



Policy Brief

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Science into Policy: Participatory Development of Biomass Energy Regulatory Instruments in Kenya

Abstract

Biomass energy, mainly as solid biomass charcoal and firewood (woodfuel), plays a significant role as cooking energy in Kenya, as in many other countries in Africa. Despite its multiple benefits, unsustainable practices have negative environmental and health impacts. Efforts to transition from woodfuel to other forms of cooking energy have been in place for many years, but woodfuel still remains the key cooking fuel in Kenya due to its affordability and accessibility, cultural norms, as well as lack of access to affordable clean cooking alternatives.

The Government of Kenya realized the need to have an effective regulatory framework in place to address the negative environmental and health impacts of woodfuel, while optimizing its benefits and in line with its targets in addressing health and achieving low carbon climate resilient development. Following consultation

with key stakeholders in 2020 and 2021, the Bioenergy Strategy, 2020–2027, charcoal and carbonized briquettes standards and Value Added Tax (VAT) exemption for sustainable briquettes, biogas and denatured bioethanol energy were introduced.

To bridge the science-policy gap, scientists must engage beyond providing written documents and oral presentations to become key stakeholders. Prior and participatory engagement and dialogue with policymakers and implementors is essential to build trust and confidence. This brief illustrates the role of science and stakeholder engagement in developing policy regulation instruments in Kenya and highlights the need for scientists to actively participate in dialogue with policymakers and implementors on an ongoing basis, a role that needs to be built into research processes.

1. Introduction

Kenya is one of the few countries in Africa with regulations around sustainable biomass energy use and production. In this brief, we focus on the development of the three policy instruments that will shape the solid biomass energy sector: the Kenyan Bioenergy Strategy (2020–2027), standards for charcoal and carbonized briquettes, and the exemption of Value Added Tax (VAT) on sustainable biomass energy products achieved in 2020 and 2021. The objective of this brief is to illustrate that transformative policy change is possible when informed by science through a participatory process. Developing the three instruments to regulate the biomass energy sector involved presentation of data and stakeholder discussions on the scientific evidence of the role of bioenergy in Kenya, its socio-economic, health and environmental impacts, innovations to make its use and production sustainable, development of regulatory instruments, development of standards for quality control and request for VAT exemption to the national Treasury. The lessons learned can be applied in research and development, entrepreneurship and policy development and are replicable and adaptable for countries in the Global South who aim to achieve sustainable biomass energy use and production at scale.

Development of the three regulatory instruments described in this brief shows that scientific evidence coupled with stakeholder engagement are key. Biomass energy is frequently used at the household and commercial levels, and stakeholder engagement needs to include relevant institutions such as scientific and academic, private sector, development practitioners and funding stakeholders in national policy development. Without inclusive participation of these groups and information on gender perspectives/ approaches in local context, policies can be undermined by well-meaning innovative programs that are unsustainable and unacceptable to local conditions. The co-authors of this brief represent a diverse team of a few of those that were that were involved in the processes hence illustrate the important role of stakeholder engagement in turning science into policy.

1.1 Benefits and sustainability challenges of biomass energy in Kenya

About a third of the world's population and 90 percent of sub-Saharan Africa relies on solid biomass as fuel for traditional cooking appliances (IEA 2017). Woodfuel (charcoal and firewood) is the most commonly used form of biomass energy in Kenya and is favoured by many for its accessibility, low cost and compatibility with local cooking cultures. Further, woodfuel is also used for household heating and well as the key source of energy in food preparation in local schools and eateries. Women are primarily responsible for collecting firewood in Kenya (Njenga et al., 2021a). Efforts to transition from woodfuel to other forms of cooking energy

have been in place for many years, but a complete shift is yet to happen.

To meet their diverse cooking and heating needs, households supplement woodfuel with substitution fuels, a practice known as fuel stacking; similarly, even households that adopt efficient cooking technologies still retain the use of traditional cookstoves (stove stacking) (MoE and CCAK 2019; KNBS 2019; Gitau et al., 2019; Ochieng et al. 2020; ESMAP, The World Bank 2021; Njenga et al. 2021a;). This behaviour complicates the transition away from woodfuel, as the persistence of stacking means that households have strong preferences for cooking with stoves that use woodfuel (and substitutions) (Figure 1). In the Kenyan population census of 2019, 67 percent of households (84 percent rural and 9 percent urban) use firewood as their main source of cooking fuel. Charcoal is the main source of cooking fuel for 12 percent of the population (8 percent rural and 18 percent urban) (KNBS, 2019). Liquid petroleum gas (LPG) is the main source of cooking fuel for 24 percent of the population (6 percent rural and 53 percent urban {mainly high and middle income}).

