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RENEWABLES-BASED ELECTRIC COOKING

Climate commitments and finance

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RENEWABLES-BASED ELECTRIC COOKING

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CONTENTS

FIGURES

TABLES

BOXES

ABBREVIATIONS

AFOLU	agriculture, forestry and other land use
BAR-HAP	Benefits of Action to Reduce Household Air Pollution
BAU	business as usual
°C	degree Celsius
C-NDC	co-operative NDC implementation scenario
CCA	Clean Cooking Alliance
CIC	Cooking Industry Catalyst
CIP	Climate Investment Platform (IRENA)
CO_2eq	carbon dioxide equivalent
COP 26	26th UN Climate Change Committee of Parties
COP 28	28th UN Climate Change Committee of Parties
DFI	direct foreign investment
E-NDC	enhanced ambition scenario
EAQIP	Energy Access and Quality Improvement Project (Rwanda)
EASP	Energy Access Scale-up Project (Uganda)
EnDev	Energising Development
EPC	electric pressure cooker
ESMAP	Energy Sector Management Assistance Program
ETAF	Energy Transition Accelerator Financing (IRENA)
EUR	euro
GBP	United Kingdom pounds
GCF	Green Climate Fund
GEAPP	Global Energy Alliance for People and Planet
GeCA	Global eCooking Accelerator
GeCCO	Global Electric Cooking Coalition
GHG	greenhouse gas
GMA	Global Market Assessment
GNI	gross national income
Gt	gigatonne
HIC	high impact country
IEP	integrated energy planning
INR	Indian rupee

IOC	Indian Oil Corporation
IRENA	International Renewable Energy Agency
ITMOS	internationally transferred mitigation outcome
JETP	Just Energy Transition Partnership
KES	Kenyan shilling
kg	kilogramme
kWh	kilowatt hour
LDC	least developed country
LEDS	Low Emission Development Strategy (Fiji)
LMD	last-mile distribution
Long-Term Strategy	Long-Term Low Emissions Development Strategy
LPG	liquified petroleum gas
MCFA	Modern Cooking Facility for Africa
MECS	Modern Energy Cooking Services
Mt	Megatonne
MTF	Multi-Tiered Framework
MW	megawatt
NDC	Nationally Determined Contribution
OEM	original equipment manufacturer
PAYGO	pay-as-you-go
RBF	results-based financing
SDG	Sustainable Development Goal
SEforAll	Sustainable Energy for All
SIDA	Swedish International Development Agency
SME	small and medium-sized enterprises
t	tonne
TA	technical assistance
TES	thermal energy storage
UEF	Universal Energy Facility
UN	United Nations
USAID	United States Agency for International Development
USD	United States dollar
VAT	value added tax
W	watt
WETO	World Energy Transitions Outlook
WHO	World Health Organization

EXECUTIVE SUMMARY

RENEWABLES-BASED ELECTRIC COOKING

Globally, around 2.3 billion people lacked access to clean cooking technologies and fuels in 2023. Despite substantial gains over the last decade, universal access to clean cooking may not be achieved by 2030 at the current rate of progress (IEA *et al.*, 2023). The continued use of polluting fuels and inefficient cookstoves results in negative environmental, health and human livelihood externalities.

Over the next decades, as outlined in IRENA's *World Energy Transitions Outlook* (IRENA, 2023a), the world will need to accelerate its shift to renewable cooking solutions in alignment with the 2030 Agenda for Sustainable Development Goals and Climate Agenda. This will involve both cleaner bioenergy solutions (including biogas and bioethanol) and renewables-based electric cooking. The appropriate mix will vary from context to context.

Renewables-based electric cooking is one of the cleanest cooking technologies, essential to achieving a low-carbon energy transition economy and minimising greenhouse gas (GHG) emissions from cooking, which contribute an estimated 2% of global emissions (Floess *et al.*, 2023; World Resource Institute, 2021; Ritchie, Roser and Rosado, 2020). Analysis has shown that universal adoption of electric cooking by 2040 could reduce cooking-related emissions by 40% compared to 2018 levels (Floess *et al.*, 2023). Achieving emission reductions requires investments into renewable energy sources, which are increasing (IRENA, 2023a). Based on current generation mixes, nearly all countries in sub-Saharan Africa could reduce emissions by adopting efficient electric cooking devices. The International Renewable Energy Agency (IRENA) *World Energy Transitions Outlook 2021* presents a pathway that limits global temperature increases to 1.5 degrees Celsius (°C) and calls for electric cooking to account for 85% of cooking energy by 2050 (IRENA, 2021).

To scale up electric cooking for climate action, this report assessed countries' status on access to renewables-based electric cooking and climate commitments to understand the current situation and priorities on electric cooking. Following that, since financing is one of the significant issues in translating the country's electric cooking targets into actual action on the ground, the report further looked into the financial landscape, challenges and supportive policies to address the challenges. Lastly, the report provides action plans to scale up electric cooking solutions for different groups of countries based on their current situation of electric cooking solutions.

COUNTRY ASSESSMENT

The current average penetration rate of electric cooking remains low at 8.9% among 185 IRENA members and states in accession with available data.[1] Analysis of the cooking energy landscape reveals that electric cooking penetration was directly correlated with the level of electricity access in the country: the countries with electric cooking rates above 5% have often shown electricity access rates above 97%. However, a group of 11 outlier countries[2] demonstrates that universal electricity access is not a prerequisite for electric cooking

[1] *Countries included in the study include 168 member states, the European Union, 15 states in accession and Lao People's Democratic Republic. The full list of countries is provided in Appendix A.*

[2] *The 11 countries are Botswana, Eswatini, Ethiopia, Guatemala, Honduras, Lesotho, Namibia, Papua New Guinea, South Africa, Zambia and Zimbabwe. Details are discussed in Chapter 2.*

market penetration. Instead, countries can make progress on scaling up electric cooking concurrently with scaling up electricity access. This group of outliers also shows that the affordability of electricity, market size and development status are not necessarily barriers to beginning a transition toward electric cooking. Although these affect the viability of electric cooking, many countries have market segments that are ripe enough to begin the energy transition toward electric cooking.

Only a handful countries that were assessed have already incorporated electric cooking into their climate commitments, with 22 countries including electric cooking in their Nationally Determined Contributions (NDCs) or Long-Term Low Emissions Development Strategies (Long-Term Strategies). These countries include nine least developed countries (LDCs)[3] representing a diverse cross-section of the world in terms of current access levels, economic development and geography, and encompassing a broad range of perspectives on how electric cooking would penetrate into the fuel mix and whether it should be promoted alongside or considered as a substitute for liquified petroleum gas (LPG) or traditional fuels.

Commitments toward increasing electric cooking adoption took many forms, with most countries setting qualitative targets towards promoting electric cooking. The role of electricity in the mix of cooking fuels was viewed differently, as some countries targeted electricity to displace biomass and LPG, while others considered promoting electric cooking alongside improved cookstoves or gas stoves. The differences in approach demonstrate the range of contexts in which a transition toward electric cooking can take place.

Of 185 members whose NDCs were reviewed, 52 included some other form of cooking in their NDCs and Long-Term Strategies, with most focusing on improved cookstoves, LPG, biogas and sustainable biomass. However, the majority of the countries reviewed did not mention cooking in their NDCs or Long-Term Strategies. While some climate commitments and national policies are framed in general terms, which could encompass electric cooking, it is important for countries to be specific in their commitments. Many countries can enhance their NDCs by including electric cooking targets, which would indicate their ambition to transition toward electric cooking and help attract support to make such a transition possible. The NDC targets can be either conditional or unconditional, depending on resource availability. Countries might need to set conditional targets if international financial support is necessary, for which carbon market mechanisms could play a large role in bringing finance.

FINANCING THE ELECTRIC COOKING TRANSITION

A shift for enhancing finance is required to scale up electric cooking. Historically, clean cooking has been underfinanced, and a small percentage of clean cooking funds went toward electric cooking projects. Recent developments suggest that finance for clean and electric cooking is increasing and that new sources of finance can expand financial flows further. A broad range of initiatives, including funds, projects, market accelerators and public finance programmes, were established with the explicit goal of accelerating the adoption of clean cooking technologies, including electric cooking.

To increase financial flows to electric cooking, barriers need to be addressed from four dimensions, including the enabling environment, investment, suppliers of electric cooking solutions and end users.

[3] *The nine LDCs are Bhutan, Cambodia, Democratic Republic of the Congo, Eritrea, Ethiopia, Mauritania, Nepal, Togo and Uganda.*

- **Enabling environment:** The lack of guiding policies relevant to electric cooking is a significant barrier. Many countries have not explicitly recognised electric cooking in their policy frameworks, which deters financial investments. Unclear and unfavourable regulations for electric cooking are another barrier for investors.
- **Investment:** Unsuitable financial terms can further restrict the financing available for electric cooking. Investors may not offer financing on terms that companies or projects require, such as longer loan tenors or smaller ticket sizes. In addition, in many countries where clean cooking access is low, the electric cooking market is led by small and medium-sized enterprises (SMEs) and early-stage companies. A lack of domain expertise is another deterrent of potential investment.
- **Suppliers of electric cooking solutions:** The limited capacity of SMEs and start-ups as suppliers is another barrier to finance for electric cooking. There is also an absence of a mature supply chain in emerging markets as large-scale companies have not fully invested in the markets where clean cooking access is most urgently needed.
- **End users:** The affordability of electric cooking appliances is one of the major barriers. This is because the adoption of electric cookstoves tends to require higher upfront costs than other clean cooking solutions. Low awareness levels on the part of end users are another significant barrier that limits the market for electric cooking.

Hence, electric cooking requires improved sourcing of finance because investments must be made into distribution channels, appliances and infrastructure. There are three potential financial sources: private supplier's finance, electricity sector finance and carbon finance. The three finance sources are complementary, and each has significant potential to help scale-up electric cooking.

- **Private sector finance:** Development of business models and de-risking measures of investment can help early-stage start-ups, SMEs and experienced companies to attract finance for developing the electric cooking market.
- **Electricity sector finance:** Electric cooking solutions can be integrated into electricity supply and grid modernisation projects through holistic energy access planning. Integrating electric cooking into the electricity sector will create a new opportunity for increased finance from an existing source, as billions of dollars are invested into grid generation, transmission and distribution each year.
- **Carbon finance:** Carbon finance measures, including Paris Agreement Article 6 market mechanisms and voluntary carbon markets, can be used as opportunities to expand the deployment of electric cooking solutions. Although there are some uncertainties around how Article 6 market mechanisms will be operationalised, electric cooking is a high-potential activity for consideration under the market mechanisms.

Considering the barriers and opportunities assessed so far, four approaches can be considered to unlock finance for renewables-based electric cooking. These include: 1) develop the policy and regulatory environment for electric cooking; 2) integrate electric cooking into the electricity sector; 3) foster the growth of electric cooking solution suppliers; and 4) engage and support end users. These four approaches support seizing the financing opportunities while addressing the barriers to finance.

Table S1 Strategy for increasing finance for electric cooking

Approach	Description
Develop the policy and regulatory environment for electric cooking	Develop a clear framework of policies and planning for scaling up electric cooking technologies. • national commitments for electric cooking adoption • favourable policies and regulations to facilitate investment, including carbon finance measures.
Integrate electric cooking into the electricity sector	Scale-up electric cooking adoption alongside electricity infrastructure. • integrated energy planning (IEP) for assessing holistic improvement on electricity access and electric cooking • utility-based financial mechanisms for supporting appliance funding for end users.
Foster the growth of the electric cooking solution suppliers	Engage the suppliers of electric cooking solutions to facilitate investments in the market. • capacity-building programmes and technical assistance (TA) for electric cooking entrepreneurs, including start-ups and SMEs • de-risking for established electric cooking appliance companies to enter the market.
Engage and support end users	Improve end users' awareness levels and access to finance. • awareness raising of end users, government, private sector and investors • enhance electric cooking's affordability through consumer finance.

ACTION PLANS FOR COUNTRIES

There is an urgent need to scale up electric cooking to meet Sustainable Development Goal 7 (SDG 7) and broader climate goals. As the country assessment revealed, the transition to electric cooking can occur even where there are present-day barriers to electricity access and markets. While countries are beginning to recognise the role of electric cooking in their climate commitments, many countries can still enhance their NDC ambitions by purposefully including electric cooking targets. Clean cooking has been underfinanced, but recent developments signal increased flows into the sector. These flows can be expanded further with flows from an integrated energy sector and carbon finance. Addressing financial barriers and tapping into right opportunities are important for financing electric cooking.

Based on the country assessment and financial landscape analysis on renewables-based electric cooking, this report classified markets from 49 countries into three groups – untapped, primed and maturing markets – to identify countries with high-potential markets for electric cooking. In each group, recommended actions are identified broadly for four areas of intervention: enhance the policy and regulatory environment, integrate electric cooking into electricity planning, foster the growth of electric cooking solution suppliers, and engage and support end users.

Table S2 Outline of action plans per market potential

Category	Untapped markets	Primed markets	Maturing markets
Improve the policy and regulatory environment	Countries would benefit from the support on the assessment to enhance their NDC and Long-Term Strategy commitments by including electric cooking targets and measures. Regulations also need to be improved to support the shift to electric cooking. Such regulations would include the phaseout of subsidies for polluting fuels.	Incentive mechanisms should be devised to facilitate the investment in electric cooking. These mechanisms would include the exemption of import tax and value added tax (VAT). In addition, technology certificates help support the diffusion of qualified cookstoves while energy efficiency regulations can also ensure the use of efficient appliances.	Countries need to assess the potential and plan to expand their grid capacities and coverage to reach more people and increase the proportion of renewable energy used in cooking. To further increase access to electric cooking appliances, carbon finance measures, such as the Paris Agreement Article 6 market mechanisms, can be considered.
Integrate electric cooking into electricity planning	TA programmes can help countries incorporate electric cooking into the electricity supply and infrastructure planning. Capacity-building programmes would be a good starting point to raise the awareness of policy makers and utilities.	Through IEP, programmes to bundle electricity connection at households with electric cooking appliances would help the dispersal of appliances. Financial mechanisms, such as targeted loan programmes for electricity access/grid connection with electric cooking appliances, on-bill financing, or others, may be supportive.	Smarter grids can be considered to improve the stability and reliability of the grid by better matching grid supply and demand in light of the increasing load due to a scale-up of electric cooking usage. Also, the development of appliance repair programmes would be needed for households to access utility channels for the sustained use of electric cooking.
Foster the growth of electric cooking solution suppliers	Suppliers of electric cooking solutions need to become familiar with electric cooking devices and the fund raising, marketing and sales of the devices. Support from the public sector, such as the creation of accelerator and mentorship programmes and financial incentives, also needs to be developed for the private sector to start developing the electric cooking business.	To ensure an adequate supply of electric cookstoves, training programmes can be provided for companies to assist their electric cooking businesses. The programmes may include financial modelling and valuation, accounting support, and other relevant activities.	Public sector support should accelerate the replacement of conventional cookstoves with electric cookstoves. Programmes for public buildings such as hospitals and schools can be considered, followed by the scaled-up update of electric cookstoves in household levels.
Engage and support end users	End user awareness should be raised to recognise electric cooking solutions through campaigns and workshops. Consumers' access to electric appliances should also be improved through consumer finance instruments.	Further end user awareness raising is necessary to nurture the interest and demand of end users in electric cooking. This may include education programmes and materials to inform consumers about the benefits and use of electric cooking appliances.	Further engagement with end users is recommended to raise demand for electric cookstoves, communicating their economic and sustainable development co-benefits such as pollution mitigation, health impacts and other benefits.

Notes: untapped markets = countries that have large market or opportunities for electric cooking but have not realised this potential or recognised cooking in their climate commitments; primed markets = countries that have not yet achieved high levels of electric cooking access but have taken the important step of recognising cooking in their NDCs or Long-Term Strategies; maturing markets = countries that have made progress in scaling electric cooking adoption and have made this part in their NDCs or Long-Term Strategies.

Table S3 High-potential countries for support on electric cooking climate action

Untapped markets	Primed markets	Maturing markets
(25 countries)	(15 countries)	(9 countries)
Afghanistan	Cambodia	Bhutan
Algeria	Congo	China
Argentina	Democratic Republic of the Congo	Costa Rica
Bangladesh	Dominica	Cuba
Brazil	Ecuador	Ethiopia
Chile	Eritrea	Fiji
Colombia	India	Honduras
Egypt	Indonesia	Marshall Islands
Ghana	Malawi	South Africa
Islamic Republic of Iran	Mauritania	
Iraq	Nepal	
Kenya	Rwanda	
Republic of Korea	Thailand	
Malaysia	Togo	
Mexico	Uganda	
Morocco		
Nigeria		
Pakistan		
Peru		
Philippines		
Romania		
Sri Lanka		
Sudan		
Türkiye		
Uzbekistan		

Note: For each of the above countries, a country profile has been developed and appended to this report.

The transition to electric cooking is an important part of achieving the 1.5°C pathway, as it phases out traditional bioenergy such as charcoal and wood for cooking. The action plans can be taken forward through the collaboration of governments and development agencies. The actions elaborated above would be key starting points for countries to scale up electric cooking solutions for climate action. As countries have different levels of readiness for technology adoption, considering each national circumstance will be a key step to bring a concrete set of actions for scaling up electric cooking solutions.

1 INTRODUCTION

1.1 CLEAN COOKING AND THE ENERGY TRANSITION

Clean cooking is increasingly recognised as an essential solution to address energy poverty and ensure sustainable energy security for billions of people. Switching to clean cooking solutions brings transformative impacts on the climate and environment, and the health and well-being of women and children. However, despite the expected gains of clean cooking, 2.3 billion people, or 29% of the global population, still lack access to clean cooking (IEA *et al.*, 2023). This population continues to rely on inefficient and traditional use of biomass for cooking, including charcoal, fuelwood and kerosene. The use of such fuels generates indoor air pollution affecting the health conditions of women and children (IRENA, 2021).

In the face of this challenge, the United Nations (UN) Sustainable Development Goal (SDG) 7 sets a target to achieve universal access to affordable, reliable and modern energy services by 2030. A key indicator of SDG 7 (*i.e.* 7.1.2) targets increasing the proportion of the global population with primary reliance on clean fuels and technology for cooking (IEA *et al.*, 2023).[4] However, current data show a substantial shortfall in access to clean fuels, with 71% of the world's population having access as of 2021 (Table 1).

Table 1 SDG 7 indicators

SDG 7 **Ensure access to affordable, reliable, sustainable and modern energy for all**	
Target 7.1 **By 2030, ensure universal access to affordable, reliable and modern energy services**	
Indicators	**Progress 2021**
Indicator 7.1.1 Proportion of population with access to electricity	91%
Indicator 7.1.2 Proportion of population with primary reliance on clean fuels and technology	71%

Based on: IEA *et al.* (2023) ; WHO (2023a).

[4] *When estimating access rates, the World Health Organization (WHO) consults nationally representative household surveys with data on household cooking fuels, considering unprocessed biomass (e.g. wood), charcoal, coal and kerosene as polluting fuels and categorising gaseous fuels, electricity and other fuels like alcohol as clean (IEA et al., 2023).*

1.2 BENEFITS OF CLEAN COOKING

The use of polluting cooking fuels is associated with significant environmental, human health and livelihood challenges. These externalities are estimated to result in 2.4 trillion US dollars (USD) in global economic losses each year (ESMAP, 2020b). The use of solid biomass fuels, such as wood and charcoal, is a driver of deforestation and contributes to global greenhouse gas (GHG) emissions. In 2018, cooking fuels resulted in an estimated 1.14 gigatonnes (Gt) of CO_2 equivalent (CO_2eq) emissions (Floess *et al.*, 2023), representing approximately 2% of global GHG emissions (World Resource Institute, 2021; Ritchie, Roser and Rosado, 2020). The emissions from cooking result primarily from the use of unsustainable biomass and are estimated to increase to 1.30 GtCO_2eq by 2040 if left unchecked (Floess *et al.*, 2023). A third of global wood fuels are harvested unsustainably, and large shares of the global population using biomass fuels live in areas where more than 50% of biomass harvest is unsustainable (Bailis *et al.*, 2015). In East Africa, more than a quarter of the population lives in areas with more than 50% unsustainable harvest rates.

Household air pollution is a significant contributor to the global burden of disease, resulting in an estimated 92 million healthy years lost and 3.2 million premature deaths each year (WHO, 2022a; WHO, 2022b). The use of polluting fuels for cooking can produce large amounts of smoke, which can drastically increase indoor air pollution levels (Smith *et al.*, 2007). This smoke contains many harmful compounds, including particulate matter, carbon dioxide, sulphur oxides, formaldehyde and known carcinogens like benzo[a]pyrene (Ezzati and Kammen, 2002). Exposure to smoke can cause serious health conditions, including respiratory and ear infections, chronic obstructive pulmonary disease, respiratory cancers, asthma, tuberculosis, low birth weight, eye diseases, and premature death (Ezzati and Kammen, 2002).

Achieving SDG 7 will contribute to the attainment of SDG 5 on gender equality because women are disproportionately impacted by the use of polluting biomass fuels for cooking, from both a health and a livelihood perspective. Across the world, women are mostly responsible for home care and management activities like cooking, childcare, laundry and cleaning, especially in developing countries. In sub-Saharan Africa, women on average spend only a few hours per week on market work and the rest on household duties. In Ghana, United Republic of Tanzania and Uganda, specifically, the average woman works less than 25 hours per week in the market and 32-48 hours in the home taking care of the home, with over a quarter of this time spent on fuel collection and food preparation (Dinkelman and Ngai, 2022). Young girls involved in cooking in households that use polluting fuels spend, on average, 18 hours per week collecting fuel, compared to 5 hours per week in households that have access to clean fuels (WHO, 2016).

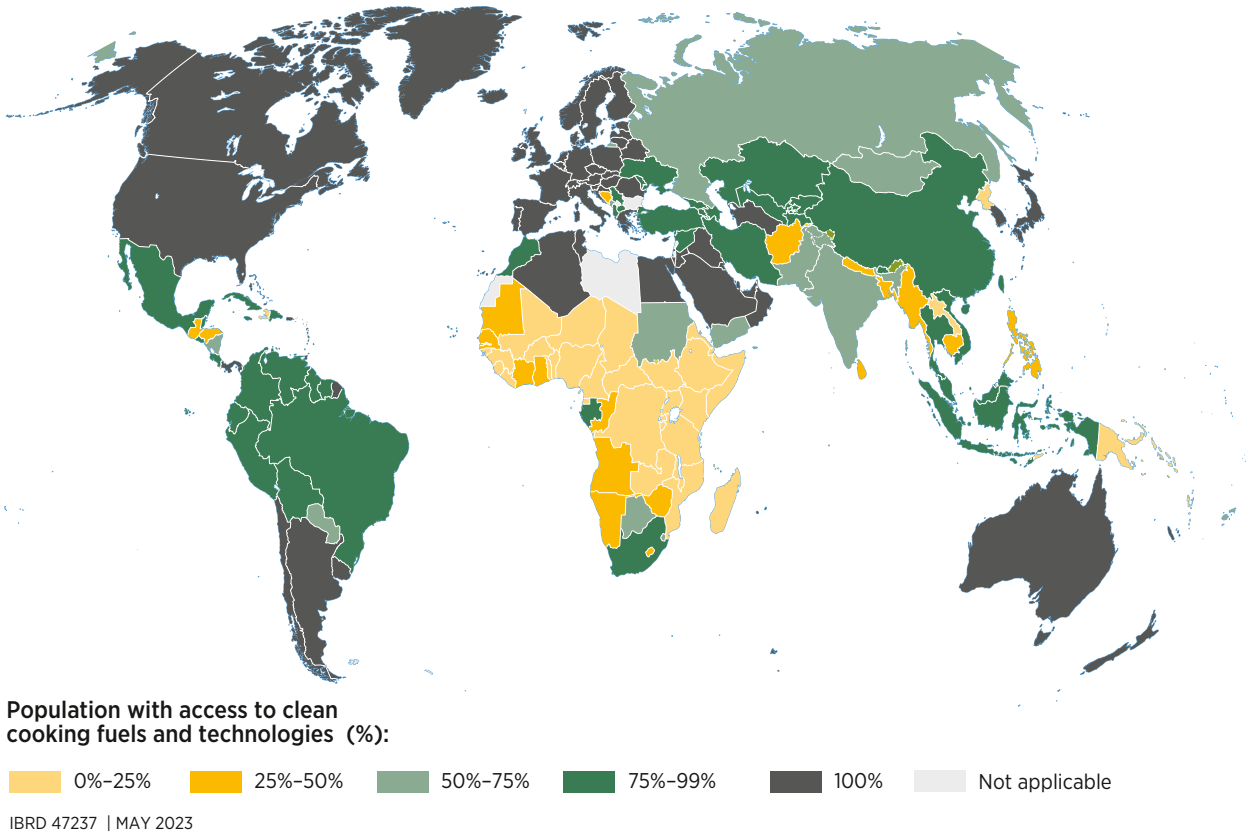
As women and children are disproportionately responsible for cooking, they also bear the costs. While cooking, women and often their children in the kitchen are directly exposed to pollution. Sixty percent of global deaths attributable to indoor air pollution occur among women and children. Collecting firewood is associated with health and safety issues resulting from carrying heavy loads for long distances and moving in secluded and unsafe areas (WHO, 2016). Exposure time and health burdens directly affect female empowerment by limiting the time and effort devoted to education, employment and income generation. A recent study across six developing countries identified a positive association between access to modern energy services and women's empowerment, defined as education, access to credit, social capital, mobility and employment (Chandrasekaran *et al.*, 2023).

Increasing access to clean cooking is essential for achieving SDG 7 and reducing the harmful effects of polluting fuels. A transition to Tier 4 or Tier 5 clean cooking technologies[5] would minimise cooking-related health hazards, fuel collection labour and GHG emissions (Bhatia and Angelou, 2015).

1.3 UNEVEN PROGRESS TOWARD CLEAN COOKING ADOPTION

Progress towards improving clean cooking access is geographically uneven, as shown in Figure 1. Those relying on polluting fuels for cooking are heavily concentrated in Africa, where only 21% of the population had access to clean fuels in 2021 and where urban areas had much higher access rates than rural areas (40% vs. 7%, respectively) (WHO, 2023b). Moreover, the majority of global improvements on access to clean cooking over the last two decades has been concentrated in five countries: Brazil, China, India, Indonesia and Pakistan. These five countries experienced a significant 58% decrease in their populations without access to clean cooking, from a combined 1.91 billion to 0.79 billion in the period between 2000 and 2021. Progress elsewhere has been limited, with population growth outpacing absolute gains in access, as the total population lacking access to clean cooking across all other countries increased from 1.19 billion to 1.44 billion (21% increase) during the same period (WHO, 2023b), as highlighted in Figure 2.

