government stakeholders in defining how to move the bioenergy strategy forward in the country, and to provide the evidence to support the bioenergy policy formulation process.

Several partnerships were created during the project (Cotton Association of Zambia, SNV and ZESCO Limited), while existing ones were strengthened (Ministry of Energy [MoE], Ministry of Agriculture [MoA], Ministry of Fisheries and Livestock [MFL], Forestry Department of the Ministry of Lands and Natural Resources [MLNR], ZamStats and Zambia Environmental Management Agency [ZEMA]).

The project design and approach envisaged the development of a solid foundation for subsequent or follow-up initiatives through; i) direct involvement of the MoE and other government agencies during the data collection and analysis phases of the project; and ii) the provision of capacity-development training sessions on the BEFS approach and tools, enabling the country to keep updating the current analysis as energy demand and biomass supply evolves.

2. Gender equality

The project partially met its target on gender (Encourage participation of women in the capacity-building training workshops, which would enable fair and gender-sensitive capacity development on bioenergy policy formulation), in that 12 of the 46 trainees were women. However, it was not possible to establish a perfectly gender-balanced group of trainees, as the participants were nominated by stakeholder institutions.

By achieving the project's expected outcome (Enhanced capacity to analyse options for the development of a sustainable bioenergy sector in Zambia), men and women benefited equally, because both have the opportunity to spend less on transport and cooking fuels.

In addition, the project ensured the participation of women in training sessions, to enable fair and gender-sensitive capacity development on bioenergy policy formulation.

3. Environmental sustainability

Through the workshops and field surveys conducted, the project exchanged experiences among national experts, biomass processing plants and farmers on sustainable utilization of biomass residues generated during the production processes, to ensure environmental sustainability. In addition, the analysis of data collected during the BEFS assessment identified key environmental benefits, such as potential wood/forest savings, resulting from the use of improved charcoal production technologies, as well as avoidable greenhouse gas emissions.

4. Human Rights-based Approach (HRBA) – in particular Right to Food and Decent Work

As mentioned above, by generating evidence and knowledge to support the bioenergy policy development process, the project indirectly contributed to creating income-generating opportunities for youth and rural communities. When managed sustainably, bioenergy can provide multiple benefits, including energy provision, employment and rural development.

5. Technological sustainability

The technology introduced was very appropriate, as the BEFS Approach and the Rapid Appraisal tools take into account the local or country context, and have adjustable default values for various parameters. In addition, the data analysis tools enable the user to run an analysis with a minimal amount of information available, which is very helpful for decision-makers, when lack of time or finances limit their capacity to carry out a full-fledged survey.

The project contributed significantly to the development of local knowledge, capacity, resources and good practices. Before the project was implemented there was no data on available quantities of residue from forest plantation harvesting, wood processing, agriculture, agroprocessing and livestock production. Therefore, the capacity built in local energy experts from stakeholder institutions, in addition to the evidence and knowledge generated by the project, should certainly enhance the local capacity and knowledge base.

6. Economic sustainability

No additional funding was allocated to the sector or subsector programme as a result of this project. However, ongoing efforts to showcase the need for a piloting phase in one or two districts could lead to some additional funding to the programme.

BEFS Rapid Appraisal tools were developed and provided to project beneficiaries/stakeholders, to be used free of charge.

Documents and outreach products

- FAO's BEFS Approach and BEFS Assessment for Zambia. PowerPoint presentation. October 2018.
- BEFS Approach and BEFS Rapid Appraisal training materials. PowerPoint presentations and Word documents. April 2019.
- BEFS Approach and BEFS Rapid Appraisal training materials. PowerPoint presentations and Word documents. July 2020.
- BEFS Bioenergy Assessment for Zambia – The Sustainable Bioenergy Potential in Zambia: Presentation of Results. PowerPoint presentation. December 2020.
- The Bioenergy and Food Security Roadmap for Zambia. PowerPoint presentation. December 2020.
- **FAO/Government of Zambia.** 2020. Sustainable Bioenergy Potential in Zambia – An integrated bioenergy and food security assessment (online and hard copy report). 245 pp.
- **FAO.** October 2018. Zambia tackles challenges related to biomass energy. Available at http://www.fao.org/africa/news/detail-news/fr/c/1161914/.