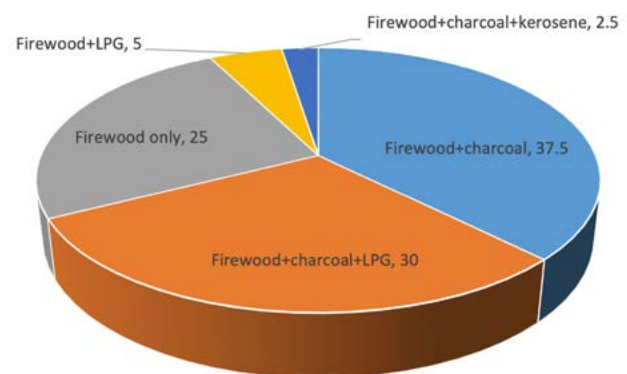


Figure 1: Household cooking energy stacking in rural Kiambu County, Kenya (Njenga et al., 2021a)

The negative impacts of unsustainable woodfuel production and use in Kenya and globally are significant and include land degradation, deforestation, loss of biodiversity, climate change and health impacts specifically on women and children. For example, in Kenya, 38–41% of wood used for woodfuel (mainly charcoal) is sourced unsustainably. Use of inefficient kilns in charcoal production results into wood wastage and air pollution and about 21,560 deaths occur every year from illnesses associated with household air pollution (HAP) from biomass burning. Additionally, women suffer huge energy burdens in firewood collection (Bailis et al. 2015; MoE & CCAK 2019; Njenga et al. 2021a).

Recognizing the significant environmental and health impacts of unsustainable production and use of woodfuel as a source of household energy and for commercial purposes, the Government of Kenya, through the Ministry of Energy, commissioned development of the Bioenergy Strategy 2020–2027, which outlines solutions to enhance sustainability in

biomass production and efficiency in processing, use and energy recovery from bioresources. A systems approach was considered to ensure that improvements are made at every stage of the woodfuel value chain as described in section 1.2.

1.2 Systems approach for sustainable woodfuel

For effective improvement of woodfuel (charcoal and firewood) use, it is important to apply a systems approach that considers every stage of the life cycle: wood production and harvesting, processing, transportation, trade and use, and connection with other socio-ecological systems and contexts. The systems approach is critical as performance in one stage of the woodfuel supply chain impacts other stages as well as related socio-ecological systems/contexts, as shown in Figure 2. This

approach involves multiple governments and departments as described in section 1.3 calling for a coordinated process.

1.3 Policy framework on woodfuel in Kenya

In Kenya, woodfuel management and regulation is the mandate of multiple government ministries and departments, which poses a challenge for coordination and enforcement. For example, tree growing and management falls under the Ministry of Agriculture, Livestock, Fisheries and Co-operatives and Ministry of Environment and Forestry, while that of processing and use is under the Ministry of Energy. Woodfuel transportation and marketing are also the responsibility of different ministries. Figure 3 gives an example of the charcoal value chain in Kenya with multi-layered responsibilities.