Figure 1 National-level estimates for access to clean cooking, 2021

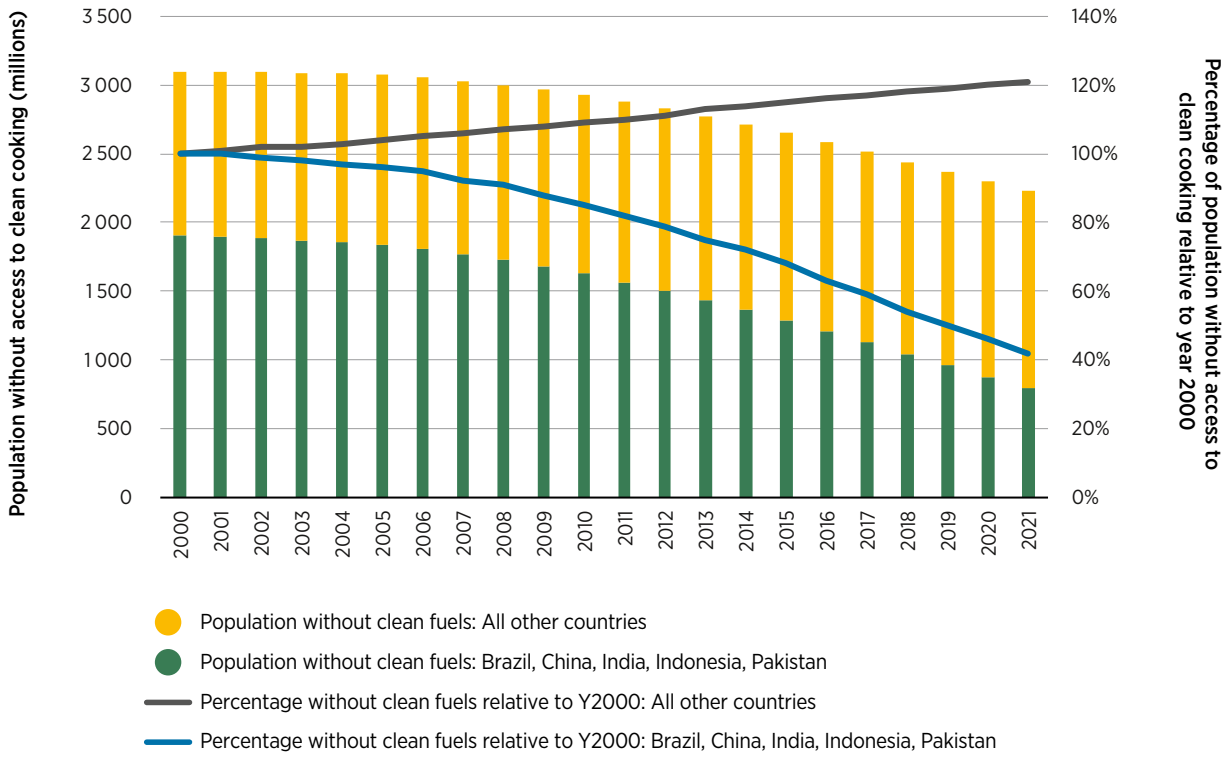


Source: IEA *et al.* (2023).

Disclaimer: This map is provided for illustration purposes only. Boundaries and names shown on this map do not imply any endorsement or acceptance by IRENA.

[5] *The Multi-Tier Framework assigns tiers to cooking fuel and technology combinations. The rankings range from Tier 0, the lowest level, to Tier 5, the highest level. Stove and fuel technologies are rated on the following characteristics: cooking exposure (personal exposure to pollutants from cooking activities), cookstove (thermal) efficiency, convenience of use, safety, affordability and fuel availability.*

Figure 2 Population without access to clean cooking, 2000-2021



Source: WHO (2023b).
Note: Y2000 = year 2000.

1.4 ELECTRIC COOKING FOR CLIMATE ACTION

Electric cooking is among the highest-tier clean cooking technologies and is an essential technology in achieving a low-carbon energy transition-based economy, provided that renewables-sourced electricity is to be globally mainstreamed.[6] This is a plausible assumption given the progress of the renewables-based capacity additions in recent years: the share of renewables in total capacity expansion reached 83% in 2022, compared to 78% in 2021 (IRENA, 2023b). Analysis of GHG emissions shows that universal adoption of electric cooking by 2040 could reduce emissions by 40% compared to 2018 levels (Floess *et al.*, 2023). Achieving this level of emission reductions requires new investments in renewable energy sources, but many electricity grids already have sufficient levels of renewable generation sources to make electric cooking a climate-friendly solution: an analysis found that adoption of induction stoves for cooking would result in an increase in emissions in only one sub-Saharan African country based on present-day generation profiles (IEA, 2023a). Investments in renewable energy sources will reduce emissions from electric cooking further in the coming decades.

In contrast to the slow growth in clean cooking access rates, developing countries have made significant progress in increasing access to electricity. As a pathway for the world to achieve the Paris Agreement goals and slow the pace of climate change through a just energy transition, IRENA's 1.5°C Energy Scenario suggests that around 85% of cooking needs are to be met through electricity by 2050, considering the phaseout of traditional use of bioenergy (IRENA, 2021).

[6] *ESMAP's Multi-Tiered Framework defines different levels of access to electricity and clean cooking. Electric cooking devices meet the requirements of Tier 4 and Tier 5 solutions, provided that households have suitable electricity access.*

As of 2021, 91% of the world's population had access to electricity (IEA *et al.*, 2023). The significant growth was concentrated in central and southern Asia, with access rates rising from 61% in 2000 to 99% in 2021 (IEA et al., 2023). Sub-Saharan Africa also drastically increased rates during this period, from 27% to 51%. Many countries are also increasing electricity supply, which can support increased adoption of electric appliances. For example, Uganda increased its installed generation capacity from 938 megawatts (MW) in 2017 to 1 347 MW in 2021, mainly from hydropower (Electricity Regulatory Authority, 2022). In this landscape of increased electricity access and supply, electric cooking is becoming a more viable solution to decreasing reliance on polluting fuels and technologies for cooking. Still, the growth of electricity demand reflecting on the update of electric cooking solutions would add extra load to grids. The electricity infrastructure should take the rising electricity demand into consideration, which includes not only the demand increase from electric cooking adoption but also other end-use electrification measures such as appliances (IRENA, 2023a). Hence, modernisation of the electricity grids needs to be concurrently managed to ensure reliable power services from stable grids.

Despite this growth, current electric cooking rates remain low in low- and middle-income country settings. For example, 26% of Kenya's population has access to Tier 4 or 5 electricity, or electricity that can support cooking services, but only 1% of the population cooks with electricity.[7] Other countries, like Zambia, have higher adoption rates, with 28% of the population having access to Tier 4 or 5 electricity and 17% cooking with electricity (ESMAP, 2020a). Overall, electric cooking expanded slightly between 2000 and 2020, increasing from 3% to 13% in low- and middle-income countries, with most of the growth occurring in urban areas (IEA et al., 2023). Electric cooking adoption is highest in East and Southeast Asia, at 24%. However, in low- and middle-income countries, liquified petroleum gas (LPG) is the dominant cooking fuel in urban areas and biomass in rural areas (IEA *et al.*, 2023).[8]

With this background, the remainder of this report looks at the current situation, challenges and opportunities in the deployment of electric cooking solutions. Policy makers and development agencies can make use of the report's analysis to take actions in countries to support the scale-up of the deployment of electric cooking solutions. Chapter 2 commences with the assessment of the country-level status of electric cooking solutions through a review of national energy statistics and climate commitments. The climate commitments, including Nationally Determined Contributions (NDCs) and Long-Term Low Emissions Development Strategies (Long-Term Strategies), clarify which countries target electric cooking solutions as part of their climate action plan. Financing is a significant issue when translating the countries' electric cooking targets into action on the ground. Therefore, Chapter 3 assesses the financial landscape of electric cooking to identify the barriers to finance. It further looks into strategic recommendations for facilitating finance for electric cooking. Finally, building on these assessments and recommendations, Chapter 4 proposes country-level action plans for the increased deployment of electric cooking solutions. Taken as a whole, this report provides insights on how to transition to electric cooking adoption while taking into consideration countries' differing circumstances.

[7] *A Tier 4 or Tier 5 electricity access level requires at least 800 watts (W) of power output, 3.4 kilowatt hours (kWh) of usable energy per day, and high reliability and availability.*

[8] *A majority of the population of sub-Saharan Africa uses traditional biomass for cooking (Khavari et al., 2023).*

2 SITUATION ANALYSIS OF ELECTRIC COOKING SOLUTIONS

Transitioning to electric cooking will require concrete action and commitment. Although electric cooking is a principal component for SDG 7 and achieving universal access to clean cooking, it also plays an important role in achieving net-zero emissions. In this section, we assess the current situation of electric cooking solutions in countries through quantitative analysis, followed by an assessment of countries' prioritisation of electric cooking through a review of national climate commitments, including NDCs, Long-Term Strategies and national policies.[9]

2.1 ANALYSIS OF ELECTRIC COOKING LANDSCAPE IN COUNTRIES

IRENA's *World Energy Transitions Outlook: 1.5°C Energy Scenario 2021* outlines a pathway for achieving net-zero emissions by 2050, under which 85% of cooking will need to be done using electricity by 2050 (IRENA, 2021). The latest *World Energy Transitions Outlook* (WETO), published in 2023, further argues that cooking, which relies heavily on fossil fuels and traditional biomass globally, would need to rapidly adopt electricity-powered efficient stoves and sustainable biomass (IRENA, 2023a). However, current electric cooking adoption rates remain low. Among the assessed countries,[10] the average rate of electric cooking adoption is just 8.9% (WHO, 2023b).

To better understand the landscape for electric cooking among countries, a quantitative analysis was conducted.[11] This analysis reveals the opportunities and challenges that countries face in achieving electric cooking access and is used to identify action plans for countries (see Chapter 4).

A plotting method was used to visualise the electric cooking landscape through two different lenses through access and market, as described in Table 2 and consider countries in relation to each other. With this method, countries are individually plotted and geographically color-coded to reveal the relative position of individual countries as well as broader regional trends.

Table 2 Lenses for viewing progress toward electric cooking

Lens	Variables
Access: Progress on access to electricity and electric cooking	Access to electricity *vs.* Access to electric cooking *vs.* Population
Market: Market potential for electric cooking	Total market size *vs.* Affordability of electricity *vs.* Market growth potential

[9] *Details of the country-level situation analysis for each subsection topic are described in Appendix B: Country assessment details.*
[10] *In this report, we analysed IRENA Member Countries, including 168 states, the European Union, 15 member states in accession and Lao PDR.*
[11] *Datasets from IEA, WHO, the World Bank and other sources were used for the analysis.*

The first plot views clean cooking from the access lens and visualises the progress towards achieving universal access to electricity and high adoption of electric cooking technologies per SDG 7 and WETO's 1.5°C Energy Scenario targets. The second plot uses the market lens and reveals where electric cooking is most viable by comparing the affordability of electricity to the untapped market potential for electric cooking technologies.

Combined, these analyses present a global view of the current status and opportunities for scaling electric cooking. Following that, the analysis is expanded upon with the addition of data from an analysis of NDCs.

Access: Progress on access to electricity and electric cooking

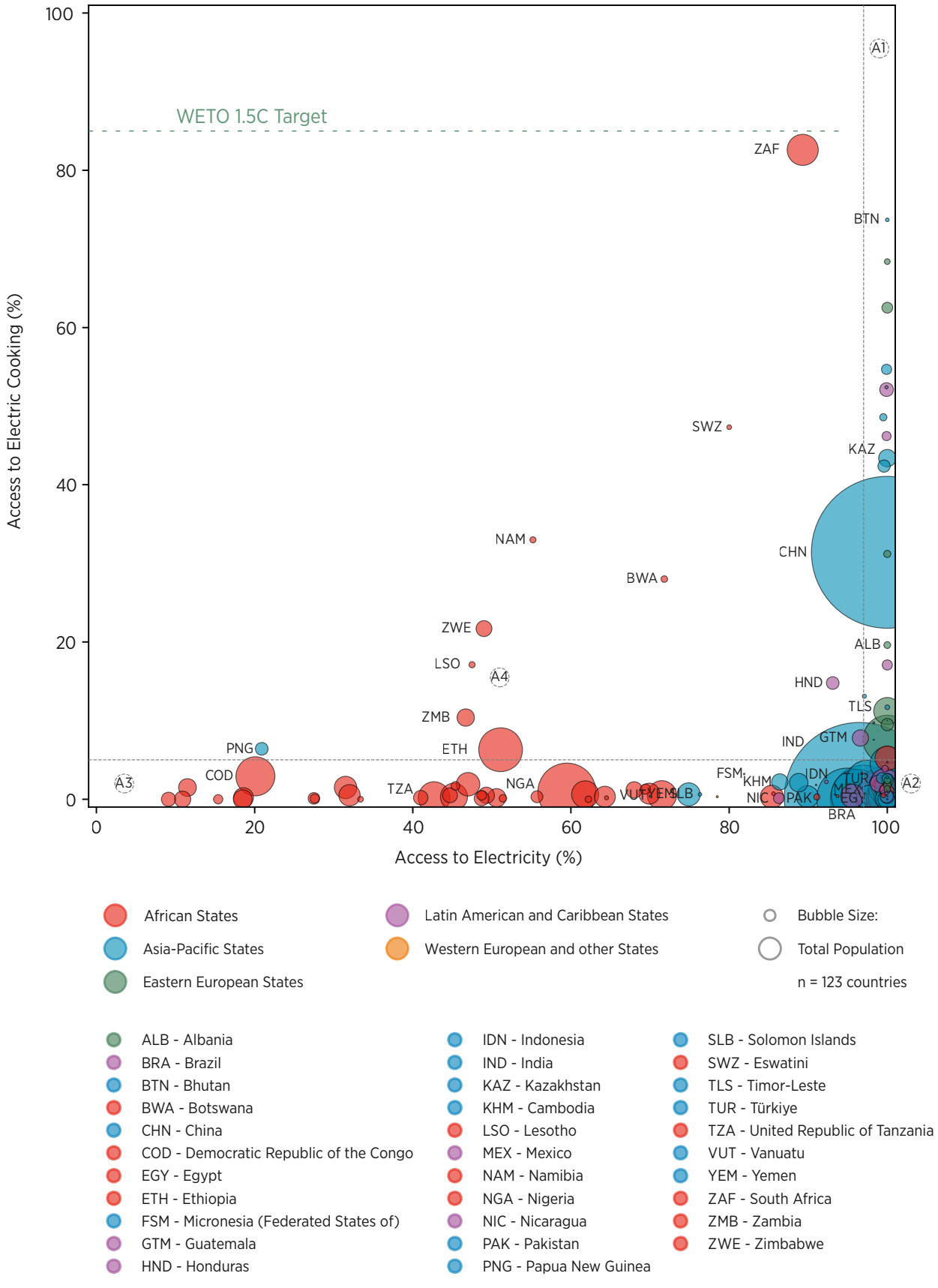
From the analytical lens of access, Figure 3 visualises countries' progress on access to electricity and access to electric cooking. SDG 7 targets universal access to electricity and clean cooking by 2030. The x-axis and y-axis illustrate access to electricity and access to electric cooking, respectively, while the bubble size indicates total population, as described in Table 3.

Due to data availability, 123 countries were considered in this analysis. Countries are divided into groups based on their relative position on the graph, with divisions corresponding to 97% access to electricity (signifying near-universal rates of electricity access) and 5% adoption of electric cooking (the mean rate of adoption in countries with access to electricity less than 97%).

Table 3 Access-related variables

Variable	Description
Access to electricity (%)	The percentage of the population with access to electricity in 2020. Data on access to electricity is derived primarily from national household surveys, with gaps in data filled using a modelling approach based on regional, country and time variables. **Source:** IEA *et al.* (2023)
Access to electric cooking (%)	The percentage of the population that relies primarily on electricity for cooking in 2020. WHO derives estimates for reliance on kerosene, gas, electricity, biomass and charcoal from models that use household survey data and time. Some data are unavailable because high-income countries and countries with more than 15% of respondents that are not categorised as cooking with a fuel type are not modelled by WHO. **Source:** WHO (2023b)
Total population	The total population in 2020. Population estimates are based primarily on national censuses with missing years interpolated using demographic models. **Source:** World Bank (2023d)

Figure 3 Population with access to electricity and access to electric cooking, 2020



Based on: IEA *et al.* (2023); WHO (2023b); World Bank (2023d).
Note: The detailed list of countries in each group is shown in Table B1.

Figure 3 shows that countries with high rates of electric cooking adoption have often already achieved universal or near-universal access to electricity, as shown on the middle- and upper-right sides of the graph (Group 1, "A1"). This group consists of 23 countries, including Albania, Bhutan, China, Kazakhstan, and Timor-Leste. This group has an overall access to electricity rate greater than 99.9% and an overall rate of access to electric cooking of 33%. Representing 28% of the overall population among the countries shown in Figure 3, these countries demonstrate that electric cooking is already feasible and being adopted in many different contexts, including both developed countries and least developed countries (LDCs). Many high-income countries that are not shown in this graph would also fall into this group, such as Greece, which has met the access goals under SDG 7 and WETO 1.5C and achieved universal access to electricity and an electric cooking penetration above 85%.

Countries that have not yet achieved universal access to electricity tend to have very low rates of electric cooking adoption. Of the 66 countries with electricity access rates below 97%, 55 had less than 5% electric cooking penetration (Group 3, "A3"). Thirty-eight of the countries in A3 were African countries, with the Democratic Republic of the Congo, Nigeria and the United Republic of Tanzania the largest by population from the region. Seventeen non-African countries were also in this group, including Cambodia, India, Micronesia (Federated States of), Nicaragua, Pakistan, Solomon Islands, Vanuatu and Yemen.

At the cross-section of these two groups, 34 countries have electric cooking penetration rates less than 5% despite having rates of access to electricity that are greater than 97% (Group 2, "A2"). These countries are positioned in the lower-right portion of the graph and include Brazil, Egypt, Indonesia, Mexico and Türkiye. A2 had an overall rate of access to electricity of 99.7% and an overall rate of access to electric cooking of 1.4%. Countries in both A2 and A3 have a huge opportunity to transition their already-electrified households to begin cooking with electricity. Initiatives such as India's Surya Nutan (Box 1) and Indonesia's electric stove conversion programme are examples of how countries are pursuing this goal.

The groups described above suggest a trend wherein electric cooking technologies are adopted only if access to electricity has already been achieved. For 112 of the 123 countries considered in this analysis, electric cooking technology does not reach penetration rates greater than 5% unless the state has achieved the highest levels of electricity access above 97%. This observation may help us understand perspectives on pathways for scaling electric cooking: countries may believe a two-step approach to access is necessary, wherein they first prioritise universal access to electricity and then promote electric cooking afterwards.

However, 11 countries comprise a fourth group (Group 4, "A4") on the graph that is characterised by significant electric cooking penetration despite having access to electricity rates below 97%. On the lower left corner of the plot, Papua New Guinea has a 6.4% penetration of electric cooking and a 21% access to electricity rate. In the central part of A4, Ethiopia, Lesotho, Namibia, Zambia and Zimbabwe have access to electricity rates ranging from 47% to 56% and electric cooking access rates ranging from 6.3% to 33%. To the right of these, Botswana and Eswatini have access to electricity above 72% and access to electric cooking above 28%. In the lower right, Guatemala and Honduras have electric cooking penetration rates of 7.8% and 12.4%, respectively, and both have electricity access rates above 93%. In the upper-right corner of A4, South Africa has an 82.6% electric cooking penetration rate and an 89.3% electricity access rate (Box 2). The positions of these countries in the figure demonstrate that universal access to electricity is *not* a prerequisite for electric cooking penetration. Rather, electric cooking can achieve market penetration even while countries make progress to electrify more of their populations.

A4 also suggests concerns around the affordability of electric cooking may be overstated, as 4 out of 12 countries are LDCs: Ethiopia, Lesotho, Timor-Leste and Zambia. While cost can be a significant barrier for some households, electric cooking can still be viable in other customer segments, particularly higher-income urban populations. The above-average rates of adoption in these LDCs might be explained by favourable policy environments (for example, government programmes in Ethiopia supported the sales of electric injera stoves in the 1970s), affordable electricity (Zambia and Ethiopia have the fourth- and eighth-lowest prices of electricity, respectively, among the assessed countries), or some other broad range of factors such as subsidies on electricity consumption and the competitiveness or availability of alternative fuels (Sieff, Troncoso and Tesfamichael, 2022; World Bank, 2022b). Countries in A4 should be investigated closely when analysing the context of how electric cooking scales. As eight of these countries are located in Africa, their circumstances may be particularly relevant for other African countries that have low rates of access to electricity and comprise most of A3 in the lower-left section of the figure.

Box 1 India's new electric cooking technology – Surya Nutan

India is exploring a new solar-electric cookstove technology to scale up electric cooking. The Prime Minister of India, Narendra Modi, inaugurated an indoor solar-electric cookstove, Surya Nutan, developed by the Indian Oil Corporation, at India Energy Week (February 2023) in Bengaluru. He announced that the cookstove will reach 30 million Indian households within the next few years.

The government's objective is to reduce indoor pollution in rural households that depend on biomass burning for cooking and to decrease the dependence on LPG through the mass adoption of solar-electric cookers. This is expected to transform cooking practices and could help limit GHG emissions, thereby contributing to India's energy security by reducing LPG imports.

According to the Indian Oil Corporation, the cooker is available in a solar and hybrid model. It is designed to use both solar energy and alternative fuels. Surya Nutan's design minimises radiative and conductive heat loss, increasing its efficiency. The cost of the solar-electric cooker ranges from INR 12 000 (Indian rupees) to INR 30 000 (around USD 140-USD 370). While other cost elements, such as photovoltaic panels, need to be considered when adopting electric cooking solutions, the expected cost reduction of the solar-electric cooker would help consumers shift to electric cooking solutions.

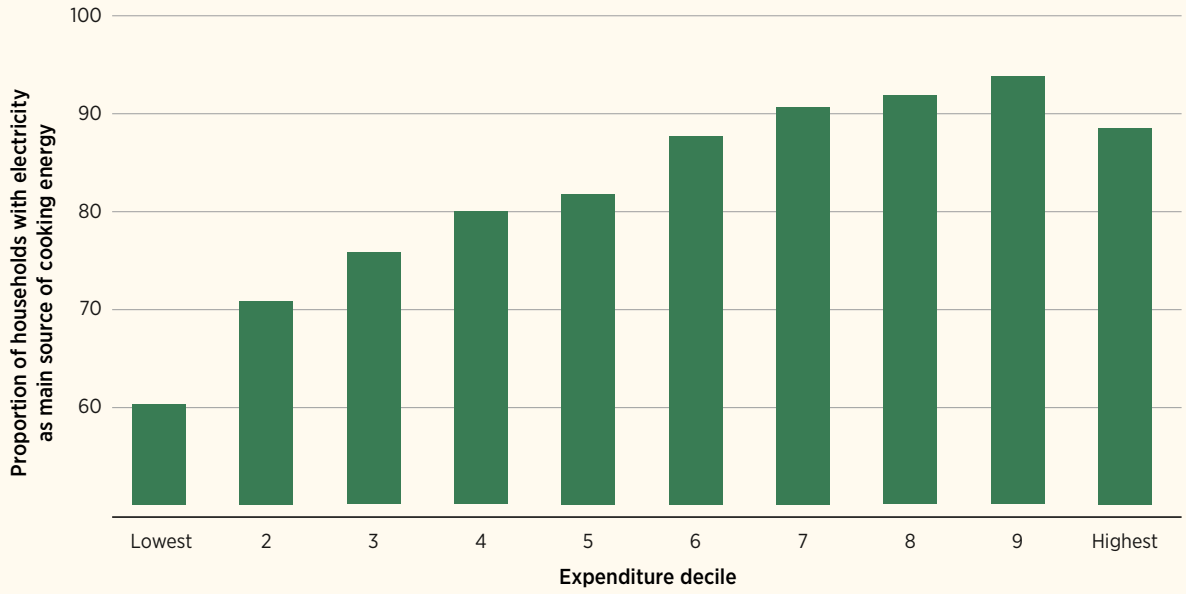
Previous models of solar cookers had to be kept outdoors, and the cooking process was slow. Surya Nutan's solar cooking system overcomes some of these challenges with the use of thermal energy storage that enables cooking indoors and without sunlight in real-time. The stove can be placed indoors while a solar panel collects energy from the sun, converts it into heat through a specially designed heating element, stores thermal energy in a thermal battery and reconverts the energy for cooking. The developers claim that the solar panel has a lifespan of 25 years, and the stove does not need maintenance for 10 years. Unlike batteries that store electrical energy in the form of chemical energy, thermal batteries do not have to be electronically charged, adding to the advantages of the solar cooker.

Box 2 Electric cooking in South Africa

South Africa has achieved the highest rate of clean cooking access on the African continent. The rate of access to clean cooking grew from 56% to 87% between 2000 and 2020, and 83% of households cooked with electricity as of 2020 (WHO, 2023a and 2023b).

In other settings, electric cooking is often correlated with expenditure. In South Africa, electric cooking rates are still high even among the poorest households. Sixty percent of households in the lowest expenditure decile report using electricity as their main cooking energy source, compared to almost 90% in the highest expenditure decile (Statistics South Africa, 2017).

Figure 4 Electric cooking in South Africa, by expenditure decile



Based on: Statistics South Africa (2017).

What might explain South Africa's comparatively high rate of electric cooking? First, the country has achieved high electrification rates, with 89% of the population being connected to an electricity source as of 2020 (IEA et al., 2023). In addition, the country has, historically, heavily subsidised electricity consumption, lowering the cost of electric cooking. In 2003, the country began to offer a "lifeline" block, or 50 kWh per month for free, to qualifying households – those consuming less than 150 kWh per month (Department of Minerals and Energy, 2003). Recent tariff changes have removed this lifeline block and raised tariffs overall, so it remains to be seen whether the high electric cooking rates will persist (Eskom, 2023).

South Africa has faced continuous electricity supply issues in recent years as a result of under-investments in electricity infrastructure, as well as corruption and sabotage (Cowan, 2021; Smolaks, 2023). This has affected the ability of households to consistently cook with electricity and resulted in households considering alternative cooking methods (Scheepers, 2023). Under the Just Energy Transition Partnership, USD 8.5 billion is being invested in South Africa to decarbonise the electricity sector and accelerate investments into renewable energy (European Commission, 2022). These investments will help to ensure that households are able to cook reliably and with minimal emissions.

Market: Market potential for electric cooking

From a market perspective, countries with affordable electricity and large households with electricity access represent highly likely markets for electric cooking distributors.

Figure 5 visualises the market potential for electric cooking by plotting the affordability of electricity against the market size and its growth potential. The x-axis and y-axis illustrate addressable market size and affordability of electricity, respectively, while the bubble size indicates market growth potential, as described in Table 4.[12]

The countries are split into four groups based on the average addressable market size and the average affordability of electricity. Divisions were made at:

1. an addressable market size of 12, the mean of all states and representing 4.8 million electrified households without electric cooking
2. a relative affordability index of 24, the mean affordability among states with electric cooking rates greater than 5% (A1 and A4 in Figure 3) and equivalent to country with a USD 0.16 per kWh electricity tariff and USD 17 800 gross national income (GNI) per capita.

