

# How Kenya can transform the charcoal sector and create new opportunities for low-carbon rural development

Biomass is the main source of energy for households in Kenya, and a major energy source for the country as a whole. In 2013, 72% of the country's total primary energy supply came from bioenergy and waste.<sup>1</sup> A large share of the biomass used is in the form of charcoal, which provides 82% of household energy in urban areas, and 34% in rural areas, according to the Kenya Forest Service (KFS). The charcoal sector employs nearly 900,000 people in production and trade, and has been estimated to contribute US\$1.6 billion per year to Kenya's economy.<sup>2</sup>

In Kenya, demand for wood is estimated at 41.7 million m<sup>3</sup> per year, including 18.7 million m<sup>3</sup> for fuel wood and 16.3 million m<sup>3</sup> for charcoal, but the amount that can be harvested sustainably is estimated at just 31.4 million m<sup>3</sup>.<sup>3</sup> That means that every year, Kenya is losing 10.3 million m<sup>3</sup> of wood from its forests, a serious environmental concern.

Several countries, including Kenya, have tried to ban charcoal production in order to protect forests, but given that charcoal production and sales occur mostly in the informal sector, those efforts have failed. Since 2009, Kenya has been trying a different approach, adopting policies and regulatory frameworks to formalize the charcoal sector. This discussion brief, which is based on a workshop hosted by SEI and UNDP in Nairobi in June 2016, examines the progress to date, opportunities still to be realized, and key challenges ahead.

The brief is meant to inform policy-makers at the national and county levels, with special attention to the potential role of charcoal-sector measures in helping Kenya to meet its commitment under the Paris Agreement to reduce greenhouse gas (GHG) emissions by 30% from business-as-usual levels by 2030.<sup>4</sup> Several of these measures could also contribute significantly to rural development and poverty reduction.

## Key messages

- Biomass is by far the main source of household energy in Kenya; in urban areas, charcoal is predominant. With rapid population growth and urbanization, charcoal use is likely to remain high for decades still.
- While charcoal production now occurs almost entirely in the informal sector, it has great potential to be transformed through effective regulation, to become environmentally sustainable and contribute to low-carbon development in Kenya.

## Understanding the charcoal value chain<sup>5</sup>

The charcoal value chain involves several activities, often performed by different people: wood production, harvesting, carbonization, packaging and transport, distribution and sales, and consumption. Charcoal is typically produced in rural areas, near where the wood is harvested and then sold onsite or transported to wholesalers and retailers in urban areas. Consumers buy charcoal in 35kg bags or 2kg tins.

Given the complexity of the value chain – and its informal nature – it is difficult to manage. With the Forests (Charcoal) Regulations 2009, known as the “Charcoal Rules”, Kenya set out to address this problem by requiring that, in order to obtain a license, producers organize themselves in Charcoal Producer Associations (CPAs). As of 2013, there were about 150 CPAs across Kenya.

CPAs are responsible for sourcing wood sustainably and ensuring that their members harvest the right species, use the right carbonization technologies, and sell from central collection points. They are also expected to facilitate charcoal deliveries and negotiate better prices – a key role given that, even with CPAs in place, nationally, an estimated 78% of profits goes to transporters and retailers, and only 22% to producers.

When the system works, it can be transformational, enabling CPA members to greatly improve the efficiency (and sustainability) of charcoal production and help them generate more income through collective action.<sup>6</sup> Yet as of 2013, an estimated 60% of Kenya's charcoal was still being produced illegally, outside of CPAs. The vast majority was also produced in traditional earth kilns, which have wood-to-charcoal conversion rates of 10–15% – highly inefficient.<sup>7</sup>

There are still big improvements to be made in the legal charcoal trade as well. Most county governments have yet to adopt charcoal legislation, even though they have a key role to play in implementing national policies under Kenya's new devolved government system. Access to finance remains a major challenge for CPAs, and producers need significantly more capacity-building.



A woman transporting charcoal to Kilgoris town, Narok County.





Charcoal for sale in the Kibera slum in Nairobi.