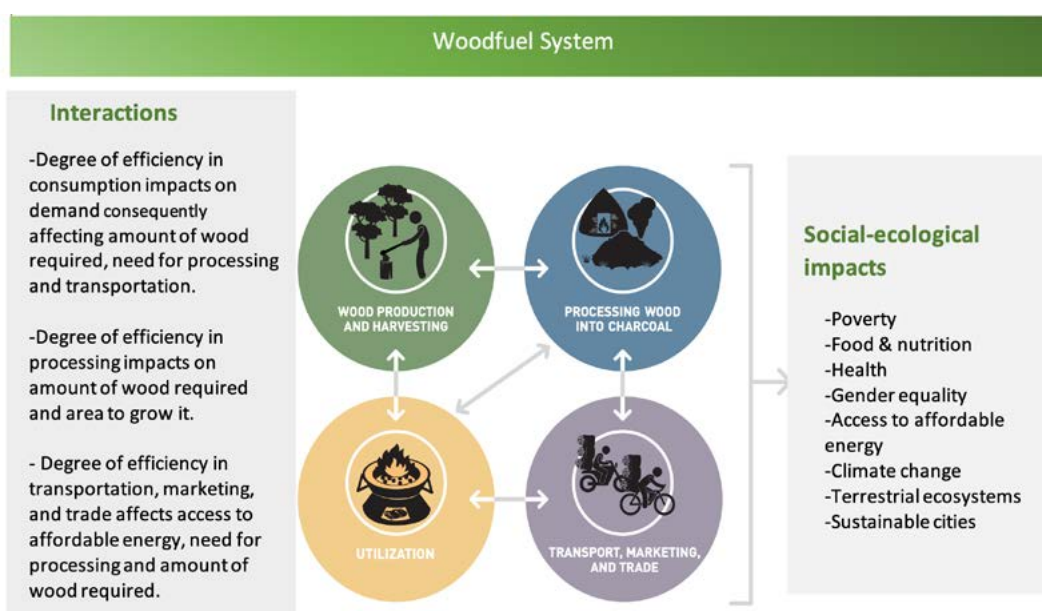


Figure 2: Components of the woodfuel system and how the performance of one influences other systems Njenga et al. 2021b

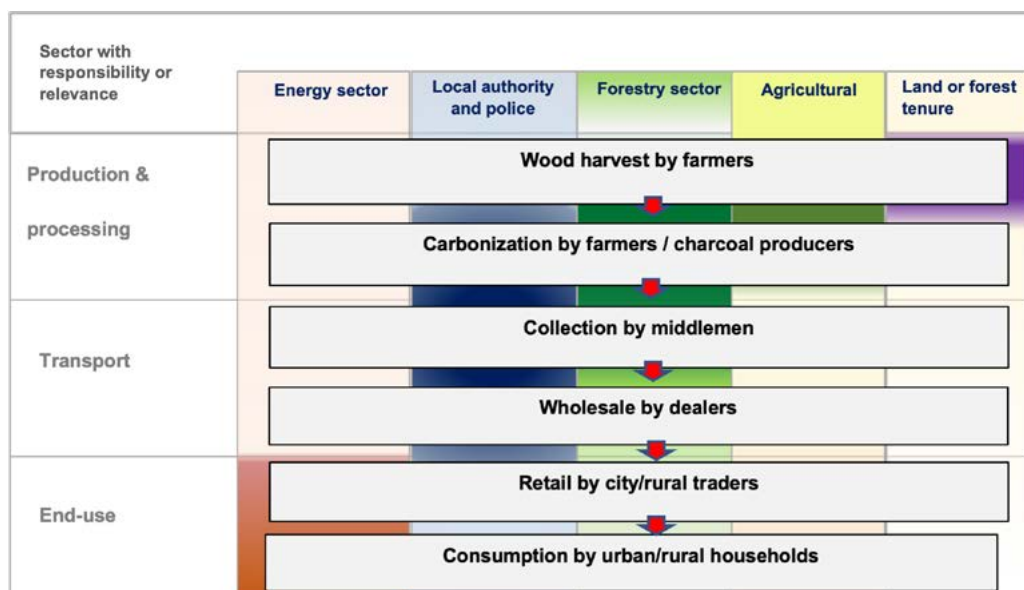


Figure 3: The charcoal value chain in Kenya, showing activities, actors and formal/informal regulatory sectors Notes: The darker the colour, the greater the responsibility (Infographics by Miyuki Iiyama)

The policy mechanisms that regulate the woodfuel sector in Kenya are set out in Table 1. While Kenya has attempted to address unsustainability in the sector before, the policies have been ineffective and led to negative consequences, such as loss of government revenue and illegal logging for unsustainable charcoal production. In response to these ineffective policies, the Ministry of Energy developed the Bioenergy Strategy in 2020, designed to guide the sector towards sustainability.

Table 1: Kenyan bioenergy regulatory instruments

Policy mechanism	Objective
Sustainable Energy for All	Roadmap for achieving SDG 7 – Access to clean and affordable energy
Africa Bioenergy Policy Framework and Guideline 2020–2027	Informed development of Kenya's Bioenergy Strategy
Bioenergy Strategy, 2020–2027 (Ministry of Energy)	Provides framework to address the negative consequences of ineffectual woodfuel policies
The Energy Act, 2019	Provides framework for regulating and licensing production, transportation, and distribution of biomass fuels
The National Energy Policy, 2018	Recognizes the importance of biomass fuels as the primary energy for rural and peri-urban areas and the need for sustainable management
National Climate Change Action Plan (2018-2022)	Development of bioenergy resources on the priority areas, specifically clean cooking solutions, restoration of forests and agroforestry
Forest Conservation and Management Act, 2016	Regulates the production, transportation, and marketing of charcoal through the Kenyan Forest Service
Draft energy regulations of 2013 (improved biomass cookstoves)	Sets out the classes and requirements for licensing for installation, maintenance, manufacture, importation and distribution of cookstoves
Forest (Charcoal) Rules of 2012	Regulates the sustainable production, transportation and marketing of charcoal
Article 42, Kenyan Constitution, 2010	Obligates clean and healthy environment for all