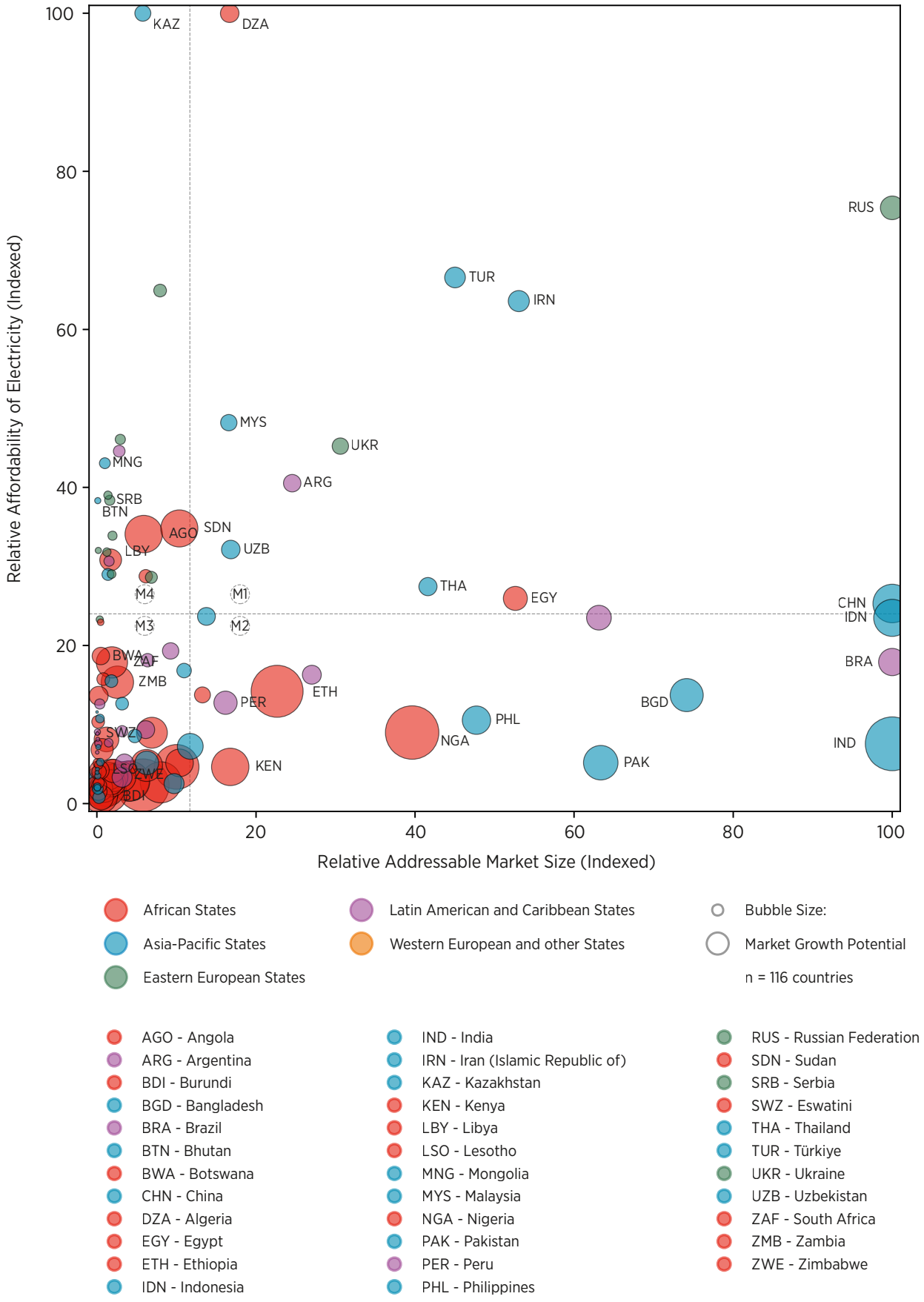
Thus, countries on the left portion of the graph have below-average total market sizes for electric cooking. Countries in the upper sections of the graph have electricity prices that are more affordable than those of countries where electric cooking is already being adopted in a substantial way.

Table 4 Market-related variables

Variable	Description
Total addressable market size	The number of households that have access to electricity but do not rely on electric cooking in 2020, indexed on a 0-100 scale among the assessed countries. The total market size was calculated as the number of households that have access to electricity minus the number of households that have primary reliance on electric cooking. The number of households was calculated based on population and the average total market size. The total market sizes were indexed on a 0-100 scale, with the maximum set as one standard deviation above the mean market size. Each index point represents 40 000 households. **Based on:** IEA *et al.* (2023); WHO (2023b); World Bank (2023d); Pew Research Center (2019)
Affordability of electricity	The price of electricity relative to household income, indexed on a 0-100 scale among the assessed countries. The affordability of electricity was calculated as the GNI per capita divided by the price of electricity. The affordability was then indexed on a 0-100 scale with the maximum set as one standard deviation above the average affordability of electricity. Assuming a fixed USD 0.16/kWh price of electricity, each index point represents a GNI of USD 740 per year. **Based on:** World Bank (2021, 2023c)
Market growth potential	The share of households that can adopt electric cooking in the future as a result of population growth or increased electricity access. The market growth potential was calculated as the number of households that lack access to electricity plus the population birth rate times the number of households. **Based on:** IEA *et al.* (2023); World Bank (2023a, 2023d); Pew Research Center (2019)

[12] *As Figure 5 specifies, the market size in this report's analysis is measured based on the potential additional distribution of electric cooking appliances. It should be noted that there are other factors that would influence the market growth, such as electricity supply and load, which are not reflected in measuring the market size.*

Figure 5 Market potential for electric cooking among countries



Based on: IEA *et al.* (2023); Pew Research Center (2019); WHO (2023b); World Bank (2023a, 2023c, 2023d).
Note: The detailed list of countries in each group is shown in Table B2.

The upper-right portion of the graph consists of 11 countries (Group 1, "M1") including Algeria, Argentina, China, Egypt, the Islamic Republic of Iran, Malaysia, Thailand, Türkiye, and Uzbekistan. These countries are characterised as having highly affordable electricity and large populations that have electricity access (more than 99% in each country), but they do not yet cook with electricity. Three countries in this group have an electric cooking access rate above 5% (China [31.4%], the Russian Federation [7.6%] and Ukraine [11.2%]), but the majority have adoption rates below 2%. Given the high rates of electricity access and the affordability of electricity in these countries, electric cooking adoption may face barriers unrelated to the cost of cooking, such as the prevalence of competing cooking fuels or low awareness.

Fourteen countries are found in the lower-right quadrant (Group 2, "M2"), including Kenya, Nigeria, Pakistan, Peru, and the Philippines. This group includes four of the most populous countries – Bangladesh, Brazil, India and Indonesia – that are all positioned on the extreme right end of the graph, implying a large market potential for electric cooking. Three countries in M2 have access to electricity rates below 90%: Ethiopia (51.1%), Kenya (71.5%) and Nigeria (59.5%). Collectively, M2 faces challenges in the affordability of electricity, which may result in preferences for competing fuels. However, each country has a large target market size and opportunities for market growth.

Seventy-two countries are found in the lower-left section (Group 3, "M3"), the most prevalent group for countries from Africa, Latin America and the Caribbean, and Asia-Pacific. Some states in M3, such as South Africa, already have high rates of access to electric cooking while others, such as Burundi, have low rates of access to electricity, both of which reduce the size of the addressable market. Countries in M3 have below-average affordability of electricity in comparison to the overall set of countries that have achieved high rates of access to electric cooking (A1 and A4 from Figure 3). However, M3 also contains 10 out of 11 countries from A4 that were transitioning to electric cooking without already having universal access to electricity, including Botswana, Eswatini, Lesotho, Zambia and Zimbabwe. The position of these countries reinforces the idea that electric cooking can penetrate segments of the market even while other segments face access barriers.

Nineteen countries are found in the upper left (Group 4, "M4"). The majority of these countries have electricity access rates above 99%, and many have high rates of electric cooking access, including Bhutan (73.7%), Serbia (62.5%), Mongolia (48.6%) and Kazakhstan (43.4%). Three notable outliers in this group are Angola, Libya, and Sudan, which have access to electricity rates of 47.0%, 69.4%, and 61.8% and access to electric cooking rates of 1.9%, 1.3%, and 0.6%, respectively. Many countries in the group have relatively small population sizes compared to countries in other groups, with over half of M4 having a population less than 7 million. The high rate of electric cooking penetration in some M4 countries may be a result of a high percentage of hydropower in the generation mix, but shows that there can still be a viable market for electric cooking in low-population countries. The detailed list of countries in each group is shown in Table B2.

Box 3 MECS Global Market Assessment for electric cooking

The MECS Global Market Assessment (GMA) for electric cooking provides a country-level view of the market potential for electric cooking for 130 countries around the world (Coley *et al.*, 2021). The GMA combines 37 indicators across economic, physical, human and infrastructure categories to derive a score representing countries' market potential for electric cooking. These indicators are weighted, and countries are scored on three electrification scenarios (national grid, mini-grid and off-grid standalone) and receive an overall score.

The GMA draws important conclusions as to the scale-up of electric cooking. Critically, the GMA finds that electric cooking is viable in many countries, such as Kenya, Malaysia, Nigeria and Thailand, where households already pay for polluting fuels. In countries such as Bangladesh, Rwanda and Sri Lanka, electric cooking may face affordability barriers as households cook with freely gathered fuels, such as firewood.

The GMA highlights the importance of electricity infrastructure in transitioning to electric cooking. Energy enablers, such as those related to electricity infrastructure, were found to have a strong effect on the overall GMA score, indicating that adequate infrastructure is critical to enabling electric cooking. The report also highlights that many high-scoring countries have low shares of renewable energy, and it is important to couple a transition to electric cooking with that of renewable energy.

Countries with the highest overall GMA scores

1. India
2. Nepal
3. China
4. Indonesia
5. Peru
6. Algeria
7. Malaysia
8. Kenya
9. Bangladesh
10. Türkiye
11. Afghanistan
12. Cambodia
13. Philippines
14. Kazakhstan
15. Thailand
16. Viet Nam
17. Sri Lanka
18. Argentina
19. Brazil
20. Islamic Republic of Iran

Based on: Coley *et al.* (2021).

2.2 REVIEW OF ELECTRIC AND CLEAN COOKING COMMITMENTS

The NDCs and Long-Term Strategies from 185 countries[13] were reviewed to better understand how clean cooking and electric cooking have been incorporated into their climate commitments and national climate policies.[14] Countries were categorised according to their commitments on whether they included electric or clean cooking in their climate policies.

[13] *The 185 countries include IRENA members and the European Union, countries in accession, and Lao PDR, as described in Appendix A.*

[14] *The review of NDCs and Long-Term Strategies was conducted in May 2023. Recent updates to climate commitments may not be captured in this analysis. Details per country can be found in Appendix A.*

Table 5 Overview of clean and electric cooking commitments in NDCs and Long-Term Strategies

Group	Criteria	No. of countries	Population represented (%)	Proportion of population with access to clean cooking (%)
1	Included electric cooking in NDC or Long-Term Strategy	22	27.8%	74.3%
2	Included other forms of clean cooking in NDC or Long-Term Strategy	52	39.4%	55.8%
3	Did not include clean or electric cooking in NDC or Long-Term Strategy	111	32.8%	71.9%

As shown in Table 5, 22 countries included electric cooking in their NDCs or Long-Term Strategies while 52 countries included another form of clean cooking. In 111 countries, neither electric nor clean cooking was included in their NDCs or Long-Term Strategies. Overall, African countries had the highest rates of inclusion of electric and clean cooking in their NDCs at 73%, followed by Asia-Pacific countries and Latin American and Caribbean countries (both 38%), Western European and Other countries (14%), and Eastern European countries (9%). The group of countries that included electric cooking is the smallest by population, but the three groups are of similar sizes. Countries that included clean cooking in their NDCs had the lowest overall rate of access to clean cooking.

Countries that included electric cooking in their NDCs or Long-Term Strategies

Twenty-two countries from five regions included explicit references to electric cooking in their NDCs (Table 6). One-third of these countries are in Africa, and another third are in Asia-Pacific. Of these, nine countries are classified as LDCs.

Table 6 Countries with electric cooking in their NDCs or Long-Term Strategies[15]

Africa	**7**	Congo Democratic Republic of the Congo Eritrea Ethiopia	Mauritania Togo Uganda
Asia-Pacific	**7**	Bhutan Cambodia China Fiji	Marshall Islands Nepal Thailand
Latin America and Caribbean	**5**	Costa Rica Cuba Dominica	Ecuador Honduras
Eastern Europe	**1**	Hungary	
Western Europe and Other	**2**	Australia	United States of America

[15] *Countries that are designated as LDCs are underlined (United Nations Conference on Trade and Development, 2022). Regional classifications are based on UN regional group classification (Department for General Assembly and Conference Management, n.d.).*

These countries indicated their commitment to increased access to electric cooking in their NDCs in multiple ways. Eight countries (Congo, Costa Rica, Cuba, Fiji, Honduras, Mauritania, Nepal and Uganda) included quantifiable targets for electric cooking adoption, such as the number of stoves to be distributed under mitigation actions or the target penetration of electric cooking technologies in the market, as described in Uganda (Box 4) and Fiji (Box 5). Fourteen other countries had qualitative targets for increasing electric cooking penetration. Table 7 introduces exemplary cases of quantitative and qualitative targets, while Table B3 and Table B4 highlight detailed components related to electric cooking of the 22 countries in their NDCs and Long-Term Strategies.

Table 7 Examples of targets for electric cooking in NDCs and Long-Term Strategies

Quantifiable target	**"By 2030, ensure 25% of households use electric stoves as their primary mode of cooking."** - Nepal's Second NDC, 2020
	"Deploy 75 000 electric stoves by 2025 and 100 000 by 2030." - Congo's First NDC, 2021
Qualitative target	**"The penetration rate of electrification will be increased for... cooking."** - China's Revised NDC, 2021
	"Convert LPG cooking to electric." - Marshall Islands' Long-Term Strategy, 2018

Countries in this category illustrated diverse perspectives on the use of alternative fuels. Several countries targeted the displacement of biomass and LPG fuels, with electric stoves contributing to the decarbonisation efforts. This is observed in Ecuador's and Thailand's NDCs. Ecuador aims to replace LPG cookers with induction cookers, while Thailand's NDC indicates the aim to electrify end-use technologies by shifting from LPG cooking to electric cooking. In other countries, increased electric cooking access was a target, alongside an increase in improved biomass stoves and LPG usage. For example, Togo's second NDC set a target to increase household cooking by improving energy-efficient biomass stoves and cleaner fuels such as LPG or electricity. Also, this is seen in Democratic Republic of the Congo, where the country intends to implement a national energy policy framework specifically targeting clean cooking strategies, indicating the role of electric stoves and LPG.

Box 4 Uganda's NDC

Uganda's updated NDC submitted in September 2022 targets a 24.7% economy-wide reduction in GHG emissions by 2030, relative to the business as usual (BAU) scenario (Ministry of Water and Environment, 2022). Emission reductions from biomass fuels used in cooking and transitioning to electric cooking are major pillars of Uganda's NDC, as 55% of targeted emission reductions are related to cooking. The cooking-related mitigation measures are categorised under Uganda's agriculture, forestry and other land use (AFOLU) and energy sectors and include measures to promote sustainable bioenergy, improve charcoal production efficiency, transition both residential and commercial subsectors to more efficient cooking methods, and promote the use of electricity in cooking.

Mitigation policies in the energy sector focus on energy generation and use, with electric cooking targets under the latter. Targets around both clean and, specifically, electric cooking address cooking in two energy subsectors: commercial/institutional and residential. The residential sector is the highest energy consumer in the country. The institutional setting includes cooking that occurs at, for example, school, health and prison facilities. The commercial subsector is not explicitly defined in the NDC but may include facilities like restaurants, food vendors, hotels and guesthouses.

Table 8 Cooking targets in Uganda's 2022 NDC

Subsector	Mitigation measure	BAU scenario	NDC scenario
Commercial/ Industrial	Improved stove efficiency	Same efficiencies as 2015[16]	50% of schools/institutions to be using improved charcoal cookstoves in 2030
	Switching to cleaner fuels	Same fuel mix as 2015, but with 15% of energy needs met by LPG in 2030	15% LPG stoves and 35% electric stoves in 2030
Residential	Improved cook stove efficiency	65 000 improved cook stoves disseminated per year, growth in energy use driven by Uganda Bureau of Statistics household projections	Electricity to reach 50% of cooking fuel share by 2025
	Cooking fuel switch to electricity	Same fuel mix as 2015, growth in energy use driven by Uganda Bureau of Statistics household projections	

In the NDC, electric cooking will contribute to emissions reduction both by improved stove efficiency and switching from polluting to clean fuels. This switch to cleaner fuels is planned to include both LPG and electricity in the commercial/industrial sector, but is focused solely on electricity in the residential sector, where the NDC targets electricity to be 50% of the national cooking fuel share by 2025. These cooking measures are expected to reduce emissions by approximately 1.09 $MtCO_2eq$ by 2030, relative to the BAU scenario.

Electric cooking is not explicitly mentioned as part of Uganda's energy sector adaptation strategies. These are instead focused more generally on clean cooking from the perspective of a climate-resilient energy sector, with goals of:

- increasing the share of clean energy for cooking from a baseline of 15% to 65% in 2030
- decreasing the share of biomass energy used for cooking from 88% at baseline to 40% in 2030
- increasing the share of households and institutions using energy-efficient cooking technologies from 1% at baseline to 10% in 2025.

Based on: Ministry of Water and Environment (2022).

[16] *The baseline scenario lists that 1% of households and institutions use efficient cooking technologies.*

Box 5 Fiji's NDC and Long-Term Strategy

Fiji's NDC aims to reduce CO_2 emissions from the energy sector by 30% by 2030, compared to the BAU scenario using 2013 as the baseline year (Fiji, 2020). The NDC Implementation Roadmap clarifies that demand-side emission reductions are expected to total 30 000 tonnes (t) of CO_2/year and only account for emissions from efficiency increases in electric appliances, not switching from biomass fuels to electricity. These demand-side emission reductions are expected result from the promotion and adoption of energy-efficient kitchen appliances (currently focused on refrigerators and freezers). This adoption will be supported by:

1) Energy-efficiency labelling policies that inform consumers about the amount of energy they can expect to use with each appliance on the market.

2) Efficiency performance standards, often enforced on imported appliances at the border, that are designed to keep low-efficiency appliances off the market.

Fiji's Low Emission Development Strategy 2018-2050 complements its NDC by outlining policies that aim for net-zero emissions across all economic sectors by 2050. Additionally, the strategy also promotes economic growth, employment and poverty reduction (Ministry of Economy, 2018). The strategy explicitly addresses Fiji's roadmap to clean cooking. As of 2020, the country had reached a 92% electrification rate, but only 69% of the population had access to clean cooking (IEA *et al.*, 2022b). Fiji is among the 20 countries with the highest growing population with access to clean cooking fuels and technologies between 2015 and 2019 (IEA *et al.*, 2022a). Fiji aims to fully phase out wood fuel for cooking by 2036 (Ministry of Economy, 2017); however, wood remains the main cooking fuel in rural areas, where households are estimated to use 80 kilogrammes (kg) of firewood per month (Heltberg, 2003). Households in urban areas also use firewood, with an estimate of 5-60 kg per month depending on income level. During this transition, the country is promoting the use of more efficient wood fuel stoves, specifically the Rocket Wood Fuel stove, to reduce overall biomass consumption (Ministry of Economy, 2017).

Targets for electric cooking vary across scenarios. The BAU Unconditional Scenario outlines policies that Fiji plans to implement. The BAU Conditional Scenario is a more ambitious commitment and may require external financing. The Very High Ambition Scenario is the most ambitious and is projected to lead to net-zero emissions in all sectors by 2050. The cooking targets achieved in each scenario are listed in Table 9.

Box 5 Fiji's NDC and Long-Term Strategy (continued)

Table 9 Cooking projections in Fiji's Low Emission Development Strategy scenario

Residential sector	BAU Unconditional Scenario	BAU Conditional Scenario	High Ambition Scenario	Very High Ambition Scenario
Urban electrified households	Open fire cooking is completely replaced with LPG, kerosene and electric stoves by 2030; Open fires and wood stoves are replaced by electric stoves by 2050		All grid-connected households use electric stoves by 2050	
Urban non-electrified households	Will be electrified by grid by 2020 and follow pathway of urban electrified households			
Rural grid-electrified households	Open fire usage will drop to zero by 2030 and be replaced with LPG and electric stoves		All grid-connected households use electric stoves by 2050	
Rural off-grid electrified households	Open fire use decreases from 69.6% to 50% of households, kerosene increases from 9% to 20%, and LPG stove usage increases from 8% to 10% by 2030	Open fire and any wood fuel cooking are completely replaced with LPG, kerosene and electric stoves by 2030		All off-grid households use electric stoves by 2050
Rural non-electrified households	Will be electrified by off-grid technologies by 2020 and follow the pathway of rural off-grid electrified households			

Based on: Ministry of Economy (2018)

The bulk of the cooking transition, especially to electric cooking, is expected to occur in the residential sector. Policies also account for cooking fuel consumption in the industrial and tourism sectors, with LPG as a commonly used fuel for cooking. Only in the Very High Ambition Scenario are these sectors expected to reduce LPG use, with it falling to zero by 2040 and being fully replaced by electricity.

Countries that included other forms of cooking in their NDCs or Long-Term Strategies

In addition to the commitments on electric cooking, this study reviewed the other forms of clean cooking in countries' climate commitments. Fifty-two countries did not include electric cooking in their NDCs or Long-Term Strategies but did include other forms of clean cooking, as shown in Table 10. The regional distribution includes 31 African countries, followed by 12 Asia-Pacific countries, 6 Latin American and Caribbean countries, 2 Western European and Other countries, and 1 Eastern European country. Among the countries that included clean cooking, 29 countries are LDCs, which is over half of the total countries.

Table 10 Countries with other forms of cooking in their NDCs or Long-Term Strategies[17]

Africa	**31**	Angola Benin Burundi Cabo Verde Cameroon Central African Republic Chad Comoros Côte d'Ivoire Djibouti Eswatini Gambia (the) Ghana Guinea Guinea-Bissau Lesotho	Liberia Madagascar Malawi Mali Mozambique Niger Nigeria Rwanda Senegal Seychelles Sierra Leone Somalia South Africa Sudan United Republic of Tanzania
Asia-Pacific	**12**	Afghanistan Bangladesh India Indonesia Kiribati Kyrgyzstan	Lao PDR Pakistan Papua New Guinea Timor-Leste Tuvalu Vanuatu
Latin America and Caribbean	**6**	Belize Chile Colombia	Guyana Mexico Paraguay
Eastern Europe	**1**	Albania	
Western Europe and Other	**2**	Iceland	United Kingdom of Great Britain and Northern Ireland

In contrast with the countries that included electric cooking in NDCs, these countries preferred other cooking fuel sources. Table 11 indicates that at least 29 countries described the importance of improved cookstoves in their NDC or Long-Term Strategy, and at least 8 mentioned sustainable charcoal production. Countries in this group also considered the role of both LPG and biogas more often than countries that included electric cooking, such that 16 countries described the role of LPG in reducing cooking emissions, and 13 discussed using biogas for cooking. Further, Table B5 and Table B6 highlight components related to these cooking related commitments these countries' NDCs and Long-Term Strategies.

[17] *Countries that are designated as LDCs are underlined (United Nations Conference on Trade and Development, 2022).*

Table 11 Examples of targets for clean cooking in NDCs and Long-Term Strategies[18]

Countries including improved cookstoves in their NDCs	Countries including sustainable biomass for cooking in their NDCs	Countries including LPG for cooking in their NDCs	Countries including biogas for cooking in their NDCs
29	8	16	13
"reduction of residential firewood, in particular through the use of efficient wood burners" *- Comoros's Revised NDC*	***"Increase in production of non-forest biomass fuel briquettes, e.g. from agricultural waste, sawdust, and human waste, with emphasis on women and the youth"*** *- Somalia's Updated NDC*	***"Replacement of fuel-wood with LPG at the rate of 10% a year from 2020 to 2030"*** *- Lesotho's First NDC*	***"Guyana will continue to work closely with farmers in agricultural areas across Guyana to encourage the use of bio-digesters to reduce waste, produce biogas and provide affordable, healthy and efficient cooking means at the household level."*** *- Guyana's Intended NDC*
Afghanistan	Chad	Albania	Bangladesh
Bangladesh	Colombia	Benin	Burundi
Benin	Gambia	Cameroon	Cabo Verde
Burundi	Guinea	Central African Republic	Cameroon
Cameroon	Rwanda	Colombia	Central African Republic
Central African Republic	Senegal	Djibouti	Chad
Colombia	Sierra Leone	India	Colombia
Comoros	Somalia	Indonesia	Gambia
Eswatini		Lesotho	Guinea
Gambia (the)		Mozambique	Guyana
Guinea		Niger	Niger
Guinea-Bissau		Nigeria	Nigeria
Lao PDR		Senegal	Senegal
Lesotho		Sierra Leone	
Liberia		Sudan	
Madagascar		United Republic of Tanzania	
Malawi			
Mali			
Mexico			
Niger			
Nigeria			
Paraguay			
Rwanda			
Senegal			
Somalia			
South Africa			
Sudan			
Timor-Leste			
Vanuatu			

[18] *Non-exhaustive list; does not include countries that included electric cooking in their NDCs.*

Our analysis shows that many countries are likely to support electric cooking through policies or programmes, and this indirectly appears in their NDCs or policy documents. Electric cooking may be implied under an umbrella term, such as "modern energy cooking", or as a part of the energy efficiency programme. For example, Ghana's NDC does not mention electric cooking; it instead expresses a commitment to "expand the adoption of market based cleaner cooking solutions", but the affordability and cost competitiveness of electric cooking was emphasised at the 2022 Clean Cooking Forum held in Ghana. Other countries such as Kenya are known to have strong national commitments for clean and electric cooking but do not explicitly list them in their NDCs. To avoid ambiguity, it is important for countries to explicitly discuss electric cooking in their NDCs submitted to the international community.

A review of publicly available policy statements identified six countries with other forms of clean cooking in climate commitments while explicitly promoting electric cooking through other national policies and programmes, such as SDG 7 Energy Compacts, national energy policies and programmes (Table 12).

Table 12 Countries with electric cooking policies that included other forms of clean cooking in their NDCs or Long-Term Strategies

State	Policy	Description
India	Go Electric Campaign	The Go Electric Campaign was launched in 2021 to spread awareness of the benefits of e-mobility and electric cooking in India (Bureau of Energy Efficiency, n.d.).
Indonesia	Electric Stove Conversion Programme	Indonesia has developed a programme to convert households using LPG to induction cooking. The programme has since been suspended (Karyza, 2022).
Malawi	SDG7 Cleaner Cooking Energy Compact	Malawi's SDG 7 Energy Compact targets a decrease in the use of non-renewable fuels used in cooking through the adoption of fuels such as renewable biofuels, LPG and electricity (Ministry of Energy and National Cookstove Steering Committee, 2021). Malawi was among the Global Champions for the thematic areas of energy access and clean cooking in the UN High-Level Dialogue on Energy in 2021.
Rwanda	Energy Access and Quality Improvement Project (EAQIP)	Rwanda's EAQIP supports improved access to electricity and clean cooking and includes results-based financing (RBF) for electric cooking appliances and other clean cooking technologies (Rwanda Energy Group, 2022).
South Africa	Strategy to Address Air Pollution in Dense Low-Income Settlements	South Africa's strategy encourages the use of efficient appliances through the provision of subsidised and free basic electricity (Department of Environmental Affairs, 2019).
United Kingdom	Various programmes	The United Kingdom's SDG 7 Energy Compact highlights the country's commitment to supporting developing countries to increase access to electricity and clean cooking through initiatives such as the MECS and Innovate UK's Energy Catalyst programmes (MECS, 2022; Energy Catalyst, 2022).

The level of visibility of electric cooking in NDCs and policies may imply that electric cooking technology is perceived as less feasible due to respective circumstances and capabilities. In some cases, electric cooking may be specifically discouraged for the medium-term plan at the national level due to concerns such as affordability, lack of electricity access among target users, negative effects on infrastructure as a result of increased electricity demand, and increased emissions as a result of electricity supplies with a low percentage of renewable energy. Examples include:

- **Bangladesh:** A review of the electric cooking policy landscape found that there was a lack of top-down support for electric cooking as policy makers "expressed concern that e-cooking would add pressure to the grid" (Barnard-Tallier, 2022).
- **Niger:** The Niger Accelerating Electricity Access Project (Haské) promotes access to electricity and clean cooking among rural populations, but the project appraisal concludes that electric cooking is "not viable due to feasibility concerns" (International Development Association, 2021).
- **Nigeria:** Although Nigeria's National Action Plan to Reduce Short Lived Climate Pollutants encourages the adoption of modern fuels including electricity, the Nigeria National Energy Master Plan includes a strategy of "discouraging heating and cooking with electricity in households" (Federal Ministry of Environment, 2019).
- **Argentina:** An evaluation of residential energy consumption conducted as part of the Energy Efficiency in Argentina programme started in co-operation by Argentina and the European Union concluded that emissions generated from natural gas would be lower than those from electric cooking due to emissions resulting from generation and efficiency losses during transmission (Gil, 2021).

Issues of affordability, electricity access, grid stability and grid emissions are important considerations when planning a transition to electric cooking solutions, and understanding these concerns is crucial for understanding how to address them. However, progress is being made on each of these issues and is expected to continue over the course of a global transition to sustainable energy. Chapters 3 and 4 include recommendations that countries may enact to attract the support and finance required to address issues such as these.

