



Benin eCooking Market Assessment

February 2022

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EnDev/MECS eCooking Market Assessments

- Part of a series of publications produced jointly by Energising Development (EnDev) and the Modern Energy Cooking Services (MECS) Programme.
- Strategic insight on the current state of electricity access and clean cooking, identifying the key opportunities and challenges to the scale up of eCooking in 8 countries across sub-Saharan Africa and South Asia.



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This material has been funded by UKAid from the UK government; however, the views expressed do not necessarily reflect the UK government's official policies.

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Overview

- Summary of the opportunity for eCooking in Benin
- Clean cooking & electricity access
- Deep dive into:
 - Enabling environment
 - Consumer demand
 - Supply chain
- Recommendations for strategic interventions

Summary

- Benin has an electrification rate of around 41% and clean cooking access rate of around 6%, meaning that **35% of the population now have access to electricity, but are still cooking with polluting fuels**
- Clean cooking has been addressed by a few **programmes** in the past, but they were **all focused on improved biomass cookstoves (ICS)**
- Benin shows **significant potential for the uptake of e-cooking** especially among **urban, middle-class households** as the uptake of e-cooking in these segments is yet very low despite having access to electricity
- Beninese **consumers seem to be very interested** in modern energy cooking including e-cooking and the many dishes of the Beninese cuisine seem to be compatible with e-cooking solutions such as EPCs
- A challenge for e-cooking is the **comparatively high price of electricity per kWh** in comparison to the price of charcoal and power outtages
- The **e-cooking supply-chain** and market distribution is at a very **nascent stage** which means the support of local supply-chain management and business-model development for small- and medium-sized businesses flanked by a consumer awareness campaign, especially in urban areas, could significantly support the uptake of e-cooking in these areas

The clean cooking challenge

- Benin faces a formidable clean cooking challenge: the vast majority of the population (94%) still relies on polluting fuels such as firewood and charcoal for their cooking needs.
- This has led to an array of interlinked development challenges: recent data suggests that around 5,000 deaths/yr are caused by household in-door air pollution annually which translates into a case rate of around 156 per 100,000 people which is one of the highest in the world*
- Limited access to clean cooking leads to high levels of Woodfuel consumption of 3,085 kton per year which corresponds with high rates of deforestation: between 2005 and 2015 Benin's forest cover dropped drastically by over 20% (from 7.6 to 6 million hectares) and deforestation rate continues to be very high at 2.2% annually**, and around 12 Mio tCO₂e/yr is emitted.
- Women and girls are disproportionately affected, with greater exposure to cooking smoke, as well as the drudgery of collecting fuel and lighting/tending fires, which results in missed educational and economic opportunities.
- Historically, Improved Cookstoves (ICS) have been promoted in Benin through non-governmental initiatives to promoting clean cooking. Recent evidence however shows that the health benefits of ICS are much more limited than previously thought (WHO, 2016).