Achievement of results - Logical framework

Expected Impact	Improved bioenergy policy processes based on evidence resulting from information from trained practitioners/ experts	
Outcome	Enhanced capacity to analyze options for the development of a sustainable bioenergy sector in Zambia	
	Indicators	1. Bioenergy Assessment at National Level completed. 2. Capacity building on Bioenergy and Food Security completed. 3. Bioenergy Action Plan prepared.
	Baseline	1. 0 2. 0 3. 0
	End Targets	1. One BEFS Assessment. 2. Four. 3. One Bioenergy Action Plan document.
	Comments and follow-up action to be taken	1. In addition to data collection from available sources, surveys about the generation and use of wood-processing residues, agriculture, agroprocessing and livestock residues were carried out. The BEFS project team developed a crop residue module, which was incorporated as an additional section into Zambia's annual crop forecast survey. This will allow the country to collect statistics on agricultural residues and their uses for the following years. 2. The BEFS project trained a total of 46 energy officers (12 women and 34 men) from different key stakeholder institutions (MoE, MoA, MFL, Forestry Department of MLNR, ZESCO Limited, the Rural Electrification Authority (REA), ZEMA and ZamStats) on the BEFS Approach and the BEFS Rapid Appraisal (RA) tools. The training provided was on the approach, including hands-on training to use the tools, and the implications for the national policy formulation process. In addition, the project held a series of technical workshops with various government and non-government stakeholder institutions, where technical aspects of the analyses carried out were discussed, including assumptions on data and aspects of energy, agriculture, forestry and other related sectors. 3. A Bioenergy Working Group was set up to ensure a multisectorial approach throughout the project, bringing together key players, such as MoE, MoA, MFL, Forestry Department of MLNR, ZESCO Limited, REA and ZamStats. The Bioenergy Working Group was led by MoE, the project counterpart. A final project report, "Sustainable Bioenergy Potential in Zambia - An integrated bioenergy and food security assessment", was prepared, as soon as the collected data had been analysed. The findings were reviewed by the Bioenergy Working Group members/focal points of the line ministries before the results were presented to a wider group of stakeholders during the final project workshop. The workshop participants were also invited to provide views and comments. The main objectives of the action plan, including the timeline and targets, were defined; and the findings of the BEFS Assessment were integrated in the draft Bioenergy Action Plan. FAO (Publications and Library, Office of Communications) signed a copublishing agreement with the Government of Zambia (MoE) for the publication of the BEFS assessment results, and proposed the next steps, with a view to circulating copies among stakeholders.

Output 1	BEFS Capacity Building and Multi-stakeholder Institutional Dialogue		
	Indicators	Target	Achieved
	Number of officers from key stakeholder institutions trained in use of BEFS Approach and BEFS Rapid Appraisal Tools.	46 (12 women, 34 men).	Yes
Baseline	0		
Comments	National experts were trained on the BEFS Approach and BEFS Rapid Appraisal tools, and technical consultations on residues from forest plantation harvesting, wood processing, agriculture, agroprocessing and livestock production were carried out.		
Activity 1.1	Inception		
	Achieved	Yes	
	Comments	The project was successfully launched in October 2018, and its objectives were reviewed and confirmed with the stakeholders. The key line ministries were notified regarding the need for them to nominate focal points. These focal points then formed the Bioenergy Working Group for the project.	
Activity 1.2	Stakeholder meetings		
	Achieved	Yes	
	Comments	Regular and ad hoc meetings of the Bioenergy Working Group and other relevant stakeholders were held throughout the project, organized in collaboration with MoE. The Bioenergy Working Group members and other technical experts or stakeholders were keen participants, and provided valuable inputs for the assessments.	
Activity 1.3	Identify trainees		
	Achieved	Yes	
	Comments	The identification of trainees was done by the Bioenergy Working Group, who requested that the key stakeholders nominate officers who could represent their respective institutions.	
Activity 1.4	Technical consultation		
	Achieved	Yes	
	Comments	A total of four technical consultation meetings were held on the following topics: crop residues, livestock residues, woody residues and energy generation and demand. The participants were technical experts from tMoA, MoE, Department of Forestry under MLNR, REA, Poultry Association, Dairy Association, Zambia Sugar Plc., University of Zambia, etc. This allowed the project team to consult local experts on the accuracy of the data gathered, and on the assumptions made in the analysis, as well as on alternative data sources when data was not available. With some participants, bilateral follow-up meetings were held. The experts provided data and other inputs, which were included in the assessment.	
Activity 1.5	BEFS Trainings		
	Achieved	Yes	
	Comments	The project succeeded in building capacity in technical experts (46) from key stakeholder institutions on the BEFS Approach and on how to use the BEFS Rapid Appraisal tools. A three-day in-person training course was coorganized with MoE. As a result of the technical training sessions and technical meetings, ZESCO requested that a follow-up training session be organized, focusing on off-grid rural electrification opportunities, and a three-day virtual training course for energy officers from line ministries was conducted. Participants of the workshop included officers from the Department of Energy and ZESCO Limited, as well as REA. A total of 24 participants (six women and 18 men) were trained.	