2. Development of policy instruments to regulate biomass energy in Kenya

In the Section 2 we explore three case study processes followed in developing three selected policy instruments to regulate biomass energy production and use in Kenya. The first case study describes the development process for the bioenergy strategy 2020–2027 which proposes short-term and short to medium-term interventions. The second and third case studies describe initial implementation of the short to medium-term recommendations made in bioenergy strategy.

2.1 Case study I: Bioenergy Strategy, 2020–2027

The Kenyan Bioenergy Strategy, 2020–2027, published by the Ministry of Energy, includes a synthesis of available scientific evidence on the extent of production and use of biomass energy resources in Kenya.

The momentum to develop a bioenergy strategy that governs bioenergy production and use in Kenya and is aligned with the Sustainable Energy for All Action Agenda (2016), Energy Policy 2018 and the Energy Act 2019, was revitalized in early 2018 by the Ministry of Energy. The objectives of the Bioenergy Strategy are to support (i) national and county governments' renewable energy priorities and intentions to deliver modern energy solutions from available biomass energy feedstock through innovation and consultation and (ii) development of biomass energy to meet the long-term sustainable energy demand.

In an entirely consultative process, the national bioenergy committee worked with researchers, trainers and academics, government ministries, the private sector and civil society organizations to set the vision and goals of the strategy, identify areas of focus, gather and synthesize available evidence and develop the implementation plan.

The Bioenergy Strategy was launched in November 2020, and the action plan to operationalize the strategy was initiated in 2021. The Bioenergy Strategy theory of change is summarized in Table 2.



Retork Kiln Fusion Experience, Nairobi

Box 1. Role of science and stakeholder engagement in development of the bioenergy strategy.

Scientists and other organizations involved in research and development were involved in the following:

- Gathering and synthesizing scientific evidence on the production, use and benefits of sustainable biomass energy as well as entrepreneurship opportunities
- Assessment of the current challenges facing best practices in the production and use of woodfuel in Kenya.
- Co-development of a theory of change with all stakeholders involved
- Inputs to the strategy document and providing technical support to the government in drafting the document
- Validation of soundness of the evidence informing the strategy.
- Gender integration
- Integration of evidence-based innovations, and monitoring and evaluation
- Stakeholder meetings
- Prior working relationship with the Ministry of Energy hence and earned the trust to be invited in the process

Strategic interventions under the Bioenergy Strategy

The Bioenergy Strategy, 2020–2027, recommends short- and medium-term actions.

The short-term (2020–2022) strategic interventions are:

- Enhancing policy, regulatory and institutional frameworks for effective delivery and coordination of bioenergy programs;
- Comprehensive mapping of the country's bioenergy resources with potential for bioenergy development;
- Enhancing sustainable bioenergy feedstock production in urban, peri-urban and rural spaces; and
- Evaluating the viability of reviving bioethanol blending with gasoline for transport sector consumption.

The short- to medium-term (2020–2027) strategic interventions are:

- Strengthening research capacity to better inform bioenergy policy and support sector development through assessment of existing gaps and opportunities;
- Transitioning to clean cooking fuels and technologies;
- Mobilizing financial resources for local bioenergy development;
- Strengthening cooperation between the health and energy sectors for clean cooking;
- Promoting awareness and communication; and
- Supporting and facilitating private sector involvement in bioenergy development.