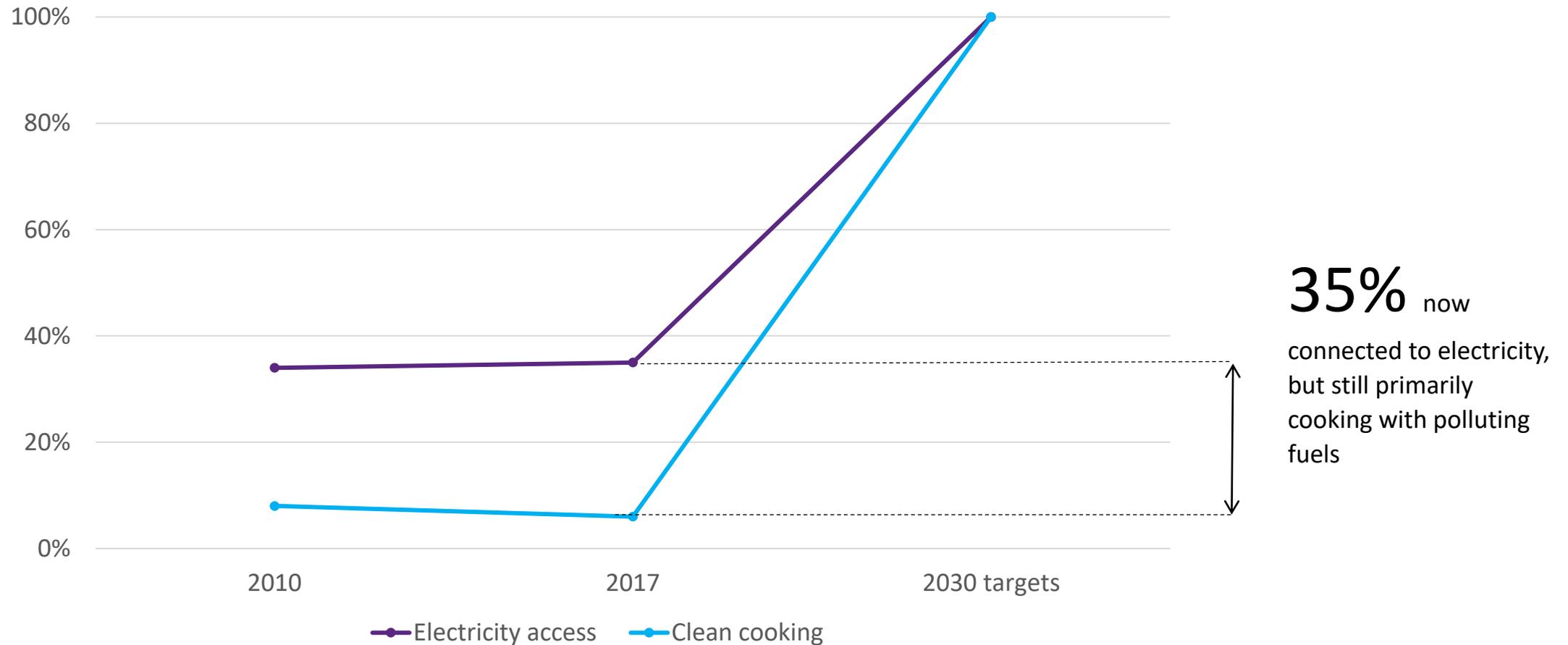
*<https://ourworldindata.org/indoor-air-pollution>

**<https://blogs.worldbank.org/nasikiliza/hidden-value-benins-forests>

The opportunity for eCooking

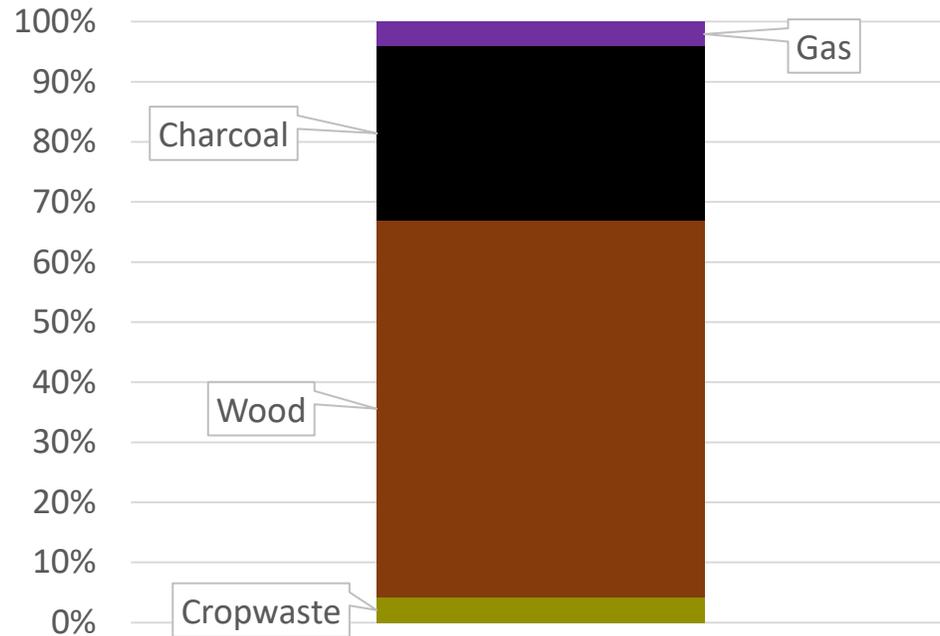
- There are a number of opportunities arising for e-cooking especially in urban areas:
- Rising charcoal prices and limited supply of firewood especially in urban areas;
- Forest-Protection efforts by the government supported by the World Bank increase sustainable charcoal & firewood supply;
- Infrastructure investment has been leading to less power cuts/increased & more stabilised power supply especially in urban areas;
- The cuisine includes many main foods that are boiled leaving good potential for e-cooking appliances
- Consumer priorities for selecting cooking methods vary, with a survey indicating: cooking speed (32%), affordability (18%), no indoor pollution (13%) which 'selling' arguments for MEC
- Annual GDP growth rates (5-6% annually) in Benin are above SSA average
- Rising awareness of companies to focus on consumer needs and awareness; some companies have started campaigning for e-cooking
- Established PAYGO models in the off-grid/SHS sector