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## Opportunities for building a sustainable charcoal sector

At our workshop, participants identified five key areas that should be prioritized in the effort to make charcoal production in Kenya more sustainable:

- **Research:** Explore pathways and scenarios associated with sustainable charcoal production and consumption, particularly the GHG emissions reduction potential;
- **Laws and regulations:** Build on existing policy frameworks, updating laws and regulations, and adopting county-level measures;
- **Standards:** Adopt energy efficiency standards for biomass fuels, kilns and cookstoves;
- **Technology:** Develop and diffuse cleaner and more efficient kiln and stove technologies;
- **Climate finance:** Implement a proposed Nationally Appropriate Mitigation Action (NAMA) focused on the charcoal value chain.

### An in-depth look at low-carbon pathways

Under an ongoing project on innovation and transition pathways for climate mitigation (TRANSrisk), funded by EU Horizon 2020, research is being undertaken on the role that a more sustainable charcoal sector could play in reducing GHG emissions.<sup>8</sup> This assessment helps to evaluate various scenarios to gain insights into the future of biomass energy supply and demand in the country. As part of this work, a decision support tool is being developed to help policymakers understand uncertainties and risks and thus be able to design more robust policies that include risk assessments.

Three-quarters of Kenya's GHG emissions in 2010 were from land use, land use change and deforestation, due to strong demand for agricultural land, urbanization and heavy reliance on wood and charcoal for fuel.<sup>9</sup> Under business as usual (BAU), Kenya expects GHG emissions to nearly double

by 2030, to 143 million tonnes of carbon dioxide equivalent (Mt CO<sub>2</sub>e), from 73 Mt CO<sub>2</sub>e in 2010. Similar patterns are seen across sub-Saharan Africa, as population growth and demand for land have led to forest encroachment and unsustainable development.

As noted above, Kenya's intended nationally determined contribution (INDC) under the Paris Agreement sets a goal of reducing emissions by 30% by 2030 relative to the BAU scenario. The Kenyan government has also embraced the notion of a "green economy" and is often seen as a regional leader on renewable energy. Like many African countries, Kenya is also very vulnerable to the impacts of climate change.

Given the large share of Kenya's emissions that come from land use and biomass energy, it is important to consider these sectors when exploring low-carbon development pathways. This includes looking for ways to build a sustainable charcoal sector, with attention to societal costs, benefits, risks and opportunities associated with continued reliance on charcoal. It is also important to understand how the development of the charcoal sector affects energy access, livelihoods and equity.

Analysis of the charcoal sector in African countries is not easy, given the complex interactions between key actors in the supply chain and the incentives they have for change and innovation. A socio-technical approach is needed to identify key actors, their linkages, possible synergies, and the extent to which the sector can support innovation for low-carbon development in Kenya.

### Legal and policy frameworks for sustainability

Although charcoal production in Kenya is governed directly by the Charcoal Rules (under the Forest Act 2005), different aspects of the trade are also covered by other laws, regulations and policy frameworks focused on forestry, energy, agriculture and even transport. Additional policies under considera-

tion by the Kenyan government, including draft energy and forest policies, would affect the charcoal sector as well.

The key activities covered by those policies are tree-growing, harvesting of wood, carbonization, and transportation, marketing, trade and use of charcoal. Table 1 provides an overview of the most relevant laws and policy frameworks. Although there are no obvious conflicts or contradictions, it is clear that there is significant overlap across policies. There is a need for better coordination to streamline policies and clarify different agencies' roles.

It is also important to engage county governments in implementing charcoal regulations and standards. The charcoal sector, particularly production, is very decentralized, yet the implementation of regulations and standards has typically been very centralized. A natural next step under Kenya's new devolved county governance structure is to adopt county-level charcoal policies. Kitui County, one of the country's top charcoal producers, adopted a Charcoal Act in 2014.<sup>10</sup> This

approach could be followed by other counties. The potential for counties to collect new revenue from the charcoal sector is substantial. A 2005 study estimated that if all charcoal traded in Kenya were subject to levies such as those charged by various county councils, 5.1 billion KES could be collected (about US\$50 million at current exchange rates).<sup>11</sup>