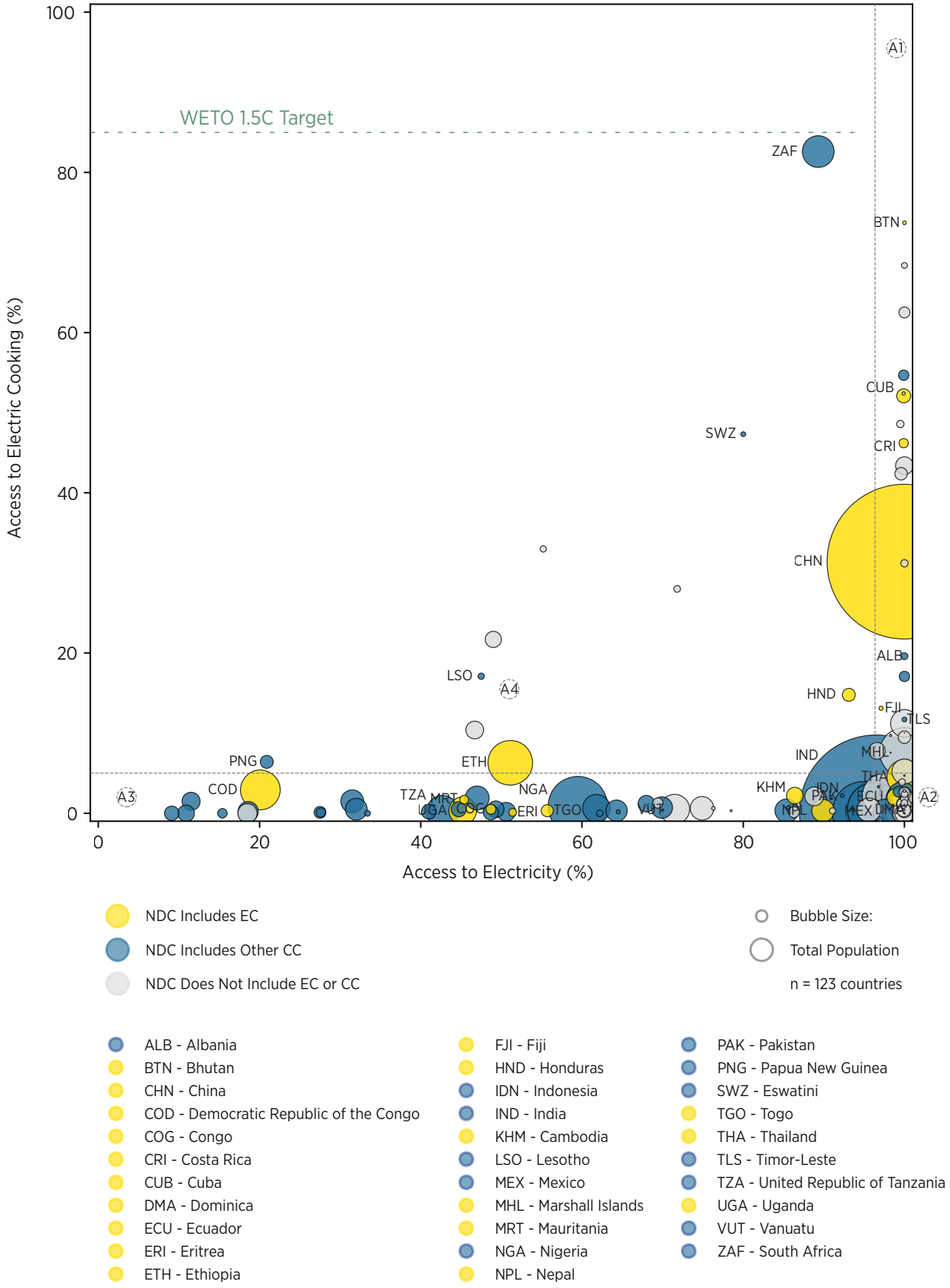
2.3 COMBINED ANALYSIS OF ELECTRIC COOKING LANDSCAPE AND NDC COMMITMENTS

The results of the NDC review can be combined with the analysis of the electric cooking landscape to visualise the current status of electric cooking and how it is supported and acknowledged in climate commitments. The inclusion of the NDC data provides a policy perspective to complement the socio-economic, market and environmental perspectives of the analysis. In the following figures, we repeat the analyses from Chapter 2, Section 2 but colour-code countries based on the assessments of their NDCs and Long-Term Strategies to visualise climate commitments in relation to access and market conditions.

Access: Progress on access to electricity and electric cooking

From the analytical lens of access, in Figure 6, countries that included electric cooking in NDCs or Long-Term Strategies were well-represented in each group but most often positioned in A3, characterised by below-average rates of access to electricity and access to electric cooking, followed by A1, characterised by above-average rates of access to electricity and access to electric cooking.

Figure 6 Combined analysis of cooking-related climate commitments and access variables, 2020



Based on: IEA *et al.* (2023); WHO (2023b); World Bank (2023d).

Notes: EC = electric cooking; CC = clean cooking; The detailed list of countries is shown in Table B7 and Table B8.

The distribution of these countries throughout the graph demonstrates that electric cooking can be considered a targeted climate action regardless of a state's current rate of access to electricity or penetration of electric cooking technologies. As discussed previously in Chapter 2, Section 1, "Access: Progress on access to electricity and electric cooking", countries in A4 indicate that electric cooking can penetrate the market even when countries have not yet fully achieved access to electricity, and this is recognised in the NDCs and Long-Term Strategies of the ten countries in A3 and A4. For example, although the Democratic Republic of Congo has access to electricity rates of 20.1%, its NDC lists electric stoves as one of the technologies to be specifically supported through a new National Energy Policy. Another example is found in Ethiopia's NDC, which calls for the shift from unsustainable biomass demand to electric stoves.

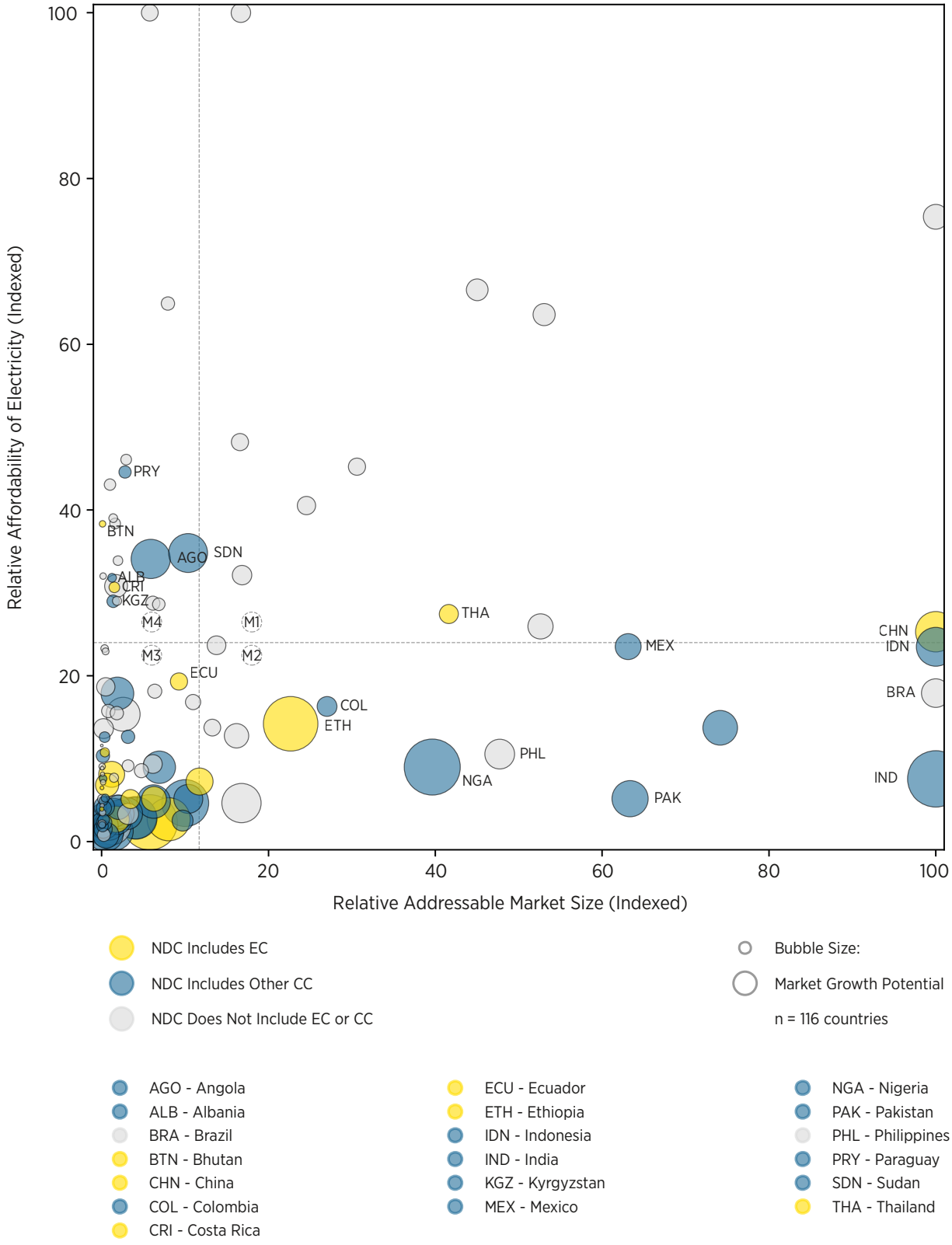
Countries that included other forms of cooking in climate commitments are predominantly found in A3, characterised by below-average rates of access to electricity and access to electric cooking, and comprise over half of the total group: of the 55 countries in A3, 8 included electric cooking in climate commitments, 35 included some other form of cooking and 12 did not include any form of cooking. Countries in this group should consider how other countries – such as those in A3 that included electric cooking in NDCs or those in A4 that have already achieved electric cooking penetration despite low rates of electricity access – have designed policies to promote electric cooking and address these barriers.

In contrast to A3, countries in A2 had a low rate of inclusion of electric or clean cooking in climate commitments: out of 44 countries in A2, only 8 included electric or another form of clean cooking in NDCs or Long-Term Strategies. These countries have already achieved high rates of electrification, meaning a transition to electric cooking is relatively more feasible. These countries can begin to support this transition by incorporating electric cooking into their climate commitments.

Market: Market potential for electric cooking

Through the market perspective, in Figure 7, it is observed that four countries (Bhutan, China, Costa Rica, and Thailand) with above-average affordability of electricity (M1 and M4) included electric cooking in NDCs while five countries (Albania, Angola, Kyrgyzstan, Paraguay, and Sudan) mentioned other forms of cooking in their NDCs. Given that these five countries have favourable market conditions for electric cooking, they should consider how electric cooking is appropriate to support their climate goals. For example, Sudan's NDC sets a quantitative target to substitute LPG for biomass and charcoal cooking in 10% of urban and 20% of rural households, but electric cooking could be a cost-effective displacement for many of these households. As another example, the affordability of electricity may make efficient electric stoves a viable cooking solution in Paraguay, whose NDC discusses promoting efficient stoves for families that are dependent on biomass for cooking.

Figure 7 Combined analysis of cooking-related climate commitments and market-related variables



Based on: IEA *et al.* (2023); Pew Research Center (2019); The detailed list of countries is shown in Table B9 and Table B10.
Notes: EC = electric cooking; CC = clean cooking; The detailed list of countries is shown in Table B9 and Table B10.

The vast majority of the countries that included electric or clean cooking in NDCs are located on the bottom portion of the graph in M2 and M3. 13 of the 17 countries that included electric cooking in NDCs or Long-Term Strategies, including Ecuador and Ethiopia, are located in M2 or M3 and are characterised by having less-affordable electricity relative to GNI. Issues of affordability will be important to address for countries to scale up electric cooking adoption. Strategies for addressing affordability issues are discussed further in Chapter 3.

Countries that included other forms of clean cooking in their NDCs, such as Colombia, India, Indonesia, Mexico, Nigeria, and Pakistan, may find electric cooking to be a viable alternative to consider. For example, Colombia's NDC sets a target to introduce 1 million efficient firewood stoves, but many households could potentially adopt electric cooking instead given that over 99% of the population has access to electricity. As another example, Pakistan's NDC sets a goal of piloting energy-efficient, low-cost cooking technologies, which could be met through a pilot of energy-efficient electric cooking technologies. Although Pakistan's electricity is relatively expensive, efficient appliances, financial and technological innovations, and climate finance support may bring down the costs.

Countries that excluded clean cooking from their NDCs are distributed throughout the graph. Many of the countries found in the upper part of the graph have favourable market conditions for electric cooking and should consider how the market for electric cooking could be intentionally supported. Countries in M2 that excluded electric cooking, such as Brazil and the Philippines, have less-affordable electricity but large market sizes and growth potential and can consider how to integrate electric cooking as part of their climate commitments.

2.4 DISCUSSION

The analysis of the electric cooking landscape and NDC and Long-Term Strategy commitments reveals that electric cooking is an emerging topic. A handful of countries are either already making progress on or have opportunities to increase electric cooking adoption. Some countries also included electric or clean cooking to demonstrate that electric cooking is an important climate issue regardless of current electrification status, market condition, geography or development status.

The review shows that countries have begun to include electric cooking in their climate commitments. Twenty-two countries set targets to increase electric cooking access. These commitments varied in their degree of specificity, ranging from broad pledges to support electric cooking to specific goals to increase electric cooking penetration. These commitments also encompassed a broad range of perspectives on the role that other fuels play in a climate-friendly transition to clean cooking: while some countries purposefully seek to displace biomass and LPG usage, other countries considered the role of improved cookstoves and LPG in displacing the most polluting and inefficient forms of biomass.

Countries that included electric cooking in their climate commitments represent a diverse cross-section of the world, including LDCs, small and island developing states, major economies, and countries across the spectrum of electricity and electric cooking access. This reinforces the idea that electric cooking is an essential consideration despite respective countries' circumstances regarding electrification or electric cooking adoption. Securing the transition to meet a net-zero future requires a global shift toward clean energy, and electric cooking with renewables is among the cleanest modes of cooking.

Fifty-two countries referred to other forms of cooking in their climate commitments, such as improved cookstoves, biogas and LPG, as well as a shift toward more sustainable fuel sources such as sustainable charcoal. These countries also represented a diverse cross-section of the world, although over half of these countries had below-average rates of access to electricity. Concerns over a lack of electricity access, affordability, grid emissions and grid stability were possible barriers for countries to include and implement electric cooking targets through their climate commitments. With respect to these issues, the inclusion of electric cooking in NDCs and Long-Term Strategies is an important indicator of a country's political will that can help attract international support to address these barriers.

Although many countries did not specifically include electric cooking in NDCs or Long-Term Strategies, this does not preclude their interest in promoting electric cooking. Many climate commitments use broad language that implies support for electric cooking, while others instead focus on other initiatives. Examples of this are seen in the United Kingdom's Long-Term Strategy, which commits to the implementation of energy performance standards for cooking appliances, as well as Kenya's NDC, which includes a programme to support gender-responsive technologies. Outside of their NDCs and Long-Term Strategies, both countries are highly involved in promoting electric cooking adoption, and the Kenyan government is developing an electric cooking strategy. In the policy review, six countries were identified that had other policies or programmes to support electric cooking, but there may be many more.

Clean and electric cooking contribute to SDG 7 and other sustainable development agendas related to gender, health, energy or the environment. By incorporating electric cooking as a target in climate commitments, countries are also recognising the potential for electric cooking to reduce emissions and achieve the aims of the Paris Agreement. This trend may enable climate finance to be facilitated toward increasing electric cooking access and realising these development agendas. Chapter 3 delves deeper into this subject and the importance of policies in finance facilitation.

3 FINANCING THE ELECTRIC COOKING TRANSITION

3.1 FINANCIAL LANDSCAPE FOR CLEAN COOKING

There is an urgent need to scale up access to clean and electric cooking, and this transition requires increased finance. Reported estimates for the investment levels needed to achieve universal access to clean cooking range from USD 4.5 billion to USD 50 billion[19] per year, with higher-tier cooking solutions requiring greater investment levels (IEA, 2020; ESMAP, 2020b). Current investment falls short of required levels by orders of magnitude (SEforAll, 2021). However, the landscape for clean cooking finance is rapidly changing, and new initiatives are increasing the investment and finance available for projects, companies and countries to scale up access to clean cooking.

This chapter presents an overview of the financial landscape for clean cooking and its recent developments. An analysis of barriers to investment in several sectors, which is synthesised into a list of barriers to finance electric cooking, follows. Based on this analysis, a country-focused strategy for facilitating finance for electric cooking is presented with actions recommended for the key approaches. This strategy is projected to account for 85% of all cooking needs under IRENA's WETO 1.5°C Energy Scenario (IRENA, 2021).

Overview of the financial landscape for clean cooking

Key reports from Sustainable Energy for All (SEforAll), Clean Cooking Alliance (CCA) and Modern Energy Cooking Services (MECS) help illuminate the landscape for clean cooking finance. SEforAll's *Energizing finance* report tracked clean cooking finance flows in 20 high impact countries (HICs) since 2021 (SEforAll, 2021), as described in Table 13. These HICs accounted for 81% of the global population lacking access to clean cooking and received a total of USD 133.5 million for financial commitments in 2019 for residential clean cooking and USD 3.4 million for non-residential clean cooking.

[19] *Based on estimates from ESMAP (2020b) for finance required by government and development partners (USD 39 billion per year) and private sector investment (USD 11 billion per year).*

Table 13 Tracked clean cooking finance commitments in HICs

Country	Clean cooking finance in 2018	Clean cooking finance in 2019
	(USD millions)	
Afghanistan	0.1	0
Bangladesh	61.9	20
China	1.4	0.8
Democratic Republic of the Congo	0	0
Ethiopia	0.9	7.2
Ghana	6.8	6.6
India	6.8	9.3
Indonesia	0.6	1.2
Kenya	36.3	62.2
Madagascar	2.6	0.6
Mozambique	1	0.9
Myanmar	..	..
Niger	0	0
Nigeria	0.7	3.6
North Korea	..	..
Pakistan	0.1	0
Philippines	0	0
Uganda	7.2	12.9
United Republic of Tanzania	3.1	7
Viet Nam	0.5	1.0

Based on: SEforAll (2021).

Box 6 Defining terms for discussions of finance

This report uses the following definitions when describing different types of finance.

Company	A for-profit business entity
Consumer finance	Credit or loans extended to individuals that enable them to make purchases
Finance	Any funds, capital or monetary resources
Funding	Another term for finance
Investment	Finance that is directed at companies
Organisation	A general term for companies, NGOs and other entities
Project finance	Finance that is designated for specific purposes and a finite time period

Based on: SEforAll (2021).
Note: NGO = non-governmental organisation.

The SEforAll *Energizing finance* report (2021) shows that the 20 HICs received almost equal amounts of private finance and public finance: USD 64.9 million and USD 61.6 million, respectively, in 2019. Carbon markets make up a small but growing source of finance commitments with USD 10.4 million flowing into the sector in 2019. The largest funding sources in 2019 were international government and commercial finance, followed by carbon markets, multilateral climate funds and multilateral direct foreign investments (DFIs). There were no major finance commitments from multilateral DFIs in 2019, with only USD 4.5 million in commitments compared to USD 45 million the previous year.

Finance commitments, in these HICs, were primarily from international sources, with the majority of commitments in the form of grants. Domestic finance sources were primarily in the form of equity and debt investments. Overall, more than half of clean cooking finance commitments in 2019 were in the form of grants (USD 72.43 million), followed by equity (USD 35.82 million), debt (USD 18.18 million) and carbon finance (USD 10.42 million).

The vast majority of financial commitments for clean cooking technologies are targeted at residential consumers. Improved cookstoves received the highest finance commitments (USD 51.41 million), followed by LPG (USD 45.27 million),[20] advanced biomass (USD 12.73 million), biogas digesters (USD 12.10 million), alcohol stoves and fuel (USD 10.16 million), electric cooking (USD 4.57 million), and solar cooking (USD 0.64 million). Overall, electric cooking finance commitments accounted for only 3.3% of the commitments, and this is the highest figure tracked to date.

Reports, such as the *Industry snapshot* by CCA, show the financial landscape through the lens of clean cooking companies (Clean Cooking Alliance, 2022). CCA tracked USD 60.7 million in investments made to clean cooking companies in 2020, with USD 53 million in investments in the form of debt (26% of total clean cooking venture investment) and equity (59% of total clean cooking venture investment). These investments were concentrated in a few companies, with seven companies raising 90% of the capital, suggesting that many clean cooking companies face challenges raising capital. In a review of last-mile distribution (LMD) companies,

[20] *SEforAll (2021) reports that LPG investments were made in just four HICs (Bangladesh, Kenya, United Republic of Tanzania and Uganda) in 2019, with USD 30 million in finance coming from private sources (including a USD 13 million project in Kenya) and USD 15 million coming from public sources. The figures suggest possible concerns in the public sector over fossil fuel investments. The reported figures include private finance, carbon markets and public finance but do not track investments in infrastructure that provides access to LPG.*

the Global Distributors Collective (2022) highlighted the lack of opportunities to raise debt finance from local lenders, who accounted for just 1% of tracked investments in LMDs, and the limited availability of equity investors, whose participation is limited by relatively few exits in early-stage investments. The acquisition of Kopagas, a Tanzanian LPG company, for USD 25 million in 2020 is the largest reported equity investment and exit in the clean cooking sector and could encourage greater interest from equity investors to invest in clean cooking companies (Circle Gas, 2020).

Grant finance is the dominant finance instrument for clean cooking, but it primarily flows toward government projects and smaller companies. In 2019, USD 69 million in grant finance was committed to clean cooking, representing 52% of all finance commitments (Table 14). Of this, USD 8 million went toward clean cooking companies, accounting for just 11% of total clean cooking venture finance despite being the most reported instrument by companies. More clean cooking companies raised grant finance than any other instrument (SEforAll, 2021; Clean Cooking Alliance, 2022).

Table 14 Overview of clean cooking grant commitments in 2019

Clean cooking grants made in 2019	USD 69 million
Clean cooking grants made to ventures in 2019	USD 8 million
% of total clean cooking finance in the form of grants in 2019	52%
% of clean cooking venture finance in the form of grants in 2019	11%

Based on: SEforAll (2021); Clean Cooking Alliance (2022).

Only 12% of the finance tracked was noted by companies as being motivated to achieve gender impacts (Clean Cooking Alliance, 2022). The average size of gender-based investments (USD 0.54 million) was almost five times smaller than that of gender-agnostic investments (USD 2.6 million), and the majority of the gender-based commitments were in the form of grants. In contrast, the MECS's *Review of the finance landscape* found that women's empowerment was the most demanded impact metric by funders. These differing perspectives suggest that women's empowerment may be a sought-after outcome of clean cooking investments but not the basis for making investment decisions.

Table 15 Comparison of finance commitments and access deficits for electricity and cooking, 2019

	Electricity	Clean cooking
Population without access	757 million	2 651 million
Percentage of the population without access in HICs	76%	81%
Tracked investments in HICs *(Off-grid and mini-grid vs. residential clean cooking)*	USD 294 million	USD 133.5 million
Tracked Investments in HICs per person without access	USD 0.51	USD 0.06

Based on: IEA *et al.* (2022c); WHO (2023b); SEforAll (2021).

Finance for increasing clean cooking access trails behind electricity access on a per-person basis. In 2019, the off-grid and mini-grid sector received USD 294 million in finance commitments in 20 HICs that accounted for 76% of the 757 million global population without electricity access (USD 0.51/person), as shown in Table 15. In comparison, the residential clean cooking sector received USD 133.5 million in finance commitments in 20 HICs, accounting for 81% of the 2.6 billion population lacking access to clean cooking (USD 0.06/person). As clean cooking is an integral part of SDG 7 and profoundly impacts climate, health and women's empowerment, this disparity in investment emphasises a need to scale up finance commitments for clean cooking.

Beyond investments into expanding electricity access with off-grid and mini-grid systems, there are significant investments made into the existing power sector, which includes investments in generation, transmission and distribution. In Africa, approximately USD 30 billion is invested in the power sector each year (IEA, 2022). This finance supports the provision of electricity to households, but could be leveraged to also increase access to electric cooking, which would stimulate demand for grid electricity. In recent years, the price of renewables has been decreasing and clean energy investments have increased (IEA, 2023b), which suggests that electric cooking will be increasingly done with renewable energy.

The finance trends for access to electricity and clean cooking show that both sectors are underfinanced. Scaling up the level of finance for the clean cooking sector to achieve SDG 7 and current financial commitments fall short of the estimated required annual investment of USD 4.5 billion globally. However, leveraging investments in the electricity sector to include clean cooking would blur the categorisations of finance for SDG 7.1.1 and 7.1.2 and enable greater efficiencies.

Between 2013 and 2022, an estimated USD 60-150 million of finance (USD 6-15 million per year) was sourced from carbon markets for clean cooking activities[21] (Galt *et al.*, 2023). Forecasts predict that finance from the voluntary carbon market will continue to grow and reach a cumulative USD 640 million to USD 1.15 billion between 2023 and 2030 (USD 80 million to USD 144 million per year). The increases in finance are expected to result from increased prices for voluntary clean cooking credits, which fetch a premium compared to other voluntary credits but lag far behind the price of credits sold for compliance purposes. The total volume of carbon finance may increase further as more projects are registered.

To date, the majority of finance from the voluntary carbon market has focused on efficient cookstoves, which reduce biomass usage but do not deliver health benefits associated with higher-tier cooking solutions. Clean cooking credits in the voluntary market have been issued mostly for biogas projects, which account for 80% of registered clean cooking activities, and are concentrated in five countries that account for 95% of clean cooking issuances: Cambodia, China, India, Nepal and Viet Nam (Galt *et al.*, 2023).

Recent developments in clean cooking finance

Reports on clean cooking finance tend to utilise data from a time period several years before publication. Although the industry data are recent, the landscape for clean cooking finance is changing rapidly. The *Clean cooking industry snapshot* mentions that the amount of capital in the first part of 2022 is more than twice the amount raised in 2020, which is a positive indication of rising investment levels (Clean Cooking Alliance, 2022).

[21] *Upper-bound estimations are based on carbon credit issuances; lower-bound estimates are based on retirements.*

In response to the need for clean cooking finance, several initiatives have been developed since 2020 that aim to increase finance for clean cooking, as listed in Table 16. These initiatives range from venture funds investing in clean cooking companies in Africa to new methodologies for disbursing carbon finance. Many of these initiatives seek to leverage existing finance commitments to secure additional investment and help to finance a transition to universal access.