Clean cooking and electricity access in Benin



Cooking energy

0% cook primarily with electricity

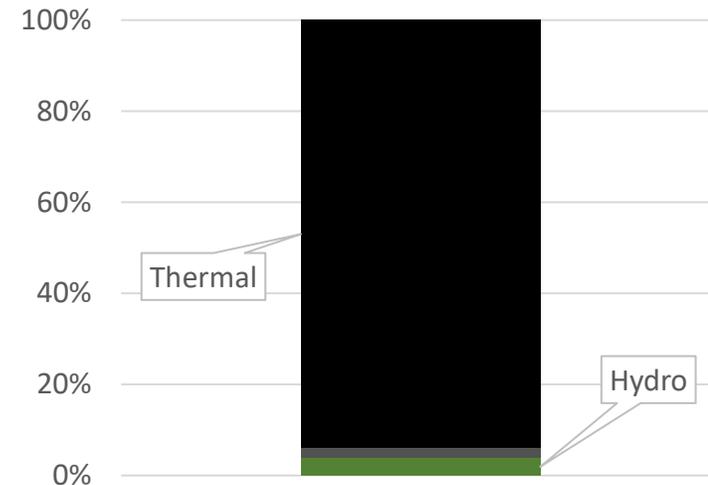


95% cook primarily with polluting fuels

26% cook primarily with commercialised polluting fuels (charcoal)

Electricity generation (on-grid)

94% fossil fuels; over 90% is imported



0% surplus power generation

Low reliability: avg. 28

blackouts/month

Off-grid sector emerging; around 2-3 mini-grids established but accurate data missing

MECS eCooking GMA viability scores/rankings

- GMA = Global Market Assessment
- Scored all low- & middle-income countries using international indicators for:
 - economics (clean fuels, market size, financial sector strength)
 - human (policy, health, gender, development, business environment)
 - infrastructure (electricity access, reliability, RE share)
- MECS.org.uk/GMA

Benin	Overall:	On-grid eCooking:	Mini-grid eCooking:	Off-grid eCooking:
	109th/130	0.390 – 110th/130	0.315 – 111th/130	0.372 – 87th/130

Key opportunities

- Rising charcoal prices and limited supply of firewood especially in urban areas;
- Forest-Protection efforts by the government supported by the World Bank increase sustainable charcoal & firewood supply;
- Infrastructure investment has been leading to less power cuts/increased & more stabilised power supply especially in urban areas;
- The cuisine includes many main foods that are boiled leaving good potential for e-cooking appliances
- Consumer priorities for selecting cooking method according to survey: cooking speed (32%), affordability (18%), no indoor pollution (13%) which 'selling' arguments for MEC
- Annual GDP growth rates (5-6% annually) in Benin are above SSA average
- Rising awareness of companies to focus on consumer needs and awareness; some companies have started campaigning for e-cooking
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Key challenges