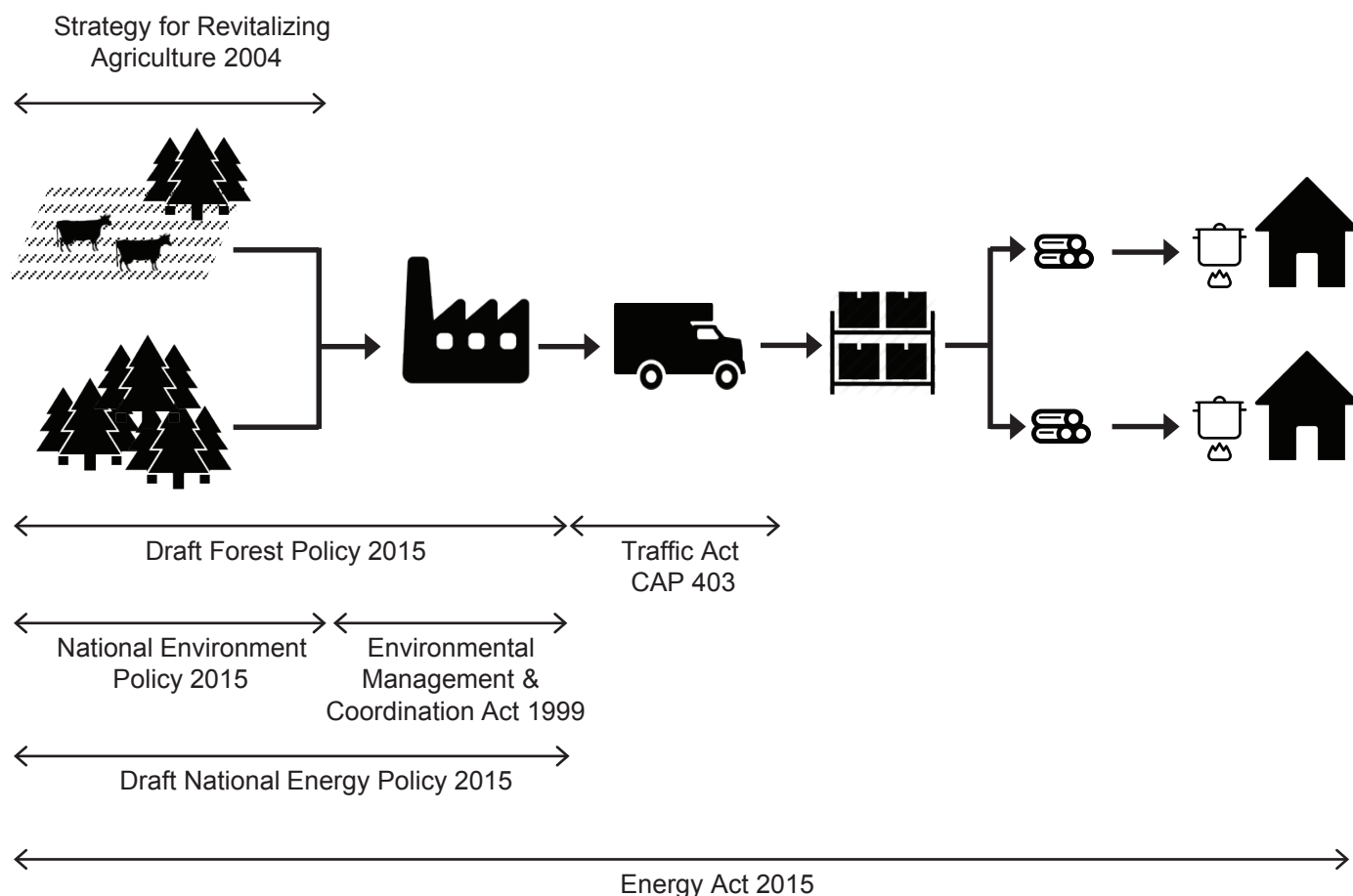
#### Standards for charcoal production and use

Standards are critical for quality control – for ensuring that actors across the charcoal supply chain have a clear understanding of what is expected of them, and for holding them accountable. Effective quality standards merge scientific research with practical experience to ensure that the requirements are technically optimal but also achievable in real-world conditions.