Table 16 Recent initiatives in the clean cooking finance

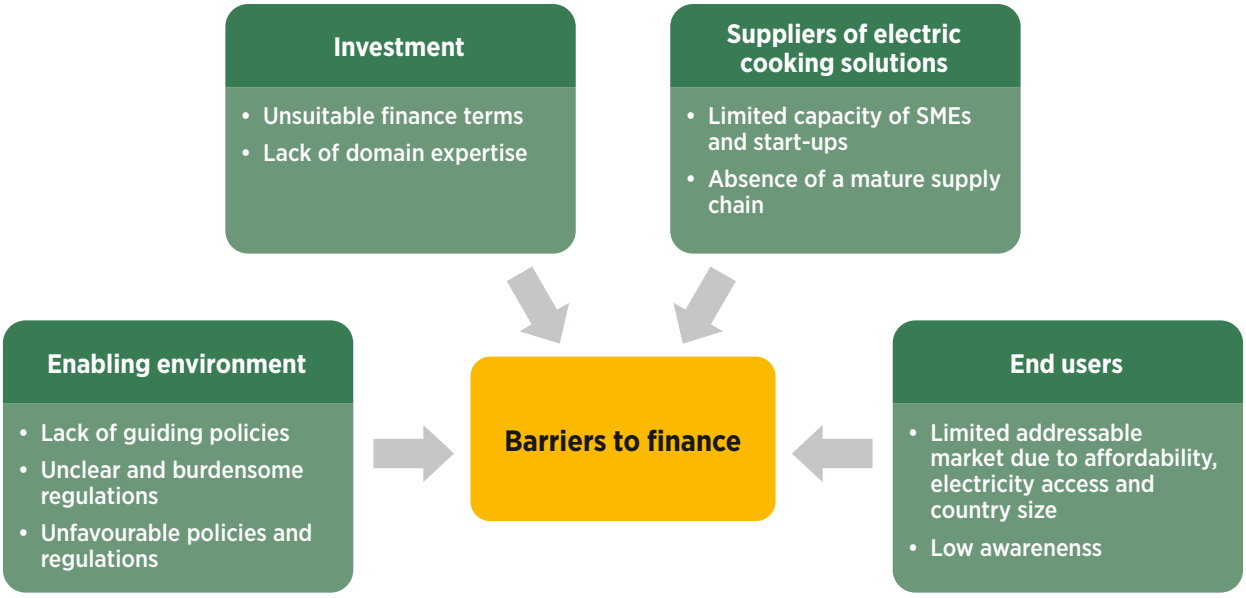
Global Electric Cooking Coalition (GeCCO)	GeCCO's initial target is to support 10% of households and 10% of public institutions to transition to electric cooking in ten countries by providing guidance, leadership, integration, knowledge and funding. GeCCO is anchored by Energising Development (EnDev), Global Energy Alliance for People and Planet (GEAPP), MECS and SE4All and is expected to be officially launched at the 28th UN Climate Change Committee of Parties (COP 28).
Clean Cooking Fund	The World Bank's Energy Sector Management Assistance Program (ESMAP) launched the Clean Cooking Fund in 2020 with USD 500 million in funding. The fund is expected to co-finance and leverage USD 2 billion in capital for catalysing technology and business innovation, and linking incentives with verified result (ESMAP, n.d.).
Spark+ Africa Fund	Spark+ Africa Fund was launched in 2020 with USD 70 million in capital for investment in private sector companies working on clean cooking access. The fund has so far invested USD 6.5 million in three Kenyan companies, including two that distribute electric cooking appliances (Spark+ Africa, 2022).
Modern Cooking Facility for Africa (MCFA)	MCFA was launched in late 2022 and has mobilised EUR 32.6 (euros) million for clean cooking solutions in six countries (Modern Cooking Facility for Africa, 2021). MCFA is funded by the Swedish International Development Agency (SIDA) but is working toward expansion into a multi-donor programme to provide clean cooking solutions to 3 million people in Africa by 2027.
Universal Energy Facility (UEF)	UEF is a multi-donor results-based financing facility managed by SEforAll. The UEF was launched in 2020 and provides incentive payments to organisations deploying energy solutions and providing verified results. The UEF aims to grow, providing 300 000 clean cooking solutions to households and leveraging USD 0.5 billion in finance (SEforAll, n.d.). To date, at least USD 50 million has been committed (Tena, 2022).
MECS Challenge Funds	MECS has developed several challenge funds that provide grant funding to clean cooking companies, such as its Supply Chain Challenge Fund. These funds are often targeted toward building new capacities within companies. MECS has allocated GBP 7 (United Kingdom pounds) million towards challenge funds and has deployed over GBP 3 million since 2019 (MECS and Energy 4 Impact, 2022).
Cooking Industry Catalyst (CIC)	The CCA launched its CIC programme in 2020, which consolidated various industry development programmes into a Venture Catalyst, Market Catalyst and Demand Catalyst. The Venture Catalyst facilitates access to capital and has a portfolio of 29 companies, including at least three electric cooking companies (Clean Cooking Alliance, n.d.).
Global eCooking Accelerator (GeCA)	EnDev's GeCA promotes access to electricity and clean cooking via RBF, innovation grants, access to finance, enabling environment measures, and research and learning. As a result, especially in 2021 and 2022, about 70 000 people have gained access to electric cooking in three of countries: Bangladesh, Kenya and Nepal. As of July 2023, EnDev was scaling up these interventions to at least 13 countries. Interventions range from grid-connected to mini-grid-based electric cooking.

3.2 BARRIERS TO FINANCE

The trend of clean cooking finance commitments in recent years has been positive. Yet, the clean cooking industry remains at an early stage, and significant growth is needed to achieve universal access. Estimates for the amount of finance required to achieve universal access range vary from USD 4.5 billion per year (IEA, 2020) to USD 50 billion per year (ESMAP, 2020b), depending on the timeframe and tier of clean cooking solutions considered. Finance levels fall short of these figures when considering the newly planned injections of capital.

Additional finance must be unlocked to scale up access to electric cooking. To develop strategies for increasing financial flows for electric cooking, barriers in different parts of the electric cooking market landscape are mapped and analysed in this section, as shown in Figure 8.

Figure 8 Barriers to finance for electric cooking



Note: SME = small and medium-sized enterprise.

Barriers to finance: Investment

Unsuitable finance terms can further restrict the finance available for electric cooking. Investors may not offer finance on terms that companies or projects require, such as longer loan tenors or smaller ticket sizes. A report on impact investment in developing markets highlighted that impact investors targeted a 5-to-7-year time horizon for their investments, while companies operating in developing markets often require 10 years to realise their potential (Global Impact Investing Network, 2019). Even this window may be too small, as investments into grid electricity systems are taken on time horizons of up to 25 years (NS Energy, n.d.).

In many countries where clean cooking access is low, the electric cooking market is led by small and medium-sized enterprises (SMEs) and early-stage companies. These companies may fail to meet investment eligibility requirements, such as having sufficient operational history, that would qualify them as investible. For example, Uganda Off-Grid Market Accelerator (2019) found that local banks in Uganda perceived many

local clean energy companies as too high-risk to invest in, despite a United States Agency for International Development (USAID) programme guaranteeing that 50% of any potential losses would be covered. Available finance can also be expensive for companies to secure: the length of due diligence, complexity of terms or high return expectations of investors can result in companies being unable to afford or unwilling to take on new investment.

A lack of domain expertise is another deterrent of potential investment. Investors may be unfamiliar with business models, products, technologies, market segments, regulatory environments or investible companies. The lack of domain expertise includes both foreign investors and established local entities; however, literature in the off-grid solar space emphasised that unfamiliarity with pay-as-you-go (PAYGO) was a major deterrent for investment by local lenders who instead defaulted to more familiar, fossil-fuel related assets (Abraszek *et al.*, 2022; Uganda Off-Grid Market Accelerator, 2019; Uganda Off-Grid Market Accelerator, 2021).

Barriers to finance: Enabling environment

The lack of guiding policies relevant to electric cooking is a significant barrier. Many countries have not explicitly recognised electric cooking in their policy frameworks, even if it may be implied or supported under existing policies, and this opacity creates risks and deters financial investments. Further, there are opportunities for electric cooking to be financed from sources such as carbon finance or finance for integrated energy planning (IEP) projects, but many countries do not have a clarified position on how they will facilitate and develop these financial flows. As an example, finance from voluntary carbon markets is limited by unclear positions on how countries will promote and regulate electric cooking projects. Meanwhile, finance that could be sourced under Article 6 of the Paris Agreement is also unavailable because few countries have included electric cooking in their NDCs and none have made public expressions that they intend to scale-up electric cooking through the Article 6 market mechanisms.

Unclear and burdensome regulation is another barrier for investors. As with policies, a lack of clarity creates regulatory risks that can limit investment (European Investment Bank, 2016). One example of this is product standards, which are often non-existent in countries with low electric cooking penetration. The lack of standards for electric cooking appliances could result in increased costs due to inspection delays during importation, financial losses if a company invests in a product that cannot be brought to market, and reduced scale as companies are deterred from expanding into adjacent markets with different regulations. Regulation can also create administrative hurdles that reduce return expectations by increasing costs and reducing the speed at which companies achieve scale.

Unfavourable policies and regulation can stifle investments into electric cooking. LPG subsidies and high electricity tariffs reduce the cost-competitiveness of electric cooking and thus contribute to reduced market share and a poorer performing investment case. Ending or revising such unfavourable policies and regulations would improve the competitiveness of electric cooking technologies and make the market more investible.

Barriers to finance: Suppliers of electric cooking solutions

The limited capacity of SMEs and start-ups as suppliers is another barrier to finance for electric cooking. Small and early-stage companies are the first-movers in nascent electric cooking markets and play an important role in reaching underserved customer segments. However, these companies face challenges in attracting finance: they often lack fundraising experience and connections, have underdeveloped financial systems, lack operational history, and tend to have poor unit economics and profitability. These issues increase risk and lower return for investors, especially in comparison to more mature investment opportunities, and restrict investments.

As is, discussions around the suppliers in the context of clean cooking tend to focus on a small number of these early-stage, small-scale companies. In 2020, 6 out of 32 clean cooking companies reported annual revenues above USD 1 million (Clean Cooking Alliance, 2022). Considering that electric cooking is often viewed as a small but growing subset of clean cooking, the discussions around electric cooking suppliers are often reduced to an even smaller pool of earlier-stage companies. From this perspective, scaling up electric cooking finance requires supporting these early-stage companies to develop into scalable, investible businesses. The last decade's gains in electricity access from off-grid solar companies suggests that such development is feasible.

At the same time, electric cooking appliances have penetrated other markets with significant scale. Electric rice cookers are ubiquitous throughout Asia; the regional market for them was estimated to be worth USD 1.5 billion in 2020 (Allied Market Research, 2022). The supply chain looks very different in these markets, with well-developed manufacturing, marketing and distribution channels. Attracting mature suppliers from other markets may be another important variable for achieving scale, especially as mature suppliers can bring their own financial resources.

For now, there is an absence of a mature supply chain in emerging markets as large-scale companies have not fully invested in the markets where clean cooking access is most urgently needed. Utilities or multi-national technology corporations have resources to conceivably fill the role of both the investor and the supplier but may be deterred by the types of risks discussed throughout these sections, such as fragmented markets, unfamiliar products and business models, and uncertain enabling environments. Utilities are a high-potential actor in the supply chain, as they can leverage their financial resources, existing market penetration and familiarity with local contexts. Some utilities are beginning to distribute electric cooking appliances, but the risk-averse nature and size of such organisations means that their investments in the market could be limited without external support.

Barriers to finance: End users

The limited market size for electric cooking in emerging markets is a significant barrier to investment in developing these markets. While there is a significant market opportunity in serving the 2.4 billion households without clean cooking, the current market is perceived as fragmented and limited in size. This is observed in Figure 5, which shows how many of the countries with low electric cooking penetration have high growth potential but below-average market sizes.

One critical market size limitation is the affordability of electric cooking appliances, which tend to have higher upfront costs than other clean cooking solutions. Investors cited end user affordability as one of the five most-important factors limiting investment into clean cooking companies (MECS and Energy 4 Impact, 2022). In response to pricing concerns, some distributors implement consumer finance models, which reduce affordability barriers while also introducing complexity and overheads into the business. A survey of households in Kenya found that users are willing to pay between USD 20 and USD 100 (KES [Kenyan shilling] 3 000-15 500) for an appliance, suggesting that affordability concerns are overstated for some customer segments (Nuvoni Centre for Innovation Research, forthcoming). However, at the same time there is a recognition that subsidies play an important role in accelerating access and making appliances accessible to the poorest consumers. Still, reliance on subsidies would not ensure the sustained use of electric cookstoves as consumers may opt for more affordable cookstoves when replacing them. In either case, the perception of electric cooking as unaffordable can be a barrier to investment.

Other factors that contribute to reduced market sizes are low rates of electrification and small population sizes. As discussed in Chapter 1, universal electrification is not a prerequisite for electric cooking to penetrate the market; however, it does reduce the present-day market size. A country's population determines its total potential market size, and this can serve as a barrier for investments into less populous countries.

Above all, low awareness levels are another significant barrier that limits the market for electric cooking. Efficient electric cooking technologies are relatively new, with electric pressures a relatively recent invention. The general population may lack awareness of modern electric cooking appliances or may have inaccurate perceptions of electric cooking appliances' costs and benefits. As an example, many reports highlight that users assume electric cooking to be expensive, incompatible with local cuisines and lacking flavour, but these perceptions can change dramatically after users experience electric cooking. In point of fact, 97% of users who had concerns over the safety of cooking with an electric pressure cooker reported a change in opinion after receiving training (Kalyonge, 2022). Also, the improved awareness may positively influence the enabling environment because policies and plans, such as NDCs, may cover the electric cooking targets and measures in light of the heightened interest among consumers and relevant stakeholders.

3.3 OPPORTUNITIES TO SOURCE FINANCE FOR ELECTRIC COOKING

Electric cooking requires additional finance to scale up, as investments must be made into distribution channels, appliances and infrastructure. In the following sections, three potential finance sources are discussed, including private supplier's finance, electricity sector finance and carbon finance (Table 17). The three finance sources are complementary and each has significant potential to help scale up electric cooking.

Table 17 Three opportunities to source finance

Opportunity	Description
Private sector finance	Development of business models and de-risking measures of investment can help early-stage start-ups, SMEs and experienced companies to attract finance for developing the electric cooking market.
Electricity sector finance	Electric cooking solutions can be integrated into electricity supply and grid modernisation projects through holistic energy access planning.
Carbon finance	Carbon finance measures, including Paris Agreement Article 6 market mechanisms and voluntary carbon markets, can be used as opportunities to expand deployment of electric cooking solutions.

Financing electric cooking through the private sector

The private sector plays an important role in scaling up electric cooking. In markets with low rates of clean cooking access, the supply chains for electric cooking appliances are often underdeveloped and underfinanced.

Many companies that are actively focused on closing the clean cooking gap are early-stage start-ups and SMEs. These types of early-stage companies often lack experience fundraising, which involves sourcing deals and completing due diligence, and may also lack financial experience or operational track records that are required to close investment deals. Although several clean cooking companies are successfully raising finance, experienced management teams may still face challenges closing deals as a result of issues regarding poor unit economics and low levels of profitability, and may require substantial capital investment to scale.

Despite the challenges, these types of distribution companies could play a pivotal role in enabling clean cooking access. Looking at the off-grid solar sector, seven industry-leading off-grid solar system distributors[22] raised a combined USD 606 million in finance in 2022 (GOGLA, n.d.). These companies are young and high-growth: the oldest was founded in 2009, and they each report impacting millions of people. Smaller-scale distributors and Chinese original equipment manufacturers (OEMs) also contribute to increased electricity access and continue to enter nascent and emerging markets (Lighting Global/ESMAP *et al.*, 2022). Given the similarities of the target markets, it is possible that clean and electric cooking companies could reach a similar state of scale as electricity access companies.

A key enabler in the rapid growth of off-grid solar start-ups has been the introduction of PAYGO finance, which allows customers to purchase appliances at low up-front costs and pay small instalments over time. In the second half of 2022, 2 million solar products worth USD 280 million were sold through PAYGO models, accounting for 38% of registered off-grid solar product sales during that period (GOGLA, 2023). Introducing similar product and business model innovations could be an important factor in enabling electric cooking appliances to scale.

Rather than being led by start-ups, the electric cooking market may be led by larger private sector companies that are already active in developed markets. Companies with abundant experience in electric cooking, such as Group SEB and Philips, do not face the same fundraising challenges as early-stage companies and could finance their own expansions into emerging markets. However, these companies must justify their investments to shareholders and still face barriers that can limit their investments in this space, such as a lack of domain expertise. A company entering a new market may be unfamiliar with consumer preferences, business model innovations that are important for achieving scale, and the regulatory environment. This unfamiliarity creates risks that can deter investment and result in these companies concentrating their operations only in established, familiar markets. Other potential risks that might be perceived by established companies are the stability and accessibility of the grid, as these factors limit the potential market size. Building an enabling environment that de-risks the market entry of established companies could encourage investments and accelerate electric cooking adoption.

A conducive enabling environment is beneficial for both early-stage start-ups and mature companies. Furthermore, these different private sector stakeholders are not necessarily competitors, meaning that supporting one type of market actor can be beneficial for the other. To draw upon another example from the off-grid solar sector, Engie Energy Access is a leading off-grid solar distributor owned by the French multinational utility Engie. It encompasses an in-house mini-grid company and two PAYGO solar home system start-ups that were later acquired by Engie. In this way, start-ups helped to introduce innovations and prove the viability of the off-grid solar market, which then enabled mature companies to step in and finance later stages of growth.

Financing electric cooking through integration into the electricity sector

Another potential source of finance for electric cooking is the electricity sector. Prior studies show that investments into renewable energy sources are increasing and that investments in the power sector are increasing (IRENA and CPI, 2023; IEA, 2023b). Large-scale electricity scale-up projects are also taking place in countries with clean cooking gaps, such as Uganda and Rwanda. By integrating electric cooking into electricity investments and projects, the electricity sector can be a source of finance that supports the scale-up of electric cooking.

[22] *Bboxx, d.light, Engie Energy Access, Sun King, Lumos, M-Kopa and Zola (Lighting Global/ESMAP et al., 2022).*

Box 7 Energy Access and Quality Improvement Project (EAQIP) in Rwanda

Rwanda's EAQIP project is a USD 150 million project that seeks to scale up access to modern energy in households with adoption of clean cooking appliances, supporting Rwanda's goal of universal access to electricity by 2024 and universal access to clean cooking by 2030 (World Bank, 2023b). It is the first project implemented with support from the World Bank's Clean Cooking Fund, which has provided USD 20 million in funding to enable 500 000 households to access clean cooking technologies.

Under EAQIP, private sector companies apply to participate in a results-based finance programme that provides financial incentives to distribute clean cooking solutions to qualified households. These incentives are expected to subsidise the cost of purchasing clean cookstoves by households, thus increasing access and building the private sector's capacity. In addition to the financial incentives and opportunity to gain operational experience, companies that participate in the RBF programme receive technical assistance (TA) and promotional exposure.

IEP is important to ensure the sustainability and feasibility of electric cooking because it helps set clear goals and direct resources effectively for both electrification and clean and electric cooking access. Without holistic planning like this, underdeveloped grid infrastructure could result in low adoption rates of electric cooking solutions as issues related to generation capacity, transmission capacity, grid coverage and even household wiring limit the market potential (IEA, 2023a). Additionally, high grid emissions could result in scenarios where electric cooking has higher emissions than alternative fuels (IEA, 2023a). Rather than considering only the current state of grid infrastructure, electric cooking should be viewed through a transition lens that considers a future grid where both electric cooking and renewable energy are scaled up. Through IEP, electricity grids can be designed to have sufficient capacity for electric cooking while also minimising emissions and improving the financial sustainability of the grid.

Box 8 Integrated energy plan in Malawi and Nigeria

SEforAll has developed an IEP tool that has been used in Malawi and Nigeria.[23] This tool is used to develop IEPs that presents the present-day and forecasted energy landscapes of countries and provides a holistic view for policy makers and the private sector. The IEP tool leverages geospatial energy modelling along with the planning framework-enabled holistic energy access planning that encompasses planning for electrification, clean cooking and cold chain assessments in the country. The online platforms also provide these analytical reports to the public.

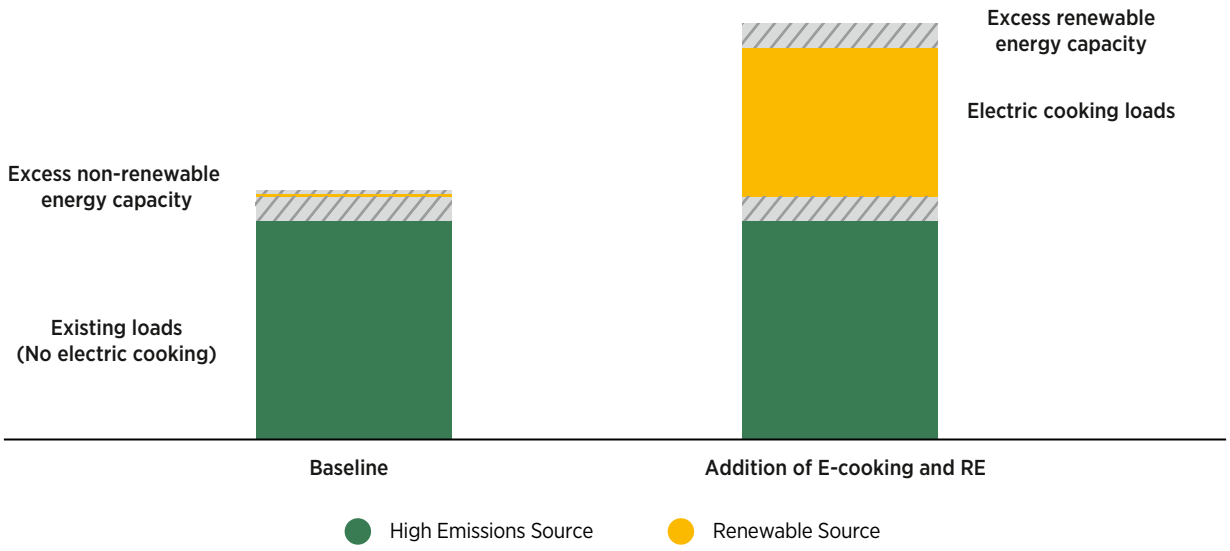
The IEP analysis was leveraged to develop an integrated energy plan, incorporating the requirements for universal residential and institutional electrification, access to clean cooking, and electrification of healthcare facilities. The analysis considers a range of supply-side solutions – such as the grid, mini-grids, electric cooking, solar home systems and other aspects – along with demand-side factors like affordability to assess opportunities for improving energy access. The IEP output included estimates for the market potential of electric cooking appliances. It estimates that 3.5 million households in Nigeria and 4.1 million households in Malawi will adopt electric cooking appliances by 2030.

As such, national frameworks for electric cooking should be supported through the improvement of a related enabling environment in line with similar efforts on electrification. IEP is instrumental to unlock the potential of electric cooking as it sets a plan and targets holistically, both for electrification and clean cooking. In this way, electric cooking solutions can be integrated in the national planning process of the energy sector with potential budget allocations.

[23] *SEforAll's Universal Integrated Energy Plans are available at www.seforall.org/universal-integrated-energy-plans.*

As shown in Figure 9, electric cooking can be a viable and climate-friendly solution, even in countries where the electricity grid currently has low capacity or high emissions, if it is supported by renewable energy investments. In the baseline scenario of this example, a rapid expansion of electric cooking would destabilise the grid and result in GHG emissions due to the grid having limited excess generation capacity from entirely non-renewable energy sources. However, by adding renewable energy capacity, the grid could support electric cooking without increasing grid emissions relative to the baseline. In this way, electric cooking can be powered by renewable energy even if a grid is not fully decarbonised.

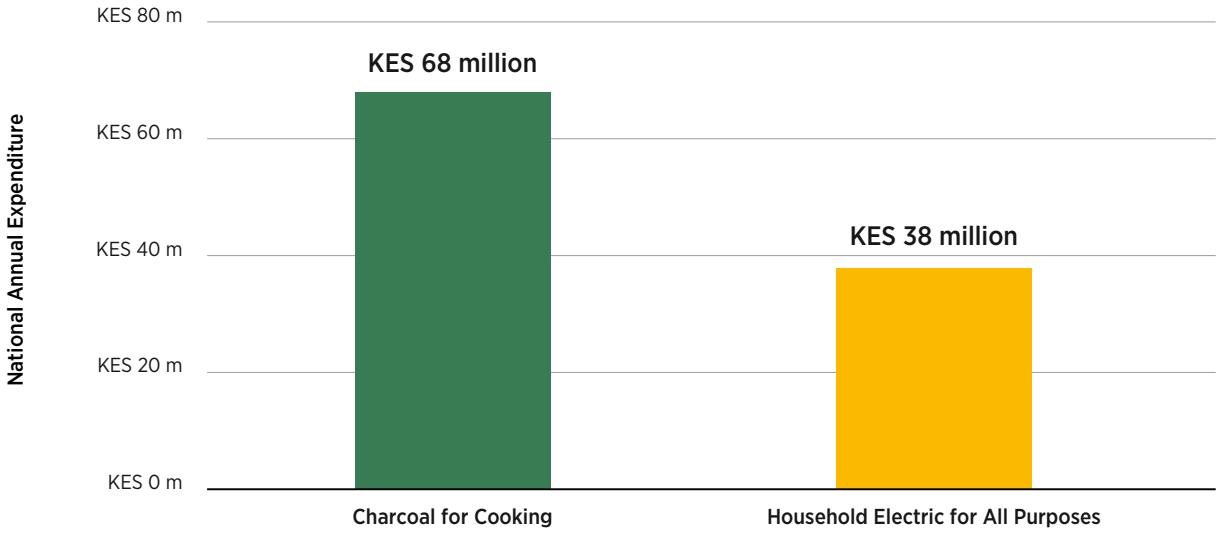
Figure 9 Example of adding renewable energy capacity to a grid with a high percentage of non-renewable energy



Notes: E-cooking = electric cooking; RE = renewable energy.

Utilities should also consider the market opportunity how electric cooking can improve the financial sustainability of renewable energy investments. A 2019 report on Kenya found that the amount of money spent on charcoal for cooking was 40% higher than the electricity revenues for all domestic household consumers, as shown in Figure 10 (Ministry of Energy for Kenya and Clean Cooking Alliance of Kenya, 2019). This example demonstrates that there is often an existing market for the energy that is used in cooking and suggests that electric cooking may be among the most lucrative and important market opportunities for utilities. For consumers, there is also a financial incentive to adopt electric cooking, which has been consistently shown to result in the lowest cost of cooking compared to other purchased fuels, such as charcoal and LPG (Scott and Leach, 2022).

Figure 10 Cost comparison of charcoal for cooking and electricity for domestic uses in Kenya, 2018



Based on: Ministry of Energy for Kenya and Clean Cooking Alliance of Kenya (2019).

Financing electric cooking with carbon finance

Recent developments have created new opportunities to source carbon finance for electric cooking under the Paris Agreement. At the UN Climate Change Committee of Parties (COP 26) in 2021, parties to the Paris Agreement adopted new guidelines for the implementation of carbon market mechanisms. The adopted guidelines, referred to as Article 6 Rulebook, define mechanisms for countries to co-operate to achieve emission reductions as part of their commitments to the Paris Agreement (UNFCCC, 2023).

Article 6 is expected to affect clean cooking finance in two key ways (Galt *et al.*, 2023). First, Article 6.2 introduces a mechanism through which countries may co-operate and transfer mitigation outcomes and enables countries to determine how those activities are governed. This creates a pathway for countries to finance emission-reduction activities in other countries as part of their own mitigation plans, which may facilitate greater international financial flows toward emission-reduction activities such as electric cooking. Second, Article 6.4 establishes a crediting mechanism that allows private companies to register their emissions reductions as certified Article 6.4 Emission Reductions. Emission reduction credits under Article 6, known as internationally transferred mitigation outcomes (ITMOSs), can be transferred internationally to other countries and would result in corresponding adjustments in the national GHG inventories of both the buyer and seller so that they are not double-counted.

Electric cooking would have the potential to be funded through carbon finance where there is a high percentage of renewable energy in the electricity generation mix. Analyses of emission reductions done by MECS and EnDev using WHO's Benefits of Action to Reduce Household Air Pollution (BAR-HAP) tool among high-potential market segments estimates emissions reduction in nine countries (Bangladesh, Benin, Ethiopia, Kenya, Mozambique, Nepal, Rwanda, United Republic of Tanzania and Uganda), as shown in Table 18. While Bangladesh and Uganda have relatively large emissions reduction potentials of 12.7 $MtCO_2eq$ and 9.4 $MtCO_2eq$ per year, respectively, those of Mozambique and Rwanda are less than 1 $MtCO_2eq$ per year (Table 22). It also found that the costs of efficient, modern electric cooking appliances ranged from USD 51 to USD 86.