- High electricity tariffs and low income: Benin's energy tariffs are comparatively high (0.24 USD per kWh/average monthly income 60-200 USD) which establishes a pricing disadvantage of e-cooking towards charcoal use.
- High import levels for electricity which makes the country vulnerable to external shocks and supply problems;
- Low access to electricity (40% overall; 17% rural; 65% urban)
- Power reliability (Most the electricity in the on-grid sector is imported (75-95%) – Benin is dependent on external suppliers; voltage variations & power-cuts are frequent)
- Limited availability of modern energy cooking fuels and appliances including an underdeveloped supply-chain and business models (low number of MEC manufacturers & specialised distributors); the simple retail-model for MEC appliances in household-appliance shops prevails
- Perceived higher durability/longevity of biomass stoves (after 9 years replacement rates for gas cookers/electric cookers were between 25-85% with biomass stoves 13-17% according to GIZ survey); new appliances are a significant investment for households (affordability issues) and there are currently no quality standards/quality control mechanisms for e-cooking/MEC devices yet which leads to poor quality of (imported) devices

Potential impacts of scaled uptake in most viable market segment

If 40% of Benin's urban charcoal users (5.2m ppl, 1.04m HHs) switched to eCooking, the [WHO's BAR-HAP*](#) tool suggests that:

- **777 DALYs/yr** avoided**
- **1.8m tonnes/yr CO₂eq** emissions increased
- **10,300 tonnes/yr** reduction in unsustainable wood harvest
- **69m hrs/yr** of women's time saved (397hrs/HH/yr)
- **No payback** for eCooking appliances (\$80/HH upfront cost, \$45/HH/yr additional expenditure on fuel energy costs)
- **236 GWh** demand for electricity stimulated

Consistent with the MECS 40% goal, the scenario models transition of 40% of those, so 174,000 households. BAR-HAP models a ramp-up of transitioning households over the first 5 years to 2025 and then a further 5 years operation.

* The World Health Organisation (WHO) "Benefits of Action to Reduce Household Air Pollution" (BAR-HAP) tool

**Disability-adjusted life year (DALY) is a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability or early death.

Potential impacts of scaled uptake in most viable market segment

- The private and public financial impacts of the transition would all be negative, with cost to government of some \$110 per household for equipment and programme costs, and higher costs to households for purchasing electricity rather than charcoal.
- Since grid electricity is dominated by fossil fuels, the transition also leads to higher GHG emissions despite the assumed shift towards more renewables in the generation mix-
- The health benefits would include more than 40 lives saved per year, and some 3% of current unsustainable wood harvesting would be avoided. Overall, the social impacts are positive, with net benefits of more than \$50/household per year. These impacts may seem modest, but this scenario is targeting less than 8% of the total population. The transition from charcoal to electric cooking would however increase greenhouse gas emissions.
- The **social benefits from avoided time spent cooking are large**, reflecting mainly time savings using an EPC, and the opportunity cost for peoples' time. **Health benefits are also considerable**, mainly associated with the lives saved. The largest element of cost is from the cost of carbon equivalent applied to the increase in greenhouse gas emissions. The purchase cost of modern stoves by government is also evident.
- This is an impact analysis for one simple scenario for just one segment (grid connected charcoal users) of Benin's population. Whilst with the near- and medium-term power generation mix eCook would not bring climate benefits, the scenario has very **significant net social benefit overall, based on the WHO's physical impact and impact monetisation methodologies.**



Enabling environment

Enabling environment

- **eCooking policy outlook:** The National Renewable Energy Development Policy document (PONADER) 2019 and the National Energy Management Policy document (PONAME 2020) focus on the expansion of RE & energy efficiency; clean cooking is found in this context through the energy saving factor in the management of electric and solar cooking equipment but there is currently no national policy that integrates clean cooking into the energy access targets. The National Clean Cooking Action Plan (PANCP) commissioned by EnDev is under development
- **Key policy stakeholders:** Ministry of Energy, The Directorate General of Energy Resources (DGRE); Beninese Rural Electrification and Energy Management Agency (ABERME); Interior Electrical Installation Control Agency (CONTRELEC); Unit in charge of Renewable Energy Development Policies in Benin (UC / PDER) (Technical Assistance Unit); The National Agency for Standardization, Metrology and Quality Control (ANM); Benin Consumers Association

RISE (Regulatory Indicators for Sustainable Energy) scores:

41%	5%	49%	31%
Electricity Access	Clean Cooking	Renewable Energy	Energy Efficiency

eCooking cuts across all 4 pillars

Targets:

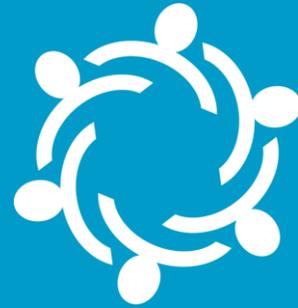
Electricity access 100% electricity access by 2030 (grid/off-grid)	Clean cooking Goals under development Specific eCooking targets under development
100% renewable grid electricity by 2030	

Key government/NGO programmes creating the enabling environment in which eCooking can scale

- EnDev support to semi-industrial units of production of cooking equipment and expansion of the range of cooking equipment
- PASE Project which finances actions on cooking equipment
- [OFEDI](#) (NGO) support of awareness for the use of clean and efficient cooking equipment.
- [LEMA](#) / [EPAC](#) laboratory which carries out research for clean cooking technologies and performs capacity building
- Other?

Key barriers/drivers in the enabling environment

- Forest-Protection efforts by the government supported by the World Bank increase sustainable charcoal & firewood supply can lead to increasing the attractiveness of alternatives to charcoal and these measure should be flanked by the promotion of modern energy cooking incl. e-cooking
- Infrastructure investment has been leading to less power cuts/increased & more stabilised power supply especially in urban areas but the prevalence of power cuts is still high
- Tax exemption from customs duties exists on equipment for producing electricity from renewable energies such as solar energy – hence, any direct-solar cooking equipment benefits from tax relief but equipment including electric cookstoves are subject to taxes/customs
- Currently there are no specific policies and regulations in place that focus on e-cooking specifically, this includes technical- and quality standards