Output 2	BEFS Bioenergy Assessment – Rural Energy		
	Indicators	Target	Achieved
	Bioenergy Assessment on rural energy at national level completed.	One national BEFS Assessment on rural energy carried out.	Yes
Baseline	0		
Comments	Both the data collection process and the BEFS Assessment on rural energy were completed successfully, including input and expertise from national and local experts.		
Activity 2.1	Policy and literature review		
	Achieved	Yes	
	Comments	The policy and literature review was conducted in the form of a review of national policies, sector strategies, and other relevant literature on the energy sector. The review was also complemented with additional consultations and discussions with the Bioenergy Working Group members and technical experts from relevant ministries.	
Activity 2.2	Feedstock and data		
	Achieved	Yes	
	Comments	The feedstock data collection process was successfully completed. Initially, in consultation with the Bioenergy Working Group, a list of suitable feedstocks for the production of cooking electricity generation was agreed, and data requirements were defined. The project team then proceeded with data collection from the existing sources and field surveys on non-existent or partially available data.	
Activity 2.3	Rural energy biomass assessment		
	Achieved	Yes	
	Comments	Based on agricultural production (crop and livestock), forest plantations management plans and volumes of processed wood, the availability of biomass residues (crop residues, livestock residues and woody residues) was assessed. The minimal spatial unit for the assessment was the district. The results were then aggregated to province and national level.	
Activity 2.4	Rural energy techno economic assessment		
	Achieved	Yes	
	Comments	Following on from the biomass assessment, the techno-economic assessment of the rural bioenergy supply options was completed. The BEFS assessment methodology was further developed and adapted to the Zambian context. The results illustrated the contribution of the assessment and analysis to the targets set out in the national energy and climate policy goals. The techno-economic analysis encompasses technologies for biomass cooking fuels production (biogas, briquettes, charcoal briquettes and efficient charcoal production) and rural off-grid electrification (gasification and combustion of agricultural residues).	
Activity 2.5	Assessment report		
	Achieved	Yes	
	Comments	The results of the rural energy assessment were an integral part of the final project report "Sustainable Bioenergy Potential in Zambia - An integrated bioenergy and food security assessment".	