Table 2: Theory of Change for the Bioenergy Strategy, 2020–2027 (MoE, 2020)

Inputs	Activities	Outputs	Outcomes	Development Goal
<ul style="list-style-type: none"> - Robust delivery and coordination mechanism at Directorate of Renewable Energy (DRE) - Strong multi-stakeholder partnerships organized around innovation platforms - Access to finance - Endorsed strategic interventions 	<ul style="list-style-type: none"> - Adaptive planning and implementation of selected strategic bioenergy interventions - Establishing the enabling environment for respective interventions including mobilizing funding, building capacity, setting policies and regulations, developing markets, soliciting political will and assessing infrastructure status - Mobilizing sustainable feedstock production, waste management, and incentivizing private sector investment in rolling out clean fuels 	<ul style="list-style-type: none"> - Policy options, regulations, sustainability standards and rules - Resource assessments and databases - New bioenergy markets - Innovation platforms - New bioenergy technologies - Innovative financing mechanisms and models 	<ul style="list-style-type: none"> - Full transition to clean cooking with bioethanol and biogas by at least 50% of all households; complete switch to improved charcoal kilns; at least 50% of households are lighting with power from bioenergy systems by 2027 - Self-sustaining bioenergy businesses are running, thriving markets, green jobs in value chains, and increased incomes - Improved respiratory health outcomes among women and children; better social indicators - Increased biomass production, healthy ecosystems and cleaner local environments 	<ul style="list-style-type: none"> - Access to modern, clean, affordable and sustainable energy for all

The interventions proposed in the strategy in improving the sustainability of biomass production and enhancing efficiency in processing and use of bioenergy is aligned to Kenyans Nationally Determined Commitments (NDC) to abate GHG emissions by 30% by 2030 (GoK, 2018).

2.2 Case Study II: Charcoal and carbonized briquette standards

Standards provide rules, guidelines and technical specifications of a product or activity, established by consensus and approved by a recognized body. The sustainable charcoal and carbonized briquette standards for Kenya were developed through a consultative process involving a series of technical reviews of existing literature on the quality of both charcoal and carbonized briquettes and were launched in December of 2020. Prior to this, the briquette sub-sector in Kenya applied the South African National Standard 1399:2008. There was need to develop standards that are suitable for the quality recorded in Kenyan context and add some parameters such as density as well the methodology applied in the country. The aim of the standard is to ensure that producers supply charcoal and carbonized briquettes of consistent quality, making them desirable and reliable. Standards also assist customers to identify themselves with the quality and characteristics of the products purchased, and derive comfort from supporting the charcoal and briquettes sectors

Led by the Kenya Bureau of Standards (KEBS), preparation of national standards for charcoal and carbonized briquette production began in 2019 following national procedures: proposal, committee review, public review, balloting, approval and publication. These procedures are coordinated by a technical committee comprising KEBS officials and sector stakeholders from research institutes, academia and NGOs, etc.

KS 2912:2020: Solid Biofuel – Sustainable Charcoal and Carbonized Briquettes for Household and Commercial Use was approved in December 2020 and defines the required quality specifications for KEBS certification for traded charcoal and carbonized briquettes.

The specification was developed using scientific evidence from research on combustion and durability quality as summarized in Table 3. Data on quality of charcoal and carbonized briquettes was sourced from Kenya Forest Research Institute, Kenya Industrial Research Institute, World Agroforestry (ICRAF), University of Nairobi and published literature such as Oduor and Githiomi 2013 and Njenga et al. 2013.

Box 2. The role of science and stakeholder engagement in development of the charcoal and carbonized briquettes standards:

- Provision of data on the quality of charcoal and carbonized briquettes and their impact on public health and the environment.
- Providing examples of carbonized briquette entrepreneurship and its role in energy recovery from bioresources.
- Discussions on the feasible standards that enable commercialization of sustainable charcoal and carbonized briquettes while considering social, economic and environmental implications.
- Drafting of the standards and validation by a diverse range of stakeholders for their scientific soundness, impacts on the charcoal and carbonized briquette sectors and in relation to similar standards elsewhere.

Table 3: Sustainable charcoal and carbonized briquettes standard specifications

Parameter	Requirements	
	Sustainable Charcoal	Carbonized Briquette
Resistance to dropping	≤ 7.5% by mass	≤ 5%
Sieve analysis	≤ 5% by mass	≤ 2.5%
Moisture	≤ 10%	≤ 10%
Volatile matter	≤ 20%	≤ 25%
Ash content	≤ 5%	≤ 27%
Fixed carbon	≥ 75%	≥ 44
Calorific value	≥ 18Mj/kg	≥ 18Mj/kg

Certification process of charcoal and carbonized briquettes

Certification of charcoal and carbonized briquettes entails the acquisition of a standardization mark, which is coordinated by KEBS through an online application process and physical visit to the production site of the applicant. The KEBS process of attaining the standardization mark involves sample collection, submission, testing, release of test results and finally the issuance of an S-mark. The timeframe is about 56 working days.