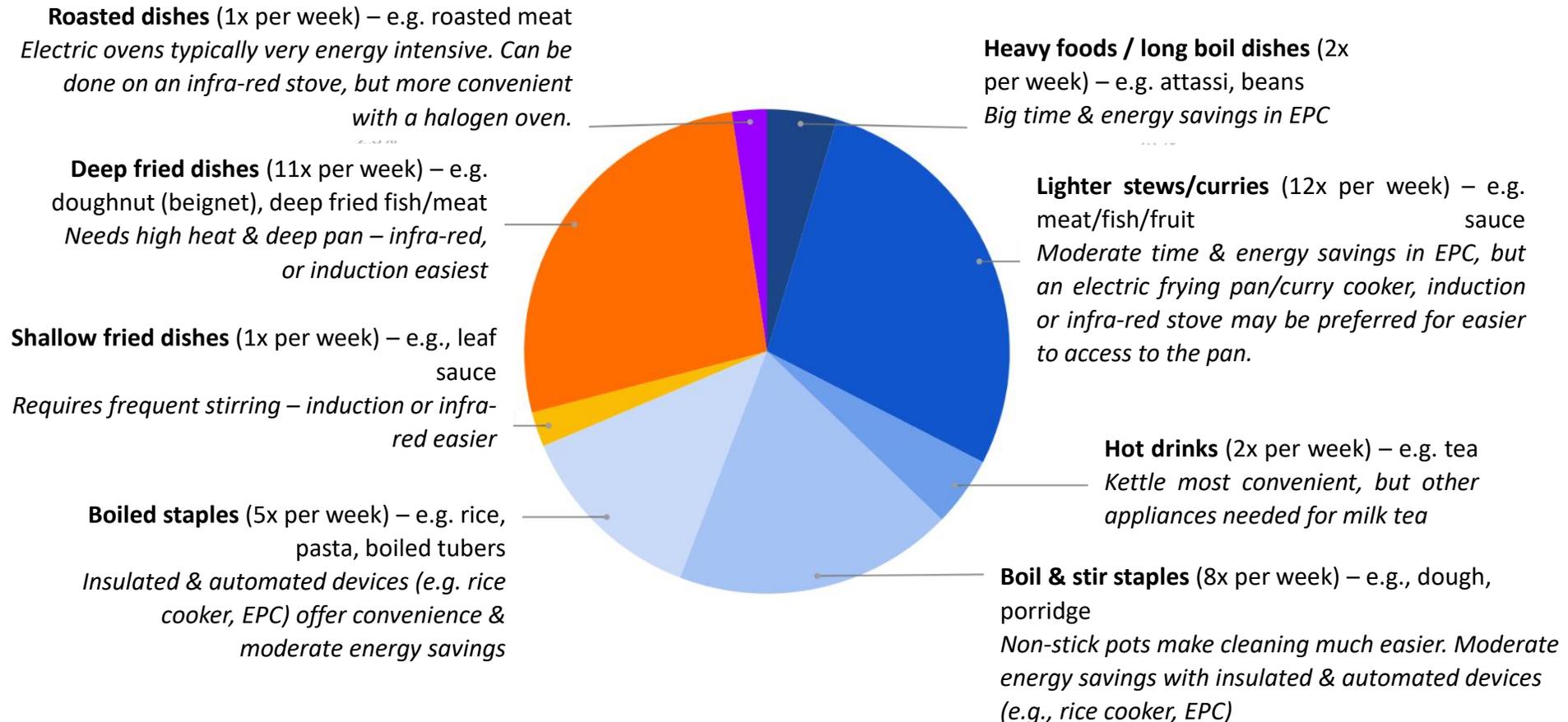


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Consumer demand

Consumer demand

In an average week, a typical Beninese household might prepare:



Popular meal combinations in Benin

- Beninese cuisine has high proportions of stews/heavy foods/long boiled dishes on the regular menu.
- These dishes can easily be prepared with modern eCooking appliances including EPCs, with big savings available on energy, cost, time and convenience.
- However, market awareness of Beninese consumers for the applicability of these appliances is currently very low.

Demand creation

- Key marketing messages:
 - Energy-efficient appliances offer substantial time and cost savings and enable multi-tasking.
 - EPCs are the cheapest and most convenient way to cook heavy foods.
- Key demand creation programmes:
 - Currently, there are no specific programmes focusing on e-cooking to a significant extent yet and such activities are often singular activities from clean cooking companies without larger outreach.

Key market segments

- *Grid connected biomass users*
 - Around 2.44 million people are currently connected to the grid but still use biomass as their primary cooking source.
 - The majority of whom are located in urban areas.
 - The EPC offers a highly attractive modern alternative however the upfront cost and the high price of electricity are substantial barriers for many who use charcoal, which can be purchased in small quantities.
- *LPG users*
 - Benin's LPG market has expanded in recent years, positioning it as the aspirational fuel for many and around 4% of the urban households are using LPG for cooking.
 - Current target markets are LPG: there seems to be significant potential for LPG In a survey 42% of respondents claimed to use gas for cooking but 'official statistics' suggest only 2%. A large LPG production & distribution facility has been opened in Benin in 2019.
 - Whilst the social impact of transitioning LPG users to electricity may be limited, many wealthier households who currently cook with LPG are starting to integrate task-specific eCooking appliances such as kettles and EPCs into their fuel stack.
 - These early adopters have a vital role to play in building the supply chain for eCooking appliances as their liquidity is high enough to make cash purchases of appliances.

Key demand side barriers/drivers 1

- **Consumer preferences:** Speed of cooking, cleanliness of fuels, ease of ignition and price are on top of the consumer preferences which present key opportunities for the promotion of e-cooking appliances incl. EPCs.
- **Gender:** Research has shown that the selection of particular cooking fuels is significantly associated with the gender of the household heads. Traditional fuels are less likely to be chosen by households headed by women compared to households headed by men headed counterparts and women are more likely to choose transition- and modern fuels compared to the male-headed households. This indicates a greater awareness for modern fuels among women than men (probably because women are typically responsible for cooking).
- **Education:** research has shown a strong correlation between education levels and the choice of transition-/modern cooking fuels **and households headed by someone** with a least secondary education level are more likely to choose modern energy cooking fuels than households headed by a person with no formal education level indicating that formal education is of key importance in adopting modern cooking
- The culinary survey revealed that out of the 21 most common dishes and drinks in Benin, 19 involve boiling which allows the application of e-cooking devices (electric cooker/stoves)
- Demand-side barriers are low market-penetration/availability/awareness of e-cooking devices and frequent power cuts.