In the charcoal sector, standards are needed for sustainable harvesting of wood, the efficiency of conversion process, the quality of the charcoal sold, and the stoves that use charcoal. Kenya already has some of these standards in place, but more

**Table 1: Key laws and policy frameworks relevant to charcoal production and trade in Kenya**

Law or policy framework	Details
<b>Charcoal Regulations 2009, under Forest Act<sup>12</sup></b>	Provides guidelines on the legal requirements for producers, transporters and traders engaged in the charcoal business. Encourages producers to form groups and develop harvesting and afforestation plans. Recommends use of efficient conversion technologies and protection of endangered species. Requires permits from the relevant authorities for the movement and export of charcoal.
<b>National Environment Policy 2014<sup>13</sup></b>	Promotes an integrated national strategy for the generation and sustainable utilization of renewable energy, including biomass. Encourages development and implementation of appropriate forestry-based investment programmes and projects.
<b>Environmental Management and Coordination Act 1999<sup>14</sup></b>	Requires large-scale projects, including those for biomass, to undergo an environmental impact assessment prior to approval. Promotes the creation of incentives for promotion and conservation of renewable sources of energy.
<b>Agricultural Sector Development Strategy 2010–2020<sup>15</sup></b>	Supports transformation of subsistence agriculture into commercial and profitable business enterprises. Promotes private investment in modern farming methods. Encourages commercial tree-growing by any farmer, cooperative, company or association as a business enterprise, including for energy.
<b>Traffic Act<sup>16</sup></b>	Consolidates laws relating to traffic on public roads, which need to be observed during charcoal transportation. Requires police officers to verify the validity of all charcoal movement permits.
<b>Energy Bill 2015<sup>17</sup></b>	Promotes development and use of renewable energy technologies, including biomass. Provides an enabling framework for efficient and sustainable production, distribution and marketing of biomass and charcoal. Promotes the use of fast-maturing trees for energy production, including biofuels, and the establishment of commercial woodlots, including peri-urban plantations.
<b>Draft Forest Policy 2015<sup>18</sup></b>	Supports production of charcoal in a sustainable manner. Supports community forest management approaches to manage dryland forests for the sustainable production of wood and non-wood forest products.
<b>Draft National Energy Policy 2015<sup>19</sup></b>	Promotes efficient conversion and cleaner utilization of biomass energy. Promotes agroforestry and social forestry programmes to increase stock of woody biomass on farms.



**Figure 1: Value chain and legal frameworks linkages**

work is still needed. For instance, Kenya Standard KS ISO 17225-1:2014 determines the fuel quality classes and specifications for solid biofuels of raw and processed materials originating from forestry, including graded wood and non-woody pellets, briquettes, chips and firewood. The Sustainability Criteria for Bioenergy (KS ISO 13065:2015) specify principles, criteria and indicators for the bioenergy supply chain to facilitate the assessment of environmental, social and economic aspects of sustainability.

New draft standards being considered by the Kenya Bureau of Standards (KEBS) would set guide quality control requirements for charcoal that is derived from wood, in lump or briquette form, and that is intended for household use. In addition, standards are being developed for pellets, briquettes and charcoal. It is anticipated that these specifications will guide practitioners on how best to choose raw materials with the right caloric value, moisture content, fixed carbon and ash content. Moreover, standards targeting charcoal kiln technologies are envisioned to ensure design, manufacture and dissemination of high-quality technologies in the sector.

The Improved Biomass Cookstoves regulations, meanwhile, provide for licensing of cookstove manufacturers, importers, distributors and contractors in order to ensure that specifications for thermal efficiency, emissions, safety and durability are met. This would contribute to reducing indoor air pollution, achieving health benefits and helping consumers save on fuel, which is now a significant household expense.

#### **Demand-driven technologies**

Wood conversion technologies that reduce emissions and maximum thermal efficiency to increase recovery rates have

been promoted among CPAs. The KFS, the Kenya Forestry Research Institute (KEFRI) and others are working to promote the adoption of high-efficiency kilns with conversion rates above 35%. Models being promoted include Casamance, the Drum kiln and the Meko kiln, among others.<sup>20</sup>

More than 90% of the charcoal produced across sub-Saharan Africa, including in Kenya, is from earth kilns.<sup>21</sup> This is because earth kilns can be constructed near the wood source and are inexpensive to set up. However, due to soil contamination and lack of control over the carbonization process, efficiency is very low, and the quality of the resulting charcoal is low.

The Casamance kiln model has one chimney placed at the opposite end of the lighting point, which allows a better control of air flow. The hot flue gases do not escape completely but are partly redirected into the kiln, which enhances pyrolysis. Due to this reverse draft, carbonization is faster and more uniform, giving a higher quality of charcoal. The Meko kiln has a pyrolysis chamber that isolates oxygen from the starter fire chamber and recirculates all volatile gases externally to assist in carbonization process. The recovery rate is improved, since only hydrocarbons and water are lost during the process.