Table 18 Estimates regarding electric cooking adoption in high-priority market segments

Country	Segment	Pop. (million)	Households (million)	CO_2 emissions reduction ($MtCO_2eq$/year)	Electric cookstove price range (USD)	Appliance
Bangladesh	Firewood	25.0	5.0	12.7	37-45	EPC
Benin	Charcoal	5.2	1.0	1.8	-	-
Ethiopia	Charcoal	4.2	0.9	2.2	43-64	Induction
Kenya	Charcoal	2.6	0.7	1.9	50-150	EPC
Mozambique	Charcoal	1.7	0.4	0.6	60-100	EPC
Nepal	Firewood	2.7	0.7	1.8	35-51	Induction
Rwanda	Charcoal	2.9	0.7	0.5	80-100	EPC
United Republic of Tanzania	Urban, Charcoal	6.0	1.2	1.3	77-81	EPC
Uganda	Charcoal	7.8	1.7	9.4	25-100	EPC

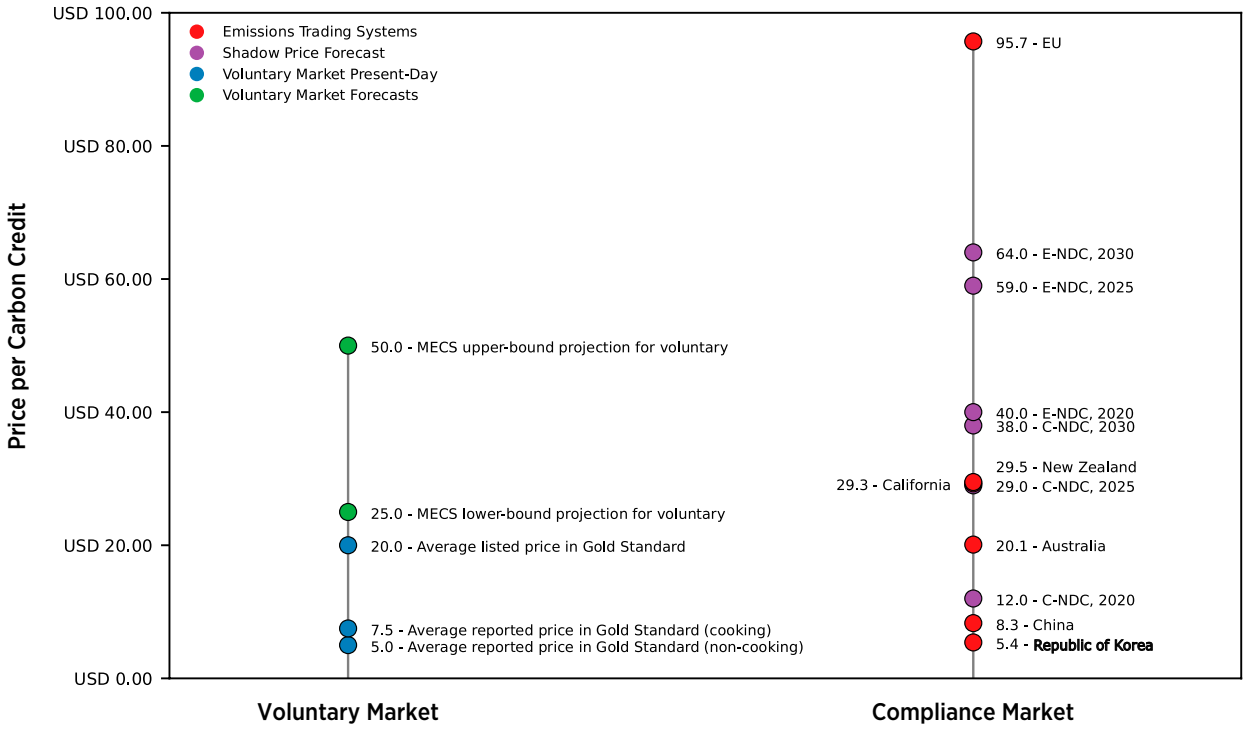
Based on: Barnard-Tallier (2022); Stritzke (2022); Sieff, Troncoso and Tesfamichael (2022); Leary (2022); Sakyi-Nyarko (2022); Barnard-Tallier, Troncoso and Sieff (2022); Bisaga and Menyeh (2022); Clements and Todd (2022); Price, Tesfamichael and Chapungu (2022).

Note: EPC = electric pressure cooker.

Further, as Figure 11 shows, the price of carbon emission reduction credits for clean cooking is higher than the average credit prices of non-cooking projects. A number of sustainable development co-benefits beyond SDG 7 and emission reductions that clean cooking projects produce may contribute to such a price premium, which is seen in voluntary markets. This suggests that electric cooking technologies also have potential to be scaled up under Article 6 market mechanisms of the Paris Agreement.

- For the voluntary market, carbon prices for cooking projects were compiled from Galt *et al.* (2023), which analysed historical prices of carbon credits in cooking projects and projected a range of voluntary markets for 2030. As an additional reference, the listed selling price for projects currently registered on Gold Standard Marketplace (n.d.) was included in Figure 11.
- For the compliance market, present-day prices for carbon credits were compiled from an online carbon market data aggregator (CarbonCredits.com, 2023). In addition, shadow price estimates from a 2019 report by International Emissions Association (Edmonds *et al.*, 2019) are included to show how prices appreciate over time and how they differ between a co-operative NDC implementation scenario (C-NDC) and enhanced ambition scenario (E-NDC).

Figure 11 Present-day and forecasted estimates of carbon pricing on voluntary and compliance markets



Based on: Edmonds *et al.* (2019); Galt *et al.* (2023); Gold Standard Marketplace (2023); CarbonCredits.com (2023).

Notes: GS = Gold Standard; EU = European Union; C-NDC = a co-operative NDC implementation scenario; E-NDC = enhanced NDC ambition scenario; MECS = Modern Energy Cooking Services; Current and forecasted carbon prices on voluntary and compliance markets were compiled from multiple sources.

3.4 STRATEGY FOR INCREASING FINANCE FOR ELECTRIC COOKING

To attract finance for electric cooking, countries must address the existing barriers to finance. Considering the barriers and opportunities assessed so far, a strategy for addressing these barriers is presented in this section. The strategy include four approaches: 1) develop the policy and regulatory environment for electric cooking; 2) integrate electric cooking into the electricity sector; 3) foster the growth of the suppliers of electric cooking solutions; and 4) engage and support end users. These four approaches support seizing financing opportunities while addressing the barriers to finance.

Table 19 Strategy for increasing finance for electric cooking

Approach	Description
Develop the policy and regulatory environment for electric cooking	Develop a clear framework of policies and planning for scaling up electric cooking technologies. • national commitments for electric cooking adoption • favourable policies and regulations to facilitate investment, including carbon finance measures
Integrate electric cooking into the electricity sector	Scale-up electric cooking adoption alongside electricity infrastructure. • IEP for assessing holistic improvement on electricity access and electric cooking • utility-based financial mechanisms for supporting appliance funding at the end user level
Foster the growth of the suppliers of electric cooking solutions	Engage suppliers to facilitate investments in the market • capacity building programmes and TA for electric cooking entrepreneurs, including start-ups and SMEs • de-risking for established electric cooking appliance companies to enter the market
Engage and support end users	Improve end users' awareness levels and access to finance • awareness-raising of end users, government, suppliers and investors • enhancing electric cooking's affordability through consumer finance

Develop the policy and regulatory environment for electric cooking

Many countries need to devise a clear framework to scale up electric cooking technologies. While cooking is often included under broad energy policies or development goals, the lack of explicit targets and concrete strategies for electric cooking sends an unclear signal to potential investors. Creating an enabling environment framework that proactively and clearly highlights electric cooking targets and implementation strategies would send a strong message that de-risks investments and facilitates new financial flows.

Countries can create this framework by developing a national electric cooking strategy that encompasses a vision for electric cooking and provides guidance on relevant policy and regulatory issues. In this strategy, countries should consider how electric cooking finance can be facilitated through mechanisms such as:

- product standards for energy efficiency and safety that lower risks for both companies and users to invest into electric cooking appliances
- import tax and value added tax (VAT) exemptions that lower the costs for both companies and users
- regulation of polluting fuels and unsustainable fuel use and accelerate a transition to electric cooking.

The enabling environment framework can be strengthened by integrating electric cooking into other policies and commitments, such as NDCs. Including electric cooking commitments in NDCs and Long-Term Strategies can signal political will and encourages collaboration and financial flows for a sustainable cooking transition path. Countries can set targets for emission reductions with electric cooking in their NDCs, outline their scale-up strategies, and call upon the international community to provide support.

National energy policies and regulations can also be expanded or amended to included greater emphasis on electric cooking and begin to integrate it into the electricity sector. Integrating electric cooking into the electricity sector can be supported through policy and regulations such as:

- electric cooking access targets for different market segments, including currently electrified and newly electrified households
- tariff designs that lower the cost of cooking for users and increase awareness of electric cooking
- regulations for electricity distribution infrastructure and household wiring to ensure infrastructure is future-proofed for electric cooking loads.

In some cases, the relevant policy frameworks may not yet exist and countries will need to develop additional frameworks such as a national plan for carbon finance. Carbon finance has huge potential to facilitate increased finance for electric cooking and help countries meet their policy goals, but a non-existent or poorly designed policy framework could deter investments or result in low-integrity transactions that undermine the integrity of a sustainable energy transition. In the context of electric cooking, a strong and transparent carbon finance policy would include:

- a vision for how countries will leverage carbon finance to scale up electric cooking
- a plan for how voluntary and Article 6 markets will be regulated and developed
- an overview of carbon finance taxes and tax incentives
- standards for calculating and verifying carbon credits
- incentives for project developers and investors.

In the absence of a national plan for carbon finance, countries can still consider these issues through an electric cooking strategy, NDC or other policy document.

Action
Create a national electric cooking strategy
Include electric cooking in the NDC or Long-Term Strategy
Create energy efficiency standards and regulate the sale of inefficient appliances
Create safety certifications for electric cooking appliances
Create import tax exemptions for electric cooking appliances
Implement VAT exemptions for purchases of certified electric cooking appliances
Create a plan to end subsidies for polluting fuels
Establish targets for electric cooking access targets for different market segments
Implement tariffs that reduce the cost of cooking and raise awareness of electric cooking
Update regulations for household wiring and electricity infrastructure
Create a national plan for carbon finance

Box 9 MECS' national strategies for electric cooking

The MECS programme in co-operation with EnDev is working on the development of national strategies for electric cooking in Uganda and Kenya, with plans to later expand this programme and develop strategies for other East African countries. The strategy development process involves data collection, local stakeholder workshops and consultations. The goal of these strategies is to develop a framework of targets and actions for key players in the sector that can be referred to in the coming years.

In Uganda, the strategy development is being developed in partnership between a local research organisation and the Ministry of Energy and Mineral Development with support from MECS. It is expected to be developed by the end of 2023.

In Kenya, the Kenya National e-Cooking Strategy is being developed by Nuvoni Centre for Innovation Research and is expected to be completed by the end of 2023. The strategy is developed as part of MECS' Capacity Building & Market Development Programme (eCAP), which is implemented in close collaboration with Kenya's largest electricity utility, Kenya Power.

Integrate electric cooking into the electricity sector

Electric cooking needs to be integrated into the electricity sector to leverage electricity investment finance. To begin, countries can develop an integrated energy plan, which would provide an in-depth analysis of how electric cooking can be cost-effectively scaled up alongside electricity infrastructure. The integrated energy plan can inform targets for electric cooking adoption and identify necessary investments in infrastructure. Countries can get support from international organisations when developing their own integrated energy plans.

When planning infrastructure, countries should consider the benefits of investing in smart grids. Smart grids can improve the stability and reliability of the grid by better matching grid supply and demand, which would be affected during a scale-up of electric cooking and renewable energy. In addition to these benefits, infrastructure such as smart meters could help countries track appliance usage. These data could be used as the basis for carbon finance investments.

If issues of electric cooking and electricity are to be intertwined, then utilities should be encouraged to take a more active role in promoting electric cooking because they are in a unique position to both support and benefit from the scale-up of electric cooking appliances. Utilities could potentially take on a number of roles, including acting as:

- ambassadors for electric cooking that conduct marketing and awareness-raising campaigns to promote electric cooking appliances
- distributors of electric cooking appliances, either by offering their own products or acting as a distribution channel for other suppliers
- service centres that offer repair services and build the capacity of local organisations to service electric cooking appliances.

One way for the electricity sector to promote electric cooking adoption is to offer consumer finance to households through on-bill financing or by bundling appliances into loans for household grid connections. The appliances could be repaid by adding a marginal increase to the households' cost of electricity. This would effectively shift electric cooking adoption into a "tool-and-fuel" model, which has the benefit of reducing upfront appliance costs. Further, making appliances available to households that could otherwise not afford them would stimulate additional demand for electricity consumption and improve the financial viability of connecting those customers to the grid.

Another important step to integrate electric cooking into the electricity sector is to require a provision for appliance funding in any projects that expand or upgrade electrical infrastructure. The costs for appliances are relatively small when compared to the scale of most energy access projects, and the investments could be recovered through appliance and energy sales. For example, the Energy Access Scale-up Project (EASP) in Uganda targets 300 000 households gaining access to clean cooking through the project. Assuming a price of USD 50 per appliance, the cost of achieving this target is just 2.3% of the total project budget of USD 638 million. Mandating this provision would ensure that finance is available to achieve electric cooking targets developed under an integrated energy plan.

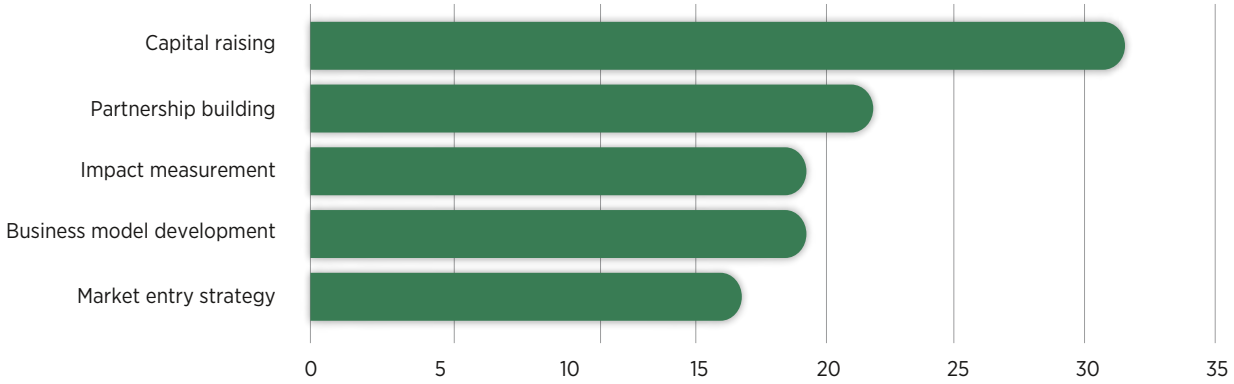
Action
Create an integrated energy plan
Develop a plan for smart grid infrastructure
Host capacity-building workshops with energy sector workers to raise awareness of electric cooking benefits
Develop a project to have electricity utilities distribute electric cooking appliances
Develop an appliance repair programme that households can access through utility channels
Bundle electric cooking appliances into loans for new household electricity connections
Create an on-bill financing programme for electric cooking
Create a provision for appliance funding in any electricity infrastructure projects

Foster the growth of the electric cooking solution suppliers

To attract private finance and investment, countries can foster the growth of the private sector, including both early-stage and mature companies.

To support early-stage companies, start-ups and SMEs, governments can provide entrepreneurs with access to capacity-building programmes and TA. MECS and Energy 4 Impact (2022) analysed the TA needs of clean cooking companies. They found that respondents ranked fundraising as the most important topic that they wanted TA support for and considered new investment and diversified funding streams to be their top two most important outcomes of TA, as shown in Figure 12. Financial management TA was not included in the survey, but financial models were an expected output of seed stage and late-growth stage companies when receiving TA. Countries can offer these services by partnering with existing TA facilities and support programmes that work with early-stage companies, such as accelerators and incubators. Some international organisations also offer free TA to socially impactful organisations. Linking entrepreneurs with experienced mentors or advisors is another way to support the development of organisation's capacities.

Figure 12 TA requirements by clean cooking companies



Based on: MECS and Energy 4 Impact (2022).

Countries should also develop strategies to lower the risks for established electric cooking appliance companies to enter the market. Fostering the enabling environment by developing a robust policy and regulatory environment as described in Chapter 3, Section 3, "Financing electric cooking through the private sector" is one way to lower risks for new private sector investments. Countries could also incentivise investments through strategies such as:

- creating investor incentive packages, such as accelerated permit and registration processes
- developing common regional customs procedures and product standards for electric cooking appliances to de-fragment the market and allow appliances to move easily across borders.

Both early-stage and established companies can benefit from being contracted to supply and distribute appliances under government-developed projects. This is seen in Nepal, where a project financed by Green Climate Fund (GCF) has implemented a reverse-auction mechanism that has companies bid on the contract to supply and distribute electric cooking appliances to households (Box 11). An alternative approach has been seen in Rwanda's EAQIP, where local appliance distributors received financial incentives and products subsidised through a RBF programme (Box 7).[24]

These government-led projects can take many shapes and forms, with multiple variations on how they are structured, financed and implemented. Electric cooking projects can be implemented as stand-alone concepts or structured as components under larger energy access or clean cooking initiatives. Project finance can involve any combination of domestic or international finance sources and instruments such as debt and grants. Target beneficiaries can also be varied, such as in Uganda's Charcoal to Power project that seeks to convert 50 000 households and 500 institutions, including hospitals, schools and prisons, to cooking with electricity. Regardless of the project type, these projects channel finance to the private sector while also giving companies the chance to build out their local operations and gain valuable operational experience in the local market.

[24] *IRENA also manages investment platforms for facilitating energy transition projects (Box 12).*

Action
Partner with incubator and accelerator programmes to offer investment-readiness training for electric cooking companies
Create mentorship programmes that link entrepreneurs with experienced business professionals
Establish a TA programme offering free or subsidised accounting services to electric cooking companies
Partner with an existing TA programme to provide services on financial modeling and valuation for electric cooking companies
Develop incentives for investment in electric cooking companies, such as exemptions on foreign investment restrictions and accelerated permit times
Create a programme that requires public institutions such as hospitals and schools to transition to electric cooking
Implement a programme that encourages households to switch from LPG to electric cooking by trading in their appliances and subsidising the switch
Create an RBF grant programme that provides incentives to companies to increase electric cooking access in underserved markets

Box 10 Supporting women entrepreneurs with fundraising

Multiple studies on entrepreneurs and fundraising indicate that there is a gender financing gap: companies led by women tend to receive less investment than companies led by men, and this gap is more pronounced as investment levels increase (International Finance Corporation, 2020; Global Accelerator Learning Initiative and Catalyst for Growth, 2020). Incubators and accelerators seek to support entrepreneurs to secure the finance necessary to develop their businesses, but these programmes often have different results for companies led by men compared to those led by women. Research shows that accelerators actually widen the gender gap for equity finance, as companies led by men raise significantly more equity post-acceleration, whereas companies led by women see little to no change in the amount of equity that they raise. For debt finance, the gender gap shrinks as women-led start-ups raise significantly more debt post-acceleration whereas men-led start-ups see little change.

Research shows that accelerators might not be able to entirely close the gender gap by building the capacity of entrepreneurs if the underlying cause of the gap is something systemic and external, such as investor bias. However, accelerator, incubator and mentorship programmes can still work to change investors' biases and risk perceptions. Additionally, these programmes can increase the participation of women-led companies by having a greater number of women on their selection committees.

Box 11 Scaling electric cooking in Nepal

One example of how governments are developing projects that involve local organisations and support company functions is in Nepal, where the government of Nepal has developed a USD 49 million project with finance sourced from GCF to promote clean cooking solutions and deploy 500 000 electric cooking appliances (Green Climate Fund, 2021).

Under this project, local governments identify households eligible for purchasing subsidised electric cooking appliances and then help co-ordinate the installation of those appliances with vendors at the identified households. The project also involves training service centres and technicians on the repair and maintenance of electric cooking appliances. In this way, the government centralises marketing, distribution and after-sales service channels and reduces the complexity that electric cooking suppliers face during the scale-up process.

Box 12 IRENA's support for project and investment facilitation

IRENA member countries can receive support on developing electric cooking projects through IRENA's Project Facilitation Services work package. Under this work package, IRENA engages with countries to develop project pipelines that are aligned with governmental priorities in collaboration with the financial sector, private sector and project developers.

IRENA also supports its member countries to secure finance for projects through two online platforms.

Climate Investment Platform

IRENA's Climate Investment Platform (CIP) facilitates the development and scale-up of renewable energy technologies through tailored TA. Support provided through CIP prepares project proponents to reach commercial feasibility and readiness for financing matchmaking with registered financial institutions.

Energy Transition Accelerator Financing

IRENA's Energy Transition Accelerator Financing (ETAF) platform facilitates capital mobilisation to finance feasible renewable energy projects. ETAF supports the implementation of ambitious NDCs and the achievement of SDGs and has so far received finance pledges of USD 1.25 billion.

Engage and support end users

Countries can develop the market for electric cooking appliances by supporting end users to more easily understand and adopt electric cooking appliances. Doing so would make it easier for companies and investors to sell to customers and thus lower the risks of investing in the private sector.

One way for countries to engage the public is to conduct awareness-raising campaigns on electric cooking. Modern electric cooking appliances are cleaner, more convenient, safer and may have lower fuel costs to use than other cooking options such as biomass and charcoal stoves, but the general public may need to be educated on these benefits.

Awareness-raising campaigns can also focus on things other than appliances. For example, governments can raise awareness around how consumers can access finance for electric cooking or develop a campaign about reducing deforestation. Campaigns such as these support the creation of an electric cooking market while also involving other stakeholder groups, such as microfinance institutions or forestry agencies, who can help spread the message.

Awareness levels for electric cooking also need to be improved among policy makers, investors and energy sector stakeholders. These groups should be engaged through workshops and dialogues to build their capacity to understand electric cooking and related topics such as carbon finance. Doing so will better enable these stakeholders to support a transition toward renewable-powered electric cooking.

Countries also have an important role to play in ensuring that users are able to afford electric cooking appliances by facilitating consumer finance. This can be done in a number of ways, such as creating consumer finance programmes, creating first-loss guarantees to incentivise lending or improving the regulatory environment for consumer finance technologies such as PAYGO.

Action
Create awareness-raising campaigns on the benefits of electric cooking
Create educational content that explains to users how to use electric cooking appliances
Create a marketing campaign to promote programmes that offer appliance finance
Partner with environmental groups to raise awareness on the costs of biomass cooking
Host a workshop on electric cooking for investors, policy makers and energy sector stakeholders to raise awareness of electric cooking products and business models
Develop women-focused consumer finance products offered through local banks and de-risked by public finance
Assess existing policies that govern asset financing and mobile money usage and identify regulatory pain points for companies to offer electric cooking appliances with consumer finance

4 WAY FORWARD: TRANSITIONING TO INCREASE ELECTRIC COOKING

4.1 OVERVIEW OF KEY FINDINGS

There is an urgent need to scale up electric cooking to meet SDG 7 and broader climate goals.

As of 2021, 2.3 billion people still lack access to modern energy cooking services and remain reliant on polluting, harmful fuels that have detrimental health, gender and climate impacts (IEA *et al.*, 2023). Greater investments in modern energy clean cooking solutions such as electric cooking are needed to achieve SDG 7 by 2030.

Beyond 2030, electric cooking also plays a critical role in achieving a sustainable energy transition. The IRENA WETO 1.5°C Energy Scenario calls for a complete phase-out of non-renewable biomass in cooking and for 85% of all cooking to be done with electricity by 2050 (IRENA, 2021). Presently, the average rate of electric cooking adoption by the assessed countries is 10%. To realise these sustainable development ambitions, countries must begin to invest in the transition to greater electric cooking adoption.

The transition to electric cooking can occur even where there are present-day electricity access and market barriers.

Electric cooking has historically lagged behind electricity (both in terms of access and finance). For nearly all the assessed countries, electric cooking adoption was correlated with having universal access to electricity: countries that have electric cooking rates above 5% almost always have access to electricity rates above 97%. However, universal electricity access is *not* a prerequisite for electric cooking to penetrate the market, as shown by 11 outlier countries in Figure 3 (Group A4). This group includes Ethiopia, Lesotho, Zambia and Zimbabwe, which have each achieved significant electric cooking penetration while having an approximate 50% rate of access to electricity.

Affordable electricity and a large addressable market size are also not requirements for an electric cooking transition to begin. The group of 11 countries mentioned above also have low affordability of electricity and below-average market sizes. Further, several of them are LDCs, heightening potential concerns related to the affordability of electric cooking products.

Issues of electricity access, affordability and market potential can limit the viability of electric cooking in some contexts, but the transition toward greater electric cooking adoption will be a progressive one that happens concurrently with other sustainable development. This transition will take time but must start somewhere, and the conditions for electric cooking to begin scaling up are often already present in contexts such as densely populated and electrified urban centres. Countries should begin developing the enabling environment for electric cooking to facilitate a transition away from unsustainable, polluting fuels.

Countries are beginning to recognise the role of electric cooking in their climate commitments.

Twenty-two countries have already integrated electric cooking into their NDC or Long-Term Strategy. These countries include nine LDCs and represent a diverse cross-section of the world in terms of current access levels, economic development and geography.

Commitments to increase electric cooking adoption took many forms, with most countries setting qualitative targets towards promoting electric cooking. The role of electricity in the mix of cooking fuels was viewed differently, as some countries targeted electricity-displacing fuels, such as biomass and LPG, while others considered promoting electric cooking alongside improved cookstoves or gas stoves. The differences in approach demonstrate the range of contexts in which a transition to electric cooking can take place.

Many countries can enhance their NDC ambitions by purposefully including electric cooking targets.

Research shows that cooking represents 2% of global emissions. A transition to electric cooking minimises GHG emissions while also producing multiple other social benefits, such as better health outcomes, increased gender equality and other gains in relevant parts of the world. Still, the majority of countries did not include electric cooking or other cooking targets in their NDCs or Long-Term Strategies.

Fifty-two countries excluded electric cooking but included other forms of cooking such as improved cookstoves (29 countries), LPG (16 countries), biogas (13 countries) and sustainable biomass (7 countries) in their NDCs and Long-Term Strategies. Some of the targets to support modern cooking technologies were framed generally and could encompass electric cooking, but it is important for countries to purposefully include electric cooking to signal their ambitions. Similarly, many countries may have policies to support electric cooking, but these policies are either not publicly available or are not explicit in their link to electric cooking.

Countries can enhance their NDCs by including electric cooking targets. This kind of clear, supportive policy statement clarifies the ambitions to transition toward greater electric cooking adoption and serves as an important signal when gathering support and finance that can make the transition possible.

Clean cooking has been underfinanced, but recent developments signal increased flows into the sector and these can be expanded further with flows from an integrated energy sector and carbon finance.

Finance for clean cooking has been historically low and is an order of magnitude less in comparison with finance for the electricity access sector on a per capita basis. Out of this limited pool, financial flows to electric cooking are even more limited and represented less than 4% of tracked commitments in 2019, with most clean cooking finance going toward biomass cookstove projects (SEforAll, 2021).

Recent developments suggest that the financial landscape for clean cooking is changing and that finance levels for the private sector are increasing. A broad range of initiatives, including funds, projects, accelerators and grant programmes, has been established with the explicit goal of accelerating the adoption of clean cooking technologies, including electric cooking.

Integrating electric cooking into the electricity sector creates an opportunity for increased finance. Current finance levels for electricity access are an order of magnitude greater than those for clean cooking access on a per-household basis, but both are dwarfed by the billions of dollars invested in grid generation, transmission and distribution.