Output 3	BEFS Bioenergy Assessment - Transport		
	Indicators	Target	Achieved
	Bioenergy Assessment on Transport at national level completed.	BEFS Assessment on Transport completed.	Yes
Baseline	0		
Comments	The results were initially discussed with the relevant stakeholders and then presented during the final project workshop: Presentation of the BEFS Assessment Results in December 2020.		
Activity 3.1	Policy and literature review		
	Achieved	Yes	
	Comments	The review of national policies and technical literature relevant for the establishment of a market for liquid biofuels production and supply in Zambia was conducted. The gathered information was of key importance for defining the scope of the analysis and later interpretation of the results.	
Activity 3.2	Feedstock and data		
	Achieved	Yes	
	Comments	The feedstock data collection was successfully completed. The first step was to define the possible crops to be used as feedstock for liquid biofuels production and to define the data required. As soon as this was completed, the team proceeded with data collection from the existing sources. The information, which was not publicly available, was obtained from the line ministries and other public organizations. In addition, during the process of feedstock definition and data collection the Bioenergy Working Group members consulted. They verified the collected data and helped in gathering further information.	
Activity 3.3	Transport Biomass Assessment		
	Achieved	Yes	
	Comments	Considering the prevailing agroclimatic conditions and the potential attainable yields of the considered crops, it is evident that there is high potential for intensification of agricultural production, and therefore increased yields. Furthermore, the records on land cover change over the past decade show high levels of forest cover losses, where agricultural expansion is recognized as the main driving force for deforestation. Therefore, given the existing yield gap in agriculture production and the need to limit land expansion, the only option to produce the biomass required for the transport sector would be through intensification.	
Activity 3.4	Transport techno economic assessment		
	Achieved	Yes	
	Comments	The techno economic analysis included a technical assessment of the potential for establishing ethanol and biodiesel production facilities based on the nationally produced feedstock, and an economic assessment of the financial viability of such facilities and the competitiveness of the respective products, i.e. ethanol and biodiesel.	
Activity 3.5	Assessment report		
	Achieved	Yes	
	Comments	The report on transport assessment is an integrated part of the final project report “Sustainable Bioenergy Potential in Zambia – an integrated bioenergy and food security Assessment”.	

Output 4	Draft Bioenergy Action Plan		
	Indicators	Target	Achieved
	Bioenergy Action Plan prepared.	One Bioenergy Action Plan prepared.	Yes
Baseline	0		
Comments	A Bioenergy Working Group, spearheaded by project focal points from line ministries and government departments, was set up to enhance collaboration and coordination with the project's lead technical unit in the formulation of a bioenergy action plan. Input for the Bioenergy Action Plan was developed and submitted to the Government of Zambia, and is awaiting finalization by the Government.		
Activity 4.1	Roadmap focal points		
	Achieved	Yes	
	Comments	The selection of focal points for the development of a Bioenergy Action Plan was done without any difficulty, because the project used the Bioenergy Working Group.	
Activity 4.2	Roadmap objectives and timeline		
	Achieved	Yes	
	Comments	The main objectives of the action plan, including the timeline and targets, were defined.	
Activity 4.3	Evidence from assessment into roadmap		
	Achieved	Yes	
	Comments	The findings of the Integrated BEFS Assessment were integrated into the draft Bioenergy Action Plan. In view of available biomass resources in identified top-performing districts in the Southern and Eastern provinces, the project team developed the following two concept notes: i) a concept note for the utilization of livestock residues (i.e. deployment of biogas digesters) in Kalomo District; and ii) a concept note for the briquetting of cotton stalks in Lundazi District. The two concept notes were developed to facilitate resource mobilization efforts.	
Activity 4.4	Roadmap workshop and finalization		
	Achieved	Yes	
	Comments	The Final Project Workshop, Presentation of the BEFS Assessment Results, took place on 3 December 2020. Owing to the prevailing circumstances related to the COVID-19 pandemic, the workshop was organized as a hybrid event. During the workshop, the project team presented the Roadmap to project stakeholders, proposing a list of viable actions and pilots that should be considered, in order to capitalize on available biomass resources in the country. A total of 35 participants attended the workshop (21 physically and 14 virtually; six women and 29 men). Institutions represented included MoE, MoA, Ministry of Commerce, Ministry of Finance, MFL, Forestry Department of MLNR, ZamStats, Zambia Development Agency, Zambia Integrated Forest Landscape Program, ZESCO Limited, ZEMA, Biofuels Association of Zambia, Cotton Association of Zambia, Industrial Development Corporation, Japan International Cooperation Agency, United States Agency for International Development, as well as the European Union. In terms of media coverage, the event was covered by the national broadcaster, a radio station and a newspaper.	

Partnerships and Outreach
For more information, please contact: Reporting@fao.org

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