Adoption of improved cookstoves is also critical to ensuring the sustainability of biomass consumption in Kenya. There is a growing body of knowledge and experience about how best to achieve a shift to cleaner and safer cooking fuels and stoves.<sup>22</sup> Numerous cookstove interventions in Kenya and across sub-Saharan Africa are beginning to reach scale, with benefits for household health, livelihoods, the environment and the economy. Kenya has recently reduced the import tax on cookstove technologies, and this is expected to transform



the market and lead to higher adoption of improved stoves.<sup>23</sup>

For both wood conversion and cooking technologies, sustained use is a critical element for achieving sustainability. Organized group production, as is provided for under the CPA system, can accelerate the adoption of these technologies. Before installation, it is important for the CPA to get the information the producers will need on wood resource availability and distribution, as this will guide the location of the kilns. The kilns themselves need to be durable, easy to handle, and able to withstand high temperatures.<sup>24</sup>



A traditional earth kiln, which can produce 60 bags of charcoal at a time, near Nyakweri Forest, Narok County.

### Implementing the NAMA on charcoal

In an effort to develop targeted interventions to further support the above activities, the United Nations Development Programme (UNDP) commissioned the drafting of a National Appropriate Mitigation Action (NAMA) for Kenya's charcoal sector. The NAMA concept was adopted under the United Nations Framework Convention on Climate Change (UNFCCC) as a way to support developing countries wishing to achieve transformational change within an economic sector or across sectors, lowering GHG emissions while also advancing national priorities. Once a NAMA has been adopted, it is supported and enabled by international climate finance, technology transfer and capacity-building.<sup>25</sup>

Kenya's NAMA for the charcoal value chain, which is still under development, has three main objectives:

**Achieving a sustainable supply of biomass:** Two options are being considered: one relies on community-based forest management, and the other uses private-sector-based forest management. There would also be activities to raise awareness of sustainability issues, of the government's goals, and of different stakeholders' roles in achieving those goals. This is to be achieved by working with the county governments, the KFS, KEFRI and universities.

**Implementing efficient charcoal production technologies:** This intervention would disseminate efficient charcoal production technologies to all commercial producers in Kenya through the CPAs, with a goal of ensuring that 90% of large-scale charcoal production is done using efficient technologies.

**Establishing a charcoal certification and labelling scheme:** This intervention would develop a simple but robust national-wide certification and labelling scheme for all of the charcoal sourced from local biomass and producers. The assumption is that charcoal consumers would be able to easily identify and purchase only sustainably sourced and efficiently produced charcoal. The proposed activities include certifying biomass and charcoal production (carbonization and briquetting).

### Challenges and concerns

While the above opportunities are welcome steps towards achieving a sustainable charcoal sector, there are still several limitations related to the lack of an integrated approach to sustainable charcoal production and consumption. The NAMA goes some way to address this, but challenges remain.

First, there is some incoherence between different initiatives. For example, the development of standards for kilns and stoves is, to some degree, being pursued in isolation from the development of new technologies. Moreover, as the process of developing standards is under way, the producers in the sector are continuing with business as usual.

Second, there is a great deal of overlap in national legal and policy frameworks (see Figure 1). While they seem to be aligned with one another, the roles and responsibilities for implementing or enforcing policy and regulations are not always clear. This is especially a challenge with the new devolved governance system in Kenya; there is still some rivalry between the national and county governments in terms of who does what. The challenge is aggravated by the lack of technical capacity at the county level to take up these responsibilities should the roles previously carried out at the national level be transferred to them.

Biomass resources play a major role in meeting cooking needs in Kenyan households, and this reliance is unlikely to decrease in the near future. Efforts to transform the biomass sector – specifically, the charcoal value chain – are well under way, and there are substantial opportunities to be realized.

Innovative research such as that conducted through TRAN-Srisk and transformative interventions such as the NAMA can provide knowledge on best available practices and technologies, and thus advance the effort to achieve sustainable biomass energy use and production. This will contribute to improving livelihoods, reduce carbon emissions, and help protect Kenya's forests.

To ensure that Kenya achieves its ambitious goals, it is important to invest in research and development, create better financing mechanisms to support biomass initiatives, and continue to improve the institutional framework that supports these efforts.

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