Developments in the carbon market have potential to change how clean cooking is financed. Carbon finance on the voluntary market for clean cooking was estimated to range between USD 6 million and USD 15 million per year before 2023 but could grow to USD 80 million to USD 150 million per year by 2030 as a result of increased prices on the voluntary markets (Galt *et al.*, 2023). Carbon finance for electric cooking is growing, and the first voluntary market transaction for metered electric cooking appliances was made in 2023. Changes to carbon market mechanisms were introduced under Article 6 at COP 26 in 2021, and there are ongoing uncertainties around how the voluntary carbon credit system will be affected in the coming years. Despite the uncertainties, electric cooking is found to be a cost-effective means of carbon displacement and is a high-potential activity to receive finance under Article 6.

Addressing financial barriers and tapping into right opportunities are important for financing electric cooking.

Scaling up electric cooking will require a substantial increase in finance. To unlock finance, countries can: 1) develop their enabling environments by focusing on developing policies and regulations; 2) integrate electric cooking into the development plan of their electricity sector; 3) foster the growth of their private suppliers; and 4) engage and support end users.

- Developing a policy environment is critical to unlocking new finance. Countries can consider developing product standards, implementing tax exemptions, regulating polluting fuels, including electric cooking in NDCs, setting targets, redesigning tariffs, revising infrastructure requirements and developing a carbon finance framework.
- Countries can support the integration of electric cooking into the electricity sector by developing an integrated energy plan; engaging utilities to conduct marketing, distribution or service activities; promoting user finance through on-bill and connection loans; and creating provisions for appliance funding in electricity access scale-up projects.
- Countries can foster the growth of private suppliers for electric cooking appliances by creating projects that contract suppliers and distributors, making TA programmes available to early-stage companies and start-ups, and offering incentives that de-risk market entry for established international companies.
- Countries should also engage end users and support them to understand and access electric cooking appliances. Countries can do this by creating awareness-raising campaigns, hosting capacity-building workshops with key stakeholders, and supporting households to access consumer finance.

4.2 ACTION PLANS FOR SCALING UP ELECTRIC COOKING

IRENA's WETO presents a pathway for sustainable development that reduces global GHG emissions and limits global warming to 1.5°C by 2050. WETO considers multiple dimensions of a transition powered by renewable energy, including socio-economic and policy implications. By 2050, the 1.5°C Energy Scenario presented in WETO 2021 calls for 85% of all cooking to be done with electricity and the remainder to be done with sustainable biofuels. Achieving this goal requires ambitious, global action. WETO 2023 reiterates the transition to renewable- and electricity-based cooking solutions. As the cooking sector still largely relies on fossil fuels and unsustainable biomass globally, the shift to renewable-powered efficient cooking stoves is necessary to support the energy transition.

Governments and development partners play a pivotal role in facilitating these actions. The starting point would vary among countries, depending on the progress of electric cooking adoption, its market size and enabling frameworks such as policy and regulations. To better understand the required action in countries, this final section builds action plans for the three country groups.

Based on the outputs of the NDC review and landscape analysis, criteria were developed to identify countries with high-potential markets for electric cooking. Markets from 49 countries were grouped and identified using the criteria, as shown in Table 20 and Table 21.

Table 20 Grouping of countries

Group	Characteristics	Criteria	Emphasis
Untapped market	High potential market size but low penetration of electric cooking technologies and no recognition of it in climate commitments	1. Electric cooking penetration rate less than 5%[25] 2. Above-average electric cooking market size 3. Electric cooking not included in the NDC or Long-Term Strategy	Enhancing NDC commitments
Primed market	Low penetration of electric cooking technologies but a recognition of the importance of electric cooking in climate commitments	1. Electric cooking rate less than 5% 2. Electric cooking included in the NDC or Long-Term Strategy	Implementing NDC commitments
Maturing market	High penetration of electric cooking technologies and a recognition of the importance of electric cooking in climate commitments	1. Electric cooking rate more than 5% 2. Electric cooking included in the NDC or Long-Term Strategy	Ensuring adequate supply of renewable energy

The grouping described above represents different levels of readiness for electric cooking adoption. Depending on the progress of each country, the engagements may emphasise different aspects, as shown below. Further details on the action plans will be given at the end of this chapter.

- **Untapped markets**

  Countries in this group have large market or climate opportunities for electric cooking but have not realised this potential or recognised cooking in their climate commitments.

  - *Policy and regulatory environment:* Countries in this group would benefit from support to enhance their NDC and Long-Term Strategy commitments by including electric cooking targets and measures, which would be the first step to incorporate electric cooking into national climate policies and planning. Regulations also need to be improved to support the shift to electric cooking. Such regulations would include the phaseout of subsidies for polluting fuels.
  - *Integrate electric cooking into electricity planning:* TA support would help countries incorporate electric cooking into the electricity supply and infrastructure planning. Capacity-building programmes would be a good starting point to raise the awareness of policy makers and utilities.
  - *Foster the growth of electric cooking solution suppliers:* Electric cooking solution suppliers, including both early-stage and mature companies, need to become familiar with electric cooking devices, fund raising, and marketing and sales. Support from the public sector, such as the creation of accelerator and mentorship programmes and financial incentives, would also need to be developed for the private sector to start developing businesses based on electric cooking.

[25] *The average rate of electric cooking adoption of IRENA members countries is 4.75%.*

- *Engage and support end users:* Awareness should be raised about electric cooking solutions through campaigns and workshops. Consumers' access to electric appliances should also be improved through consumer finance instruments.

- **Primed markets**

  This group includes countries that have not yet achieved high levels of electric cooking access but have taken the important step of recognising cooking in their NDCs or Long-Term Strategies. For this group, advisory supports on policy and finance and project facilitation would help countries accelerate building their capacities to achieve their climate goals.

  - *Policy and regulatory environment:* In addition to integrating electric cooking into policies and planning, incentive mechanisms should be strengthened to facilitate investment in electric cooking. These mechanisms would include the exemption of import tax and VAT. In addition, technology certificates help support the diffusion of qualified cookstoves while energy efficiency regulations can also ensure the use of efficient appliances.
  - *Integrate electric cooking into electricity planning:* In addition to the development of the integrated energy plan that integrates electric cooking, the actual programme to bundle electricity connection at the household level with electric cooking appliance distribution would help in the overall distribution of appliances. Financial mechanisms, such as new loan programmes, on-bill financing or others, may support this to happen.
  - *Foster the growth of electric cooking solution suppliers:* Since it is necessary to ensure the supply of electric cookstoves, TA programmes can be provided for companies to assist their electric cooking businesses. The programmes may include financial modelling and valuation, accounting support and other relevant activities.
  - *Engage and support end users:* Further awareness raising would be necessary to nurture the interest and demand of end users in electric cooking. This may include education programmes and materials to inform consumers about the benefits and use of electric cooking appliances.

- **Maturing markets**

  The countries in this group have made progress in scaling electric cooking adoption and have made this part of their commitments in their NDCs or Long-Term Strategies.

  - *Policy and regulatory environment:* Through the development of renewable energy roadmaps and long-term energy planning, countries can assess the of potential and plan to expand their grid capacities and coverage to reach more people and increase the proportion of renewable energy used in cooking. To further increase access to electric cooking appliances, carbon finance measures, such as the Paris Agreement Article 6 market mechanisms, can be considered.
  - *Integrate electric cooking into electricity planning:* With the expansion of grid connections, smarter grids can be considered. These improve grid stability and reliability by better matching grid supply and demand, which would be made necessary by the scale-up of electric cooking usage increasing loads. Further, the development of an appliance repair programme would enable households to access repairs through utility channels to sustain the use of electric cooking.
  - *Foster the growth of electric cooking solution suppliers:* Public sector support should accelerate the replacement of conventional cookstoves with electric cookstoves. Programmes for public buildings such as hospitals and schools can be considered, followed by the scaled-up update of electric cookstoves in households.
  - *Engage and support end users:* Further engagement with end users is recommended to raise the demand for electric cookstoves. This engagement would communicate the economic and sustainable development co-benefits of electric cookstoves, such as pollution mitigation, health impacts and other benefits.

Country profiles with action plans for scaling up electric cooking have been developed for each group of markets (untapped, primed and maturing) identified above (see Appendix C). These action plans draw on the strategic recommendations for facilitating electric cooking finance in Chapter 3 and include a set of concrete actions that countries can enact. Countries can adopt and implement these action plans or utilise them as guidelines in developing their own action plans and strategies.

Table 21 High-potential countries for support on electric cooking climate action

Untapped markets	Primed markets	Maturing markets
(25 countries)	(15 countries)	(9 countries)
Afghanistan	Cambodia	Bhutan
Algeria	Congo	China
Argentina	Democratic Republic of the Congo	Costa Rica
Bangladesh	Dominica	Cuba
Brazil	Ecuador	Ethiopia
Chile	Eritrea	Fiji
Colombia	India	Honduras
Egypt	Indonesia	Marshall Islands
Ghana	Malawi	South Africa
Islamic Republic of Iran	Mauritania	
Iraq	Nepal	
Kenya	Rwanda	
Malaysia	Thailand	
Mexico	Togo	
Morocco	Uganda	
Nigeria		
Pakistan		
Peru		
Philippines		
Republic of Korea		
Romania		
Sri Lanka		
Sudan		
Türkiye		
Uzbekistan		

For each of the countries above, a country profile has been developed and appended to this report. These profiles provide an overview of data utilised in this report, such as statistics on access to electricity, affordability of electricity and NDC information.

As discussed earlier, the transition to electric cooking is an important part of achieving the 1.5°C pathway, phasing out traditional bioenergy such as charcoal and wood for cooking. These action plans can be taken forward through the collaboration of governments and development agencies. The actions detailed above would be key starting points for countries to scale up electric cooking solutions for climate action. As countries have different levels of readiness for technology adoption, considering each national circumstance will be a key step to bring about the concrete set of actions for scaling up electric cooking solutions.

ACTION PLAN FOR ELECTRIC COOKING – UNTAPPED MARKETS

Improve the policy and regulatory environment

- Create a national electric cooking strategy
- Include electric cooking in the NDC or Long-Term Strategy
- Create energy efficiency standards and regulate the sale of inefficient appliances
- Create safety certifications for electric cooking appliances
- Create a plan to end subsidies for polluting fuels
- Establish electric cooking access targets for different market segments
- Update regulations for household wiring and electricity infrastructure
- Create a national plan for carbon finance

Integrate electric cooking into electricity planning

- Create an integrated energy plan with holistic consideration into electrification and electric cooking
- Host capacity-building workshops with utility and energy sector workers to raise awareness of electric cooking benefits
- Develop a project to have electricity utilities distribute electric cooking appliances
- Create a provision for appliance funding in electricity infrastructure projects

Foster the growth of the private suppliers

- Partner with incubator and accelerator programmes to offer investment-readiness training for electric cooking companies
- Create mentorship programmes that link entrepreneurs with experienced business professionals
- Develop incentives for investment in electric cooking companies, such as exemptions on foreign investment restrictions and accelerated permit times
- Create an RBF grant programme that provides incentives to companies to increase electric cooking access in underserved markets

Engage and support end users

- Create awareness-raising campaigns on the benefits of electric cooking
- Host a workshop on electric cooking for investors, policy makers and energy sector stakeholders to raise awareness of electric cooking products and business models
- Assess existing policies that govern asset financing and mobile money usage and identify regulatory pain points for companies to offer electric cooking appliances with consumer finance

ACTION PLAN FOR ELECTRIC COOKING – PRIMED MARKETS

Improve the policy and regulatory environment

- Create a national electric cooking strategy
- Include electric cooking in the NDC or Long-Term Strategy
- Create energy efficiency standards and regulate the sale of inefficient appliances
- Create safety certifications for electric cooking appliances
- Create import tax exemptions for electric cooking appliances
- Implement VAT exemptions for purchases of certified electric cooking appliances
- Implement tariffs that reduce the cost of cooking and raise awareness of electric cooking
- Update regulations for household wiring and electricity infrastructure
- Create a national plan for carbon finance

Integrate electric cooking into electricity planning

- Create an integrated energy plan with holistic consideration into electrification and electric cooking
- Develop a plan for smart grid infrastructure
- Host capacity-building workshops with utility and energy sector workers to raise awareness of electric cooking benefits
- Bundle electric cooking appliances into loans for new household electricity connections
- Create an on-bill financing programme for electric cooking
- Create a provision for appliance funding in electricity infrastructure projects

Foster the growth of private suppliers

- Establish TA programmes offering free or subsidised accounting services to electric cooking companies
- Partner with an existing TA programme to provide services on financial modeling and valuation for electric cooking companies
- Develop incentives for investment in electric cooking companies, such as exemptions on foreign investment restrictions and accelerated permit times
- Create an RBF grant programme that provides incentives to companies to increase electric cooking access in underserved markets

Engage and support end users

- Create awareness-raising campaigns on the benefits of electric cooking
- Create educational content that explains to users how to use electric cooking appliances
- Create a marketing campaign to promote programmes that offer appliance finance
- Host a workshop on electric cooking for investors, policy makers and energy sector stakeholders to raise awareness of electric cooking products and business models

ACTION PLAN FOR ELECTRIC COOKING – MATURING MARKETS

Improve the policy and regulatory environment

- Create a national electric cooking strategy
- Include electric cooking in the NDC or Long-Term Strategy
- Create energy efficiency standards for cooking appliances and regulate the sale of inefficient appliances
- Create a plan to end subsidies for polluting fuels
- Create a national plan for carbon finance

Integrate electric cooking into electricity planning

- Create an integrated energy plan with holistic consideration into electrification and electric cooking
- Develop a plan for smart grid infrastructure
- Develop an appliance repair programme that households can access through utility channels

Foster the growth of private suppliers

- Create a programme that requires public institutions such as hospitals and schools to transition to electric cooking
- Implement a programme that encourages households to switch from LPG to electric cooking by trading in their appliances and subsidising the switch
- Create an RBF grant programme that provides incentives to companies to increase electric cooking access in underserved markets

Engage and support end users

- Partner with environmental groups to raise awareness on the costs of biomass cooking
- Develop women-focused consumer finance products offered through local banks and de-risked by public finance

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APPENDIX A: LIST OF IRENA MEMBERS INCLUDED IN ANALYSIS

Countries assessed in the study include 168 member states, the European Union, 15 states in accession, and Lao PDR. The review of NDCs and Long-Term Strategies was conducted in May 2023.[26]

IRENA Member States: Afghanistan, Albania, Algeria, Angola, Antigua and Barbuda, Argentina, Armenia, Australia, Austria, Azerbaijan, Bahamas, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Belize, Benin, Bhutan, Bosnia and Herzegovina, Botswana, Brunei Darussalam, Bulgaria, Burkina Faso, Cabo Verde, Cameroon, Canada, Central African Republic, Chad, China, Colombia, Comoros, Costa Rica, Côte d'Ivoire, Croatia, Cuba, Cyprus, Czech Republic, Denmark, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Eritrea, Estonia, Eswatini, Ethiopia, European Union, Fiji, Finland, France, Gabon, Gambia (the), Georgia, Germany, Ghana, Greece, Grenada, Guatemala, Guinea, Guyana, Honduras, Hungary, Iceland, India, Indonesia, Iran (Islamic Republic of), Iraq, Ireland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kingdom of the Netherlands, Kiribati, Kuwait, Kyrgyzstan, Latvia, Lebanon, Lesotho, Liechtenstein, Lithuania, Luxembourg, Malaysia, Maldives, Mali, Malta, Marshall Islands, Mauritania, Mauritius, Mexico, Micronesia (Federated States of), Monaco, Mongolia, Montenegro, Morocco, Mozambique, Namibia, Nauru, Nepal, New Zealand, Nicaragua, Niger, Nigeria, North Macedonia, Norway, Oman, Pakistan, Palau, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Poland, Portugal, Qatar, Republic of Korea, Republic of Moldova, Romania, Russian Federation, Rwanda, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, San Marino, São Tomé and Príncipe, Saudi Arabia, Senegal, Serbia, Seychelles, Sierra Leone, Singapore, Slovakia, Slovenia, Solomon Islands, Somalia, South Africa, Spain, Sri Lanka, Sudan, Sweden, Switzerland, Tajikistan, Thailand, Togo, Tonga, Trinidad and Tobago, Tunisia, Türkiye, Turkmenistan, Tuvalu, Uganda, Ukraine, United Arab Emirates, United Kingdom of Great Britain and Northern Ireland, United States of America, Uruguay, Uzbekistan, Vanuatu, Yemen, Zambia, Zimbabwe

IRENA Member States in Accession: Andorra, Brazil, Burundi, Cambodia, Chile, Congo, Democratic Republic of the Congo, Guinea-Bissau, Liberia, Libya, Madagascar, Malawi, Syrian Arab Republic, Timor-Leste, United Republic of Tanzania

IRENA Non-Members: Lao People's Democratic Republic

[26] *Recent updates to climate commitments may not be captured in this analysis.*

APPENDIX B: COUNTRY ASSESSMENT DETAILS

This appendix provides details of the groupings of countries in the assessment of Chapter 2: Situation analysis of electric cooking solutions.

Access: Progress on access to electricity and electric cooking

A total of 123 countries were assessed on their access to electricity and electric cooking. Figure 3 displayed the analytical results of the assessments. Table B1 below gives a full list of countries.

Table B1 Groupings of countries based on access-related variables

Group	Criteria	Countries		
Group 1 (A1)	Access to Electricity > 97% Population Cooking Primarily with Electricity > 5%	23	Albania Belarus Bhutan Bosnia and Herzegovina China Costa Rica Cuba Fiji Kazakhstan Kyrgyzstan Marshall Islands Mongolia	Montenegro Morocco North Macedonia Palau Paraguay Russian Federation Samoa Serbia Tajikistan Timor-Leste Ukraine
Group 2 (A2)	Access to Electricity > 97% Population Cooking Primarily with Electricity < 5%	34	Afghanistan Algeria Argentina Armenia Azerbaijan Brazil Colombia Dominica Dominican Republic Ecuador Egypt El Salvador Georgia Islamic Republic of Iran Iraq Jamaica Jordan	Lao PDR Malaysia Maldives Mauritius Mexico Philippines Republic of Moldova Saint Lucia Saint Vincent and the Grenadines Sri Lanka Thailand Tonga Tunisia Türkiye Turkmenistan Tuvalu Uzbekistan

Table B1 Groupings of countries based on access-related variables (continued)

Group	Criteria	Countries		
Group 3 (A3)	Access to Electricity < 97% Population Cooking Primarily with Electricity < 5%	55	Angola Bangladesh Belize Benin Burkina Faso Burundi Cabo Verde Cambodia Cameroon Central African Republic Chad Comoros Congo Côte d'Ivoire Democratic Republic of the Congo Djibouti Eritrea Gabon Gambia (the) Ghana Grenada Guinea Guinea-Bissau Guyana India Indonesia Kenya Kiribati	Liberia Libya Madagascar Malawi Mali Mauritania Micronesia (Federated States of) Mozambique Nepal Nicaragua Niger Nigeria Pakistan Peru Rwanda São Tomé and Príncipe Senegal Sierra Leone Solomon Islands Somalia Sudan Syrian Arab Republic Togo Uganda United Republic of Tanzania Vanuatu Yemen
Group 4 (A4)	Access to Electricity < 97% Population Cooking Primarily with Electricity > 5%	11	Botswana Eswatini Ethiopia Guatemala Honduras Lesotho	Namibia Papua New Guinea South Africa Zambia Zimbabwe

Market: Market potential for electric cooking

Similarly, Figure 5 analysed the market perspective of 116 countries, looking at the addressable market size of electric cooking and affordability. Table B2 presents a full list of countries in each of the four groups.

Table B2 Groupings of countries based on market-related variables

Group	Criteria	Countries		
Group 1 (M1)	Indexed Affordability > 24 Indexed Total Market Size > 12	11	Algeria Argentina China Egypt Islamic Republic of Iran Malaysia	Russian Federation Thailand Türkiye Ukraine Uzbekistan

Table B2 Groupings of countries based on market-related variables (continued)

Group	Criteria	Countries		
Group 2 (M2)	Indexed Affordability < 24 Indexed Total Market Size > 12	14	Bangladesh Brazil Colombia Ethiopia India Indonesia Iraq	Kenya Mexico Morocco Nigeria Pakistan Peru Philippines
Group 3 (M3)	Indexed Affordability < 24 Indexed Total Market Size < 12	72	Afghanistan Belize Benin Botswana Burkina Faso Burundi Cabo Verde Cambodia Cameroon Central African Republic Chad Comoros Congo Côte d'Ivoire Democratic Republic of the Congo Djibouti Dominica Dominican Republic Ecuador El Salvador Eswatini Fiji Gabon Gambia (the) Ghana Grenada Guatemala Guinea Guinea-Bissau Guyana Honduras Jamaica Jordan Kiribati Lao Lesotho	Liberia Madagascar Malawi Maldives Mali Marshall Islands Mauritania Mauritius Micronesia (Federated States of) Mozambique Namibia Nepal Nicaragua Niger North Macedonia Palau Papua New Guinea Rwanda Saint Lucia Saint Vincent and the Grenadines Samoa São Tomé and Príncipe Senegal Sierra Leone Solomon Islands South Africa Sri Lanka Tajikistan Timor-Leste Togo Tonga Uganda United Republic of Tanzania Vanuatu Zambia Zimbabwe
Group 4 (M4)	Indexed Affordability > 24 Indexed Total Market Size < 12	19	Albania Angola Armenia Azerbaijan Belarus Bhutan Bosnia and Herzegovina Costa Rica Georgia Kazakhstan	Kyrgyzstan Libya Mongolia Montenegro Paraguay Republic of Moldova Serbia Sudan Tunisia

Countries that included electric cooking in their NDCs or Long-Term Strategies

Table B3 and Table B4 provide the details on how countries mentioned electric cooking in NDCs and Long-Term Strategies, respectively.

Table B3 Countries with electric cooking in their NDCs

Country	NDC	Link to electric cooking
Bhutan	Second NDC 2021	Qualitative target to replace LPG and firewood with electric cooking between 2020 and 2030
China	First NDC (Updated) 2021	Qualitative target to increase the penetration rate of electric cooking
Congo	First NDC (Updated) 2021	Quantifiable target to deploy 75 000 electric stoves by 2025 and 100 000 by 2030
Cuba	First NDC (Updated) 2020	Quantifiable target to replace 2 million resistance-driven electric cookers with energy-efficient induction cookers
Democratic Republic of the Congo	First NDC (Updated) 2021	Qualitative target to promote LPG and electric cooking by 2030
Dominica	First NDC 2022	Qualitative target to encourage electricity usage in food preparation
Ecuador	First NDC 2019	Qualitative target to replace LPG with electric induction stoves
Eritrea	First NDC 2018	Qualitative target proposed for abating emissions from efficient electric stoves
Ethiopia	First NDC (Updated) 2021	Qualitative target to switch from unsustainable biomass to electric stoves and renewable biofuels
Honduras	First NDC (Updated) 2021	Qualitative target to reduce firewood in homes through substitution with electric and LPG stoves
Mauritania	First NDC (Updated) 2021	Quantifiable target to distribute 10 000 efficient electric stoves by 2030
Nepal	Second NDC 2020	Quantifiable target to ensure 25% of households use electric stoves as their primary mode of cooking by 2030
Togo	First NDC (Updated) 2021	Qualitative target to increase the number of households using improved efficiency biomass stoves, LPG and electricity
Uganda	First NDC (Updated) 2022	Quantifiable target to reach 50% penetration of electric cooking by 2025
United States of America	First NDC 2021[27]	Qualitative target to reducing emissions in buildings through the adoption of induction stoves

[27] *First NDC after re-joining the Paris Agreement.*

Table B4 Countries with electric cooking in their Long-Term Strategies

Country	Document	Link to electric cooking
Australia	Long-Term Strategy 2021	Qualitative target to reduce cooking emissions in the buildings sector through increased efficiency and electrification of cooking
Cambodia	Long-Term Strategy 2021	Qualitative target to create policies that incentivise a switch to electric cooking to reduce emissions
Costa Rica	Long-Term Strategy 2019	Quantifiable target to have 50% of commercial, residential and institutional buildings using electricity or renewable energy in cooking Qualitative target to reduce LPG usage in cooking
Fiji	Long-Term Strategy 2019	Quantifiable target to reduce open-fire and woodstove usage by 2030 by replacing them with electric stoves in urban areas and electric stoves and LPG in rural areas
Hungary	Long-Term Strategy 2021	Qualitative target to reduce emissions in buildings through electric cooking adoption
Marshall Islands	Long-Term Strategy 2018	Qualitative target to convert LPG cooking to electric cooking and explore the use of solar power and time-of-use tariffs to stimulate demand during off-peak hours
Thailand	Long-Term Strategy (Revised) 2022	Qualitative target to electrify end-use technologies and shift cooking from LPG to electricity

Countries that included other forms of cooking in NDC or Long-Term Strategy

Similarly, Table B5 and Table B6 provide details on how countries mentioned other cooking fuels in NDCs and Long-Term Strategies, respectively.