Key demand side barriers/drivers 2

- **Geographical location:** research indicates that the adoption of cooking fuels depends on the departments – respondents in the Littoral department which also hosts the capital Cotonou are more likely to choose transition and modern cooking fuels compared to those living in the 11 other departments. Therefore, the adoption of cooking fuels is associated to regional availability of the fuels.
- **Marketing/Adoption behaviour:** To acquire equipment, households are informed from several sources and surveys show that 78% of households are informed by informal sources including 'word of mouth' (46%) and observation with neighbours (32%). Formal sources, including the mass media (radio (6%), television (14%), internet(1%)) and local awareness raising (1%) only account for 22%. It emerges that investment in the promotion of cooking equipment through the mass media and local awareness raising is low and deserves to be reinforced.
- **Market focus:** The distribution of e-cooking appliances is generally on a low level and is mainly focused on the capital.
- **Fuel stacking:** in urban areas, an average household uses around 2 different appliances
- Current target markets are LPG: there seems to be significant potential for LPG In a survey 42% of respondents claimed to use gas for cooking but 'official statistics' suggest only 2%. A large LPG production & distribution facility has been opened in Benin in 2019



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Supply chain

Supply chain

- **Key domestic eCooking appliance manufacturers:**
 - n/a
- **Key eCooking appliance distributors:**
 - n/a

Activities by companies to promote e-cooking

Actions made	Frequency of action with sales companies
Promotion / advertising (warm welcome, gifts for purchasing a product)	33%
Raising public awareness of the advantages of this equipment	29%
Reduction of selling prices from a certain level of purchase	21%
Promotion of several sources of renewable energy	8%
Popularization of equipment in rural areas	4%
Emphasis on the sale of good quality equipment	4%
TOTAL	100%

Key supply side barriers/drivers

- The GIZ/EndeV Report of 2021 currently lists around 9 companies that are distributing electric cooking devices; these are small to medium local distributors
- The availability of appliances seems to be limited to local traders/distributors that are selling household appliances and the use of electric cooking appliances is mainly concentrated around the urban areas/the capital
- Current perceived strengths of the market for e-cooking are:
 - Existence of outlets (Households and centers food production and social institutions)
 - Relative effectiveness of communication informal (word of mouth, observation of neighbours) in the popularization of cooking equipment
 - EnDev support to semi-industrial units of production of cooking equipment and expansion of the range of cooking equipment
 - Existence of the PASE Project which finances actions on cooking equipment; Existence of NGOs (OFEDI for example) of awareness for the use of clean and efficient cooking equipment. ◇ Existence of the LEMA / EPAC laboratory which carries out research for clean cooking technologies and performs capacity building; Current reduction in electricity cuts in the big cities

Popular appliances & prices in Benin today

- LPG/gas cookers are currently the best selling appliances mainly to wealthy households.
- There is a minimal uptake of electric appliances.

Technology	Average price CFA per unit	USD	Equipment share used in hh
Electric stove(stainless steel)	300,000	537	0%
Electric cooker (ceran)	167,555	300	1%
Gas stove with oven & timer	45,250	81	0%
Gast stove with 4 outlets	41,667	75	1%
Electric rice cooker	27,917	50	1%
Gas cooker (without oven)	27,500	49	2%
Table-top gas cooker	25,555	46	22%
Electric oven	25,000	45	1%
Portable gas-stove (LPG cartridge)	24,317	44	6%
Single-flame gas cooker	17,425	31	13%
Electric kettle	13,985	25	2%
Kerosene cooker	8,833	16	1%
Improved cookstove charcoal	4,125	7	41%
Ceramic cooker	3,500	6	2%
Clay oven/cooker	2,850	5	1%
Firewood stove	2,167	4	4%
Ordinary three-stone fireplace with wood	2,000	4	0%

Average prices of some cooking equipment and usage in Benin Source: Programme Energising Development (EnDev): Etude de marché des équipements de cuisson électrique solaire au Bénin; Rapport final, 09/2021

Relative cost of eCooking vs. popular cooking fuels

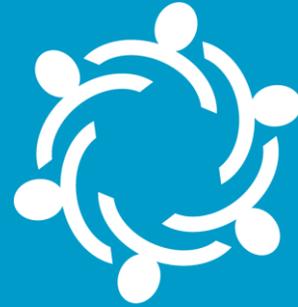
- Due to low charcoal prices and high electricity prices, e-cooking currently does not have a financial benefit compared to charcoal and firewood but has a cost benefit compared to LPG and Kerosene.