The United Briquettes Producers Association (UBPA) with 50 members from small and medium-sized enterprises and representatives from government, academia, the private sector, donor agencies, NGOs and individuals active in the sector was formed in 2019 with support from the Charcoal Project, Massachusetts Institute of Technology (MIT) D-LAB and the Clean Cooking Association of Kenya (CCAK). The United Briquettes Producers Association encourages briquette producers to attain the KEBS S-mark. The certification mark informs buyers of quality, helping them make informed decisions on purchase.

In addition to the standardization mark, the Clean Cooking Association of Kenya (CCAK) has been at the forefront in implementing the Voluntary Labelling Mark for carbonized briquettes as well as biomass cookstoves. In a study conducted in Kenya in 2020 by SNV Netherlands, 35 percent of surveyed manufacturers were found to be labelling carbonized briquettes, but the labels only contained information on the manufacturer and weight of the package, with no KEBS mark of quality (CCA et al. 2021).

2.3 Case Study III: Value Added Tax exemption on selected sustainable biomass energy products

The acquisition of VAT exemption on sustainable charcoal briquettes (both carbonized and non-carbonized), involved stakeholder consultations and scientific inputs as illustrated in box 3. Though not part of focus for the brief VAT exception was also granted for bioethanol and biogas.

Box 3. The role of science and stakeholder engagement in VAT exemption of carbonized briquettes, bioethanol and biogas

This process was led by Clean Cooking Association of Kenya and aimed at amendments to the VAT Act, No. 35 (2013) during the financial year 2021/22 to enable a 16 percent tax exemption.

- Scientific evidence was gathered and synthesized on production, use, benefits, challenges and innovations to support decision making by the National Treasury on the need for tax exemption of the three types of bioenergy.
- The private sector played a key role in providing examples of entrepreneurship in briquette production, bioethanol and biogas and their contribution to sustainable production and consumption of biofuel in Kenya.
- Stakeholders co-developed the application letters and discussed with the National Treasury.



Briquette production process by Echo Charcoal Ltd and the delivery of their briquettes at Shamba café. The briquette bags are flying off the shelves, a customer just purchased 15 bags at once, a bag is 5kg at KES800 (USD0.9).

3. Lessons and key messages

The role of science in policy development for sustainable bioenergy production and use

- Effective bioenergy policies should always be based on evidence and best practices available, which often arise from scientific research.
- The major challenge with the energy sector in rural and urban contexts is the sustainability in production and efficiency of utilization. Scientific evidence and products are needed to improve biomass production, processing and utilization of bioenergy materials. Innovative solutions guided by research are critically needed to improve bioenergy wastage and enable energy recovery and waste and pollution reduction through a circular bioeconomic approach. Evidence is also necessary in assessing progress towards set goals such as those on achievement of low carbon and climate resilience development.
- Science is key in unravelling the interdependence of components of the woodfuel system where practices in one has impacts on another. Further woodfuel systems have impacts on other socio-ecological systems such as health, food security, climate change, conservation of terrestrial ecosystems, gender equality among others.
- Science also plays a critical role in identifying and bringing out the policy role overlaps and synergies between different departments supporting the need for a strategy that promotes coordination of responsibilities including defining research priorities.

- Integrating gender considerations and inclusiveness into policy development on bioenergy in Kenya is key. This is because innovative programmes in bioenergy regulation without consultation with community producers and users may be undermined if the regulations are unacceptable and not co-owned at local levels. Science plays a key role in bringing out gender equality and inclusiveness in needs and aspirations of users.
- Scientists must engage beyond providing written documents and oral presentations to become stakeholders. Prior and participatory engagement and dialogue with policymakers and implementors is essential to build trust and confidence and consequently sustainability.

Benefits of an effective multi-stakeholder engagement in policy development

- Promotes the sharing and generation of diverse experiences and lessons, such as from academic, development and business sectors
- Enhances multi-sectorial synergies and coordination in the development of policy instruments
- Facilitates joint resource mobilization
- Private sector engagement can facilitate long-term economic sustainability
- Facilitates lobbying and advocacy
- Facilitates effective awareness creation
- Creates greater stakeholder commitment and sustainability

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Tree branches for charcoal and carbonized briquettes in dryland forest by Wiildlfie Works Photo Moses Kirimi/ICRAF

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Cover photo: Heap of charcoal

Photo by Axel Fassio/CIFOR