Grid electricity tariffs:

Regular: 95 -125 CFA/kWh (0.22-0.262 USD/kWh)



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Recommendations for strategic interventions

Recommendations 1

	Current status	Recommended interventions
Market segments	On-grid Grid-connection levels are still low, power-cuts are frequent but the situation seems to be improving	Pilot battery-supported eCooking devices to mitigate unreliability. Strengthen the availability and permanence of the SBEE electricity supply in large cities to facilitate the adoption of electric cooking equipment.
	Mini-grid Development of off-grid access projects through various programmes including EndeV but electricity access in rural areas is still very low.	Make use of the PASE to increase SBEE's access to energy to agro-food production companies which will be oriented towards electric cooking equipment
	Off-grid (SHS) There is currently the promotion of direct solar cooking appliances	Lobby government to reduce import tariffs on DC eCooking appliances and battery storage sized for cooking.

Recommendations 2

	Current status	Recommended interventions
TToC dimensions Supply chain	<p>Existence of facilities granted to small and medium-sized enterprises and industries to get grid-connection & receive tariff subsidies from SBEE but not yet widely used</p> <p>Insufficient funding for businesses to increase their range of cooking equipment / Difficulties in the recovery of debts for the sale of equipment on credit</p> <p>No structural specialization in strengthening the technical and entrepreneurial capacities of eCooking companies</p> <p>Low production & distribution capacity of national eCooking companies</p>	<p>Capacity building among eCooking companies</p> <p>Use the improvement of access to electrical energy for the SBEE to motivate the demand for electric cooking equipment</p> <p>Improve the profitability of eCooking companies manufacturing eCooking equipment by taking advantage of the subsidies granted through SBEE</p>

Recommendations 3

	Current status	Recommended interventions
Consumer demand	<p><i>Growing scarcity of firewood & charcoal and increasing prices which makes biomass cooking more expensive/less attractive but limited awareness & usage of eCooking; Misuse of eCooking equipment by customers despite advice and instructions from companies</i></p> <p><i>Weak technical and financial capacity of key stakeholders incl. companies for communication and promotion of equipment through the mass media</i></p> <p><i>Low demand for eCooking by potential customers/limited awareness/prejudice/Reluctance of some households to adopt eCooking</i></p> <p><i>Existing women distribution groups for ICS in the south but no focus on eCooking</i></p> <p><i>Challenges in terms of affordability; limited access to credit and financing</i></p>	<p><i>Awareness campaigns that target male-headed households: sensitization regarding the need of giving-up traditional fuels to achieve positive health- & environmental impacts</i></p> <p><i>Develop the e-commerce of electric and solar cooking equipment to facilitate their access to potential customers.</i></p> <p><i>Improve demand for electric and solar cooking equipment through formal (through mass media) and informal (word of mouth and neighbour observation) communication; live cooking demonstrations, Involve the media for communication around e- cooking (TV and social media.</i></p> <p><i>Focus on women's groups as enablers for eCooking</i></p> <p><i>Create attractive purchasing conditions/consumer financing models for e- cooking</i></p>

Recommendations 4

	Current status	Recommended interventions
Enabling environment	<p><i>Development of the National Action Plan underway for Clean Cooking (PANCP) under the lead of EnDev</i></p> <p><i>Growing awareness among public stakeholders but limited alignment and strategic planning among Ministries</i></p> <p><i>Development of the preliminary draft standards for "improved stoves" and strategy underway but overall lack of policy/regulations/ standards for e- cooking equipment</i></p>	<p><i>Develop draft standards for electric and solar cooking equipment based on the approach used for the preliminary draft standards on improved stoves</i></p> <p><i>Support the implementation and validation of the National Clean Cooking Action Plan (PANCP). Involve NGOs / Cabinets to sensitize potential customers for the adoption of electric and solar cooking equipment</i></p> <p><i>Advocate with the Ministry of Finance to obtain an exemption from customs taxes on imports of electric cooking equipment & components for the local manufacture of this equipment</i></p> <p><i>Make use of projects / programs in the sector for the structuring and organization of players in the electric and solar cooking equipment sector</i></p>



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- Cross-country comparison
- Impact modelling methodology
- Guiding framework