Table B5 Countries with other cooking fuels in their NDCs

Country	Document	Link to cooking
Afghanistan	First NDC 2016	Qualitative target to reduce emissions through clean cookstoves and fuels
Albania	First NDC (Updated) 2021	Quantitative target to reduce non-electric fuel energy consumption for hot water, cooking, lighting, appliances and air conditioning by 17.3% in commercial buildings and 19.3% in domestic buildings through the adoption of natural gas and displacement of LPG
Angola	First NDC (Updated) 2021	Accounting of firewood and charcoal emissions resulting from residential cooking and industrial charcoal production in GHG inventories
Bangladesh	First NDC (Updated) 2021	Qualitative target to develop new national plan for clean cooking for 2020-2030 and build off of prior programme that distributed 4.5 million improved cookstoves
Belize	First NDC (Updated) 2021	Qualitative target to assess potential for emissions reductions related to fuelwood usage

Table B5 Countries with other cooking fuels in their NDCs (continued)

Country	Document	Link to cooking
Benin	First NDC (Updated) 2021	Quantitative target to distribute improved biomass cookstoves to 809 000 households Qualitative target to support the market development of high-performance cooking equipment, including improved biomass stoves and butane stoves
Burundi	First NDC (Updated) 2021	Quantitative targets to increase adoption of improved biomass stoves to 75% in rural areas and 90% in urban areas by 2030 Qualitative targets to promote improved charcoal production, improved charcoal stoves in households, and biogas in schools and facilities
Cabo Verde	First NDC (Updated) 2021	Qualitative target to promote farm biogas units to substitute wood and fossil fuels used in cooking
Cameroon	First NDC (Updated) 2021	Quantitative targets to displace 10% of fuelwood with biogas in farms and households and to distribute 500 000 improved and natural gas stoves
Central African Republic	First NDC (Updated) 2021	Quantitative targets to increase the penetration of improved stoves (10% unconditional target, 50% conditional target), LPG (10% unconditional, 25% conditional) and solar cookers (5% unconditional, 10% conditional) by 2030
Chad	First NDC (Updated) 2021	Quantitative targets to distribute 3 million improved wood stoves and 1.5 million charcoal stoves to improve energy efficiency and 10 000 digesters on farms to reduce fossil fuel emissions
Chile	First NDC (Updated) 2020	Quantitative target to reduce black carbon levels by 25% by 2030 through national air policies covering activities including residential cooking
Colombia	First NDC (Updated) 2021	Quantitative targets to adopt 1 million efficient firewood stoves and transition 30% of urban firewood-using homes to LPG or other fuel 1 million efficient stoves Implement eco-efficient stoves by constructing efficient woodstoves by planting of 10 hectares of wood energy banks
Comoros	First NDC (Updated) 2021	Qualitative target to reduce residential firewood through the adoption of efficient woodburners
Côte d'Ivoire	First NDC (Updated) 2022	Qualitative target to reduce emissions through switching to cleaner fuels for cooking
Djibouti	First NDC 2015	Quantitative target to reduce firewood consumption through replacement of 1 000 systems with LPG
Eswatini	First NDC (Updated) 2021	Quantitative targets to achieve 100% access to clean modern energy for cooking and 50% improved uptake of efficient biomass stoves by 2030
Gambia (the)	Second NDC 2021	Qualitative target to scale-up biogas and improved biomass stoves
Ghana	First NDC (Updated) 2021	Qualitative target to expand the adoption of market-based clean cooking solutions

Table B5 Countries with other cooking fuels in their NDCs (continued)

Country	Document	Link to cooking
Guinea	First NDC (Updated) 2021	Quantitative target to disseminate 1.5 million improved biomass stoves by 2030 Qualitative target to support local renewable biofuel sectors and substitution of biogas for domestic purposes
Guinea-Bissau	First NDC (Updated) 2021	Qualitative target to disseminate improved cooking stoves on a large scale to reduce fuelwood consumption
Guyana	First NDC 2016	Qualitative target to encourage the use of biogas for cooking at the household level
Indonesia	First NDC (Updated) 2021	Qualitative target to construct a natural gas pipeline to substitute kerosene used in residential and commercial cooking
Kiribati	First NDC 2016	Qualitative target to reduce fossil fuel consumption in the energy sector, including LPG and kerosene used for cooking
Kyrgyzstan	First NDC (Updated) 2021	Qualitative target to scale-up energy-efficient stoves in households
Lao PDR	First NDC (Updated) 2021	Quantitative target to reduce the use of non-renewable biomass through the distribution of 50 000 energy-efficient cookstoves
Lesotho	First NDC 2017	Quantitative targets to reach 30% penetration of efficient stoves by 2030 and to replace wood with LPG at a rate of 10% per year from 2020 to 2030
Liberia	First NDC (Updated) 2021	Quantitative target to supply energy-efficient cookstoves to 60% of households cooking with wood and charcoal
Madagascar	First NDC 2016	Quantitative target to reach 50% adoption of improved stoves by 2030
Malawi	First NDC (Updated) 2021	Quantitative target to deploy 2 million high-efficiency charcoal stoves
Mali	First NDC (Updated) 2021	Quantitative target to transition 100% of the population cooking with biomass to cook with improved stoves by 2030
Mozambique	First NDC (Updated) 2021	Quantitative target to triple the number of people cooking with LPG
Niger	First NDC (Updated) 2021	Quantitative target to achieve a 100% penetration rate of improved stoves in urban areas and 30% in rural areas
Nigeria	First NDC (Updated) 2021	Quantitative target to reach 48% adoption of LPG and 13% adoption of improved cookstoves by 2030
Pakistan	First NDC (Updated) 2021	Qualitative target to pilot low-cost, energy-efficient cooking technologies
Papua New Guinea	Second NDC 2020	Comment on the importance of access to electricity and renewable energy to improve the livelihoods of women and youth through improved cooking
Paraguay	First NDC (Updated) 2021	Qualitative target to promote the use of efficient stoves, particularly among vulnerable, rural families that are dependent on biomass
Rwanda	First NDC (Updated) 2020	Quantitative target to reach 80% adoption rates of improved cookstoves in rural areas and 50% in urban areas

Table B5 Countries with other cooking fuels in their NDCs (continued)

Country	Document	Link to cooking
Senegal	First NDC 2020	Quantitative target to distribute improved cookstoves (800 000 per year unconditional, 1.5 million per year conditional) and biodigesters for cooking (27 000 unconditional, 48 000 conditional) by 2030
Seychelles	First NDC (Updated) 2021	Comment on the consumption of biomass for use in cooking in rural and peri-urban areas
Sierra Leone	First NDC (Updated) 2021	Qualitative targets to promote the use of biogas as a substitute for wood and briquettes and to develop capacities to manufacture efficient stoves
Somalia	First NDC (Updated) 2021	Qualitative targets to produce renewable biomass fuel briquettes and promote improved cookstoves, kilns and jikos
Sudan	First NDC 2021	Quantitative targets to supply improved biomass stoves to 300 000 households, substitute biomass and charcoal with LPG in 10% of urban households, and replace woodstoves with improved biomass stoves for 20% of the rural population
Timor-Leste	First NDC (Updated) 2022	Qualitative target to explore the use of efficient cookstoves
Tuvalu	First NDC (Updated) 2022	Comment on the experience of using biogas for cooking
United Republic of Tanzania	First NDC (Updated) 2021	Qualitative targets to regulate charcoal production and use, to reduce the consumption of charcoal by promoting affordable alternative energy sources, and to promote the use of natural gas for cooking
Vanuatu	First NDC (Updated) 2022	Quantitative target to improve the energy efficiency of cooking by 14% through the use improved cookstoves

Table B6 Countries with other cooking fuels in their Long-Term Strategies

Country	Document	Link to cooking
Iceland	Long-Term Strategy 2021	Qualitative target to support bilateral development co-operation through clean cooking initiatives
India	Long-Term Strategy 2022	Quantitative target to expand an LPG cooking fuel programme to an additional 10 million households
Mexico	Long-Term Strategy 2016	Qualitative target to substitute open-fire wood cooking with efficient, low-emission stoves
South Africa	Long-Term Strategy 2020	Qualitative target to support technology innovation and dissemination of energy-efficient cookstove technologies
United Kingdom of Great Britain and Northern Ireland	Long-Term Strategy 2021	Qualitative target to support the use of clean hydrogen fuel-powered appliances for cooking

Access: Progress on access to electricity and electric cooking

Looking at countries' climate commitments and the progress on access to electricity and electric cooking, Table B7 shows the list of countries with electric cooking in their NDCs and Long-Term Strategies while Table B8 shows countries with other cooking fuels in their NDCs and Long-Term Strategies.

Table B7 Countries with electric cooking in their NDCs and Long-Term Strategies

Group	State	Access to electricity (%)	Access to electric cooking (%)	Population (millions)
A1 (6)	Bhutan	100.0	73.7	0.8
	China	100.0	31.4	1 411.1
	Costa Rica	99.9	46.2	5.1
	Cuba	99.9	52.1	11.3
	Fiji	97.1	13.1	0.9
	Marshall Islands	98.3	7.55	0.04
A2 (3)	Dominica	100.0	0.4	0.1
	Ecuador	98.9	2	17.6
	Thailand	100.0	4.5	71.5
A3 (8)	Cambodia	86.4	2.2	16.4
	Congo	48.7	0.5	5.7
	Democratic Republic of the Congo	20.1	2.9	92.9
	Eritrea	51.4	0.1	3.6
	Mauritania	45.4	1.7	4.5
	Nepal	89.9	0.3	29.3
	Togo	55.7	0.3	8.4
	Uganda	45.2	0.3	44.4
A4 (2)	Ethiopia	51.1	6.3	117.2
	Honduras	93.1	14.8	10.1
N/A (3)	Australia	100	N/A	25.7
	Hungary	100	N/A	9.8
	United States of America	100	N/A	331.5

Table B8 Countries with other forms of clean cooking in their NDCs or Long-Term Strategies

Group	State	Access to electricity (%)	Access to electric cooking (%)	Population (millions)
A1 (4)	Albania	100.0	19.6	2.8
	Kyrgyzstan	99.9	54.7	6.6
	Paraguay	100.0	17.1	6.6
	Timor-Leste	100.0	11.7	1.3
A2 (5)	Afghanistan	97.7	0.2	39.0
	Colombia	99.7	2.1	50.9
	Lao PDR	99.3	2.7	7.3
	Mexico	99.4	1.2	126.0
	Tuvalu	99.7	0.9	0.01
A3 (35)	Angola	47.0	1.9	33.4
	Bangladesh	96.2	0.5	167.4
	Belize	96.8	3.3	0.4
	Benin	41.0	0.2	12.6
	Burundi	9.1	0	12.2
	Cabo Verde	93.7	0.4	0.6
	Cameroon	64.3	0.3	26.5
	Central African Republic	15.4	0	5.3
	Chad	10.9	0	16.6
	Comoros	85.6	0.7	0.8
	Côte d'Ivoire	69.9	0.7	26.8
	Djibouti	64.5	0.2	1.1
	Gambia (the)	62.2	0	2.6
	Ghana	85.4	0.3	32.2
	Guinea	44.7	0.5	13.2
	Guinea-Bissau	33.4	0	2.0
	Guyana	92.3	2.2	0.8
	India	96.5	0.2	1396.4
	Indonesia	97.0	0.1	271.9
	Kiribati	91.0	1.8	0.1
	Liberia	27.6	0.1	5.1

Table B8 Countries with other forms of clean cooking in their NDCs or Long-Term Strategies (continued)

Group	State	Access to electricity (%)	Access to electric cooking (%)	Population (millions)
A3 (35)	Madagascar	32.0	0.5	28.2
	Malawi	11.5	1.5	19.4
	Mali	50.6	0.2	21.2
	Mozambique	31.5	1.5	31.2
	Niger	18.6	0.2	24.3
	Nigeria	59.5	0.9	208.3
	Pakistan	94.9	0.1	227.2
	Rwanda	48.7	0.1	13.1
	Senegal	68.0	1.2	16.4
	Sierra Leone	27.5	0.1	8.2
	Somalia	49.3	0.5	16.5
	Sudan	61.8	0.6	44.4
	United Republic of Tanzania	42.7	0.2	61.7
	Vanuatu	70.0	0.4	0.3
A4 (4)	Eswatini	80.0	47.3	1.2
	Lesotho	47.5	17.1	2.3
	Papua New Guinea	20.9	6.4	9.7
	South Africa	89.3	82.6	58.8
N/A (4)	Chile	100.0	N/A	19.3
	Iceland	100.0	N/A	0.4
	Seychelles	100.0	N/A	0.1
	United Kingdom of Great Britain and Northern Ireland	100.0	N/A	67.1

Market: Market potential for electric cooking

Looking at countries' climate commitments and the market potential for electric cooking, Table B9 shows the list of countries with electric cooking in their NDCs and Long-Term Strategies while Table B10 shows those with other cooking fuels.

Table B9 Countries with electric cooking in their NDCs and Long-Term Strategies

Group	Country	Price of electricity (USD/kWh)	Market size (thousands of HHs)	Growth potential (thousands of HHs)
M1 (2)	China	14.6	254.7	3 164
	Thailand	13.7	16.6	160
M2 (1)	Ethiopia	3.6	9 061	10 534
M3 (13)	Cambodia	18.2	2 510	465
	Congo	8.1	482	545
	Costa Rica	14.4	611	15
	Democratic Republic of the Congo	10	2 311	11 325
	Dominica	36.8	16	0
	Ecuador	11.9	3 703	109
	Fiji	21.8	155	9
	Honduras	20.8	1 390	161
	Marshall Islands	40.6	8	0
	Mauritania	17.6	266	352
	Nepal	12	4 696	637
	Togo	17.6	688	590
	Uganda	16.9	3 217	4 190
M4 (1)	Bhutan	5.9	41	2
N/A (5)	Australia	20.4	N/A	N/A
	Cuba	N/A	1175	25
	Eritrea	N/A	278	279
	Hungary	18.0	N/A	N/A
	United States of America	18.1	N/A	N/A

Note: HH = household.

Table B10 Countries with cooking in their NDCs or Long-Term Strategies

Group	Country	Price of electricity (USD/kWh)	Market size (thousands of HHs)	Growth potential (thousands of HHs)
M2 (7)	Bangladesh	9.7	29 671	1 738
	Colombia	19.9	10 809	191
	India	18.2	231 848	12 416
	Indonesia	10.9	56 020	2 727
	Mexico	16.5	25 251	555
	Nigeria	11.9	15 855	11 971
	Pakistan	21.7	25 345	2 105
M3 (36)	Afghanistan	18	3 877	235
	Albania	9.4	496	6
	Belize	22.6	71	4
	Benin	20.7	579	891
	Burundi	17.3	185	1 924
	Cabo Verde	26.3	83	7
	Cameroon	17	2 494	1 529
	Central African Republic	10.5	127	730
	Chad	21.2	229	1 970
	Comoros	28.1	99	20
	Côte d'Ivoire	12.6	2 768	1 342
	Djibouti	26.2	107	63
	Eswatini	16.5	59	40
	Gambia (the)	20.2	116	77
	Ghana	23.6	4 151	847
	Guinea	20.3	730	970
	Guinea-Bissau	27.3	69	144
	Guyana	32.8	144	16
	Kiribati	41.3	23	3
	Kyrgyzstan	3.6	550	31
	Lao PDR	13.2	1 263	38
	Lesotho	13.9	122	222
	Liberia	39	205	566

Table B10 Countries with cooking in their NDCs or Long-Term Strategies (continued)

Group	Country	Price of electricity (USD/kWh)	Market size (thousands of HHs)	Growth potential (thousands of HHs)
M3 (36)	Madagascar	11.3	1 646	3 718
	Malawi	17.2	352	3 235
	Mali	14.2	850	902
	Mozambique	9.6	1 612	3 881
	Niger	21.3	581	2 716
	Papua New Guinea	28.9	199	1 122
	Rwanda	13.7	1 183	1 323
	Senegal	18.2	813	430
	Sierra Leone	18	358	989
	South Africa	16.1	758	1 440
	Timor-Leste	23.4	171	5
	United Republic of Tanzania	12.6	4 008	5 739
	Vanuatu	38.2	43	21
M4 (3)	Angola	3.7	2 353	2 976
	Paraguay	6.6	1 120	28
	Sudan	2.4	4 150	2 826
N/A (6)	Chile	10.2	N/A	N/A
	Iceland	12.2	N/A	N/A
	Seychelles	32.1	N/A	N/A
	Somalia	N/A	1 077	1 214
	Tuvalu	N/A	2	0.1
	United Kingdom of Great Britain and Northern Ireland	17.7	N/A	N/A

Note: HH = household.

APPENDIX C: COUNTRY PROFILES ON ELECTRIC COOKING

Table C1 List of countries profiled

Untapped (19 countries)	Primed (11 countries)	Maturing (8 countries)
Algeria	Cambodia	Bhutan
Argentina	Congo	China
Bangladesh	Democratic Republic of the Congo	Costa Rica
Brazil	Dominica	Cuba
Colombia	Ecuador	Ethiopia
Egypt	Eritrea	Fiji
India	Mauritania	Honduras
Indonesia	Nepal	Marshall Islands
Islamic Republic of Iran	Thailand	
Iraq	Togo	
Kenya	Uganda	
Malaysia		
Mexico		
Nigeria		
Pakistan		
Peru		
Philippines		
Türkiye		
Uzbekistan		

Table C2 Sources for country profiles

Field	Source
Population (2020)	World Bank (2023d)
Access to electricity (%) (2020)	IEA *et al.* (2023)
Access to clean cooking (%) (2020)	WHO (2023a)
Access to electric cooking (%) (2020)	WHO (2023b)
Households using LPG (%) (2020)	WHO (2023b)
GNI per capita (2020)	World Bank (2023c)
Price of electricity (USD/kWh) (2020)	World Bank (2021)
Total market size (HHs) (2020)	Calculated from IEA *et al.* (2023); Pew Research Center (2019); WHO (2023b); World Bank (2023d)
Market growth potential (HHs) (2020)	Calculated from IEA *et al.* (2023); Pew Research Center (2019); World Bank (2023a); World Bank (2023d)
Renewable energy generation (%) (2022)	IRENA (2023b)

Note: HH = household.

ALGERIA

Summary of electric cooking status

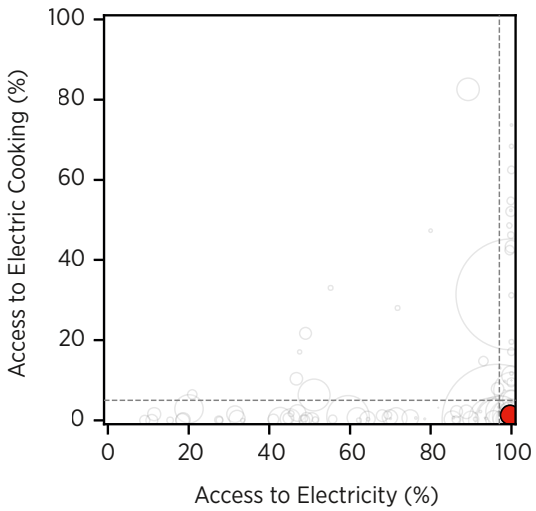
Algeria has high rates of access to electricity, access to clean cooking and proportion of households cooking with LPG. It is a large market with affordable electricity. Few households cook with electricity, and the percentage of energy generation that is renewable is low. Algeria's NDC from 2015 did not include cooking, but did include a target to have 27% of electricity be produced from renewable sources.

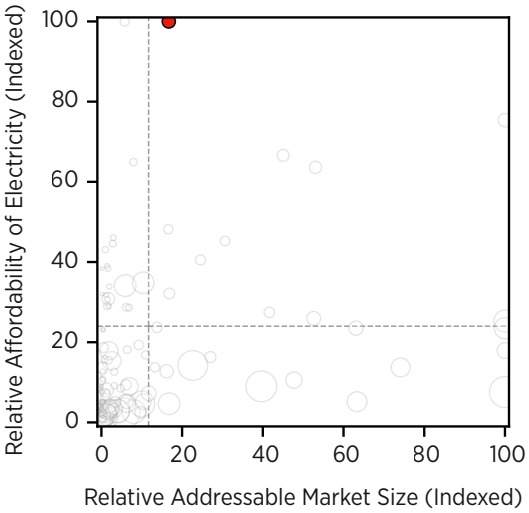
Algeria's renewable energy targets

- Quantitative target to have 27% of electricity derived from renewable sources

  First NDC, 2015

Profile





Population	**43 451 666**	GNI per capita	**11 210**
Access to electricity (%)	**99.7%**	Price of electricity (USD/kWh)	**2.1**
Access to clean cooking (%)	**99.7%**	Total market size (HHs)	**6 681 968**
Access to electric cooking (%)	**1.3%**	Market growth potential (HHs)	**171 385**
Households using LPG (%)	**97.4%**	Renewable energy (%)	**1.1%**

Candidate group: *Untapped*

Recommended support

- Enhance NDC or future national plans to include renewable energy and electric cooking targets.
- Provide technical capacity building on renewable energy solutions.
- Enhance long-term energy planning with considerations for transitioning to electric cooking.

ARGENTINA

Summary of electric cooking status

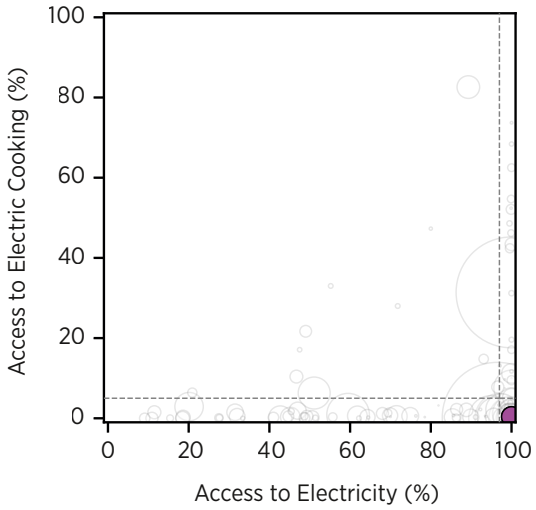
Argentina has achieved full access to electricity and access to clean cooking, but has below-average rates of electric cooking, with most households relying on LPG. Argentina has an above-average market size for electric cooking and above-average affordability of electricity. Just over 26% of Argentina's electricity is generated from renewable sources. Argentina's NDC does not include cooking-related targets but does expand its ambitions for emission reduction.

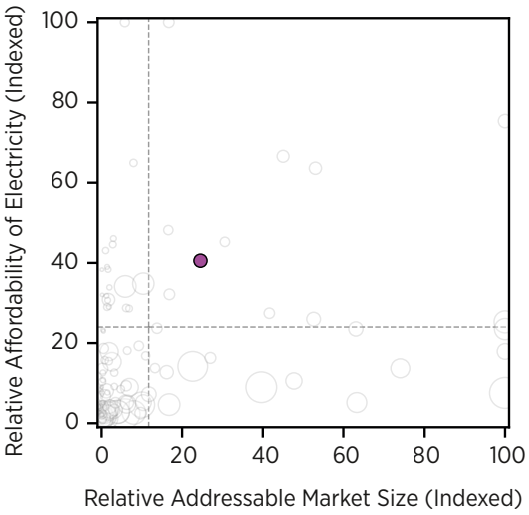
Argentina's emissions targets

- Quantitative target to reduce emission reductions by an additional 2 percentage points, equivalent to a 27.7% increase in emission reduction compared to the first NDC

  Updated NDC, 2021

Profile





Population	**45 376 763**	GNI per capita	**20 220**
Access to electricity (%)	**100.0%**	Price of electricity (USD/kWh)	**10.8**
Access to clean cooking (%)	**99.9%**	Total market size (HHs)	**9 825 056**
Access to electric cooking (%)	**0.4%**	Market growth potential (HHs)	**139 336**
Households using LPG (%)	**98.7%**	Renewable energy (%)	**26.5%**

Candidate group: *Untapped*

Recommended support

- Enhance NDC or other national plan to include renewable energy and electric cooking targets.
- Develop policies, programmes and incentives for electric cooking promotion.
- Devise plans to increase renewable energy supply.

BANGLADESH

Summary of electric cooking status

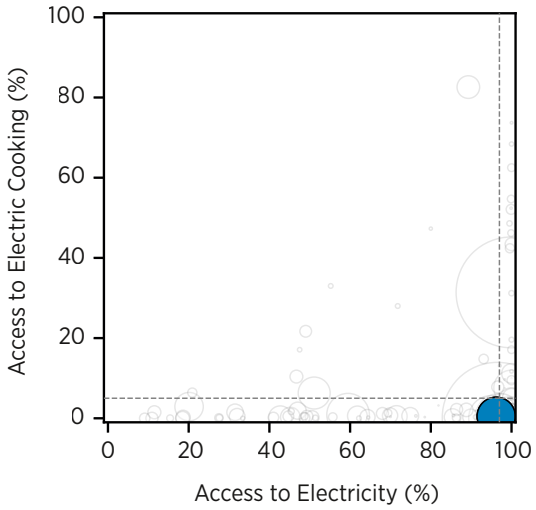
Bangladesh has high rates of access to electric cooking but below-average rates of access to clean cooking, with the majority of clean cooking households relying on LPG. Bangladesh has below-average affordability of electricity but a large potential market for electric cooking adoption. A small percentage of Bangladesh's electricity is generated from renewable sources. Bangladesh's NDC did not include electric cooking targets but did discuss policies that have promoted the adoption of electric cooking appliances.

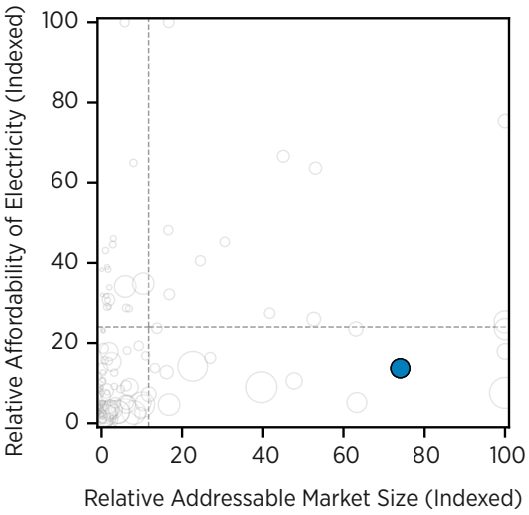
Bangladesh's clean cooking targets

- Qualitative target to develop a new national plan for clean cooking for 2020-2030 and build off of prior programme that distributed 4.5 million improved cookstoves

  Updated First NDC, 2021

Profile





Population	**167 420 951**	GNI per capita	**6 140**
Access to electricity (%)	**96.2%**	Price of electricity (USD/kWh)	**9.7**
Access to clean cooking (%)	**25.0%**	Total market size (HHs)	**29 670 713**
Access to electric cooking (%)	**0.5%**	Market growth potential (HHs)	**1 737 860**
Households using LPG (%)	**24.1%**	Renewable energy (%)	**1.5%**

Candidate group: *Untapped*

Recommended support

- Include targets and measures in NDC.
- Assess the scale-up of renewable energy and associated technologies, including electric cooking.
- Develop supportive policies and financial incentives.

BHUTAN

Summary of electric cooking status

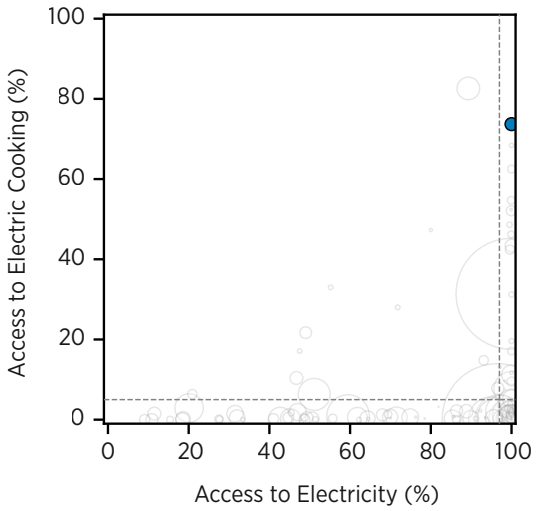
Bhutan has a high rate of access to electricity and has above-average affordability of electricity. It has a very high rate of access to electric cooking, but 14% of its population lacks access to clean cooking. Bhutan's electricity generation is fully renewable. In its second NDC, Bhutan targeted an increased adoption of electric cooking and a roll-out of rooftop solar.

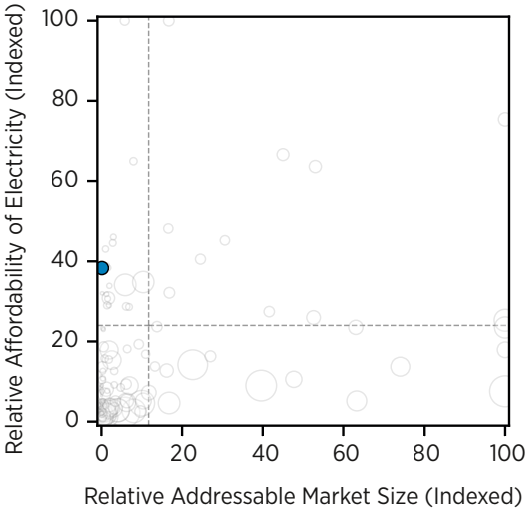
Bhutan's electric cooking targets

- Qualitative target to replace LPG and firewood with electric cooking between 2020-2030

  Second NDC, 2021

Profile





Population	**772 506**	GNI per capita	**10 440**
Access to electricity (%)	**100.0%**	Price of electricity (USD/kWh)	**5.9**
Access to clean cooking (%)	**86.0%**	Total market size (HHs)	**40 634**
Access to electric cooking (%)	**73.7%**	Market growth potential (HHs)	**1 954**
Households using LPG (%)	**7.6%**	Renewable energy (%)	**100.0%**

Candidate group: *Mature*

Recommended support

- Develop project pipelines.
- Conduct long-term energy sector planning with considerations for transitioning to electric cooking.
- Assess the effects of renewable energy and electric cooking on the grid.

BRAZIL

Summary of electric cooking status

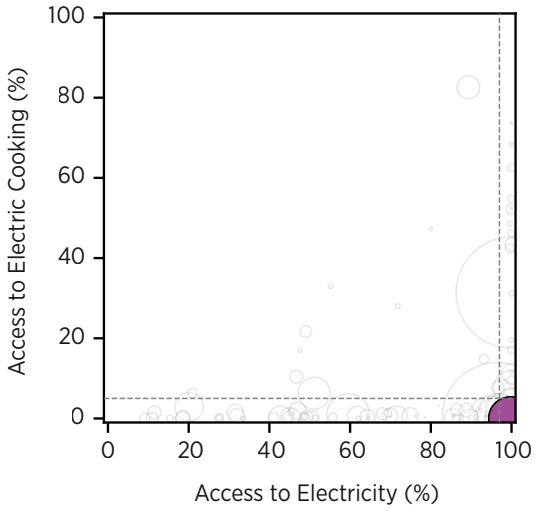
Brazil has fully achieved access to electricity and has high rates of access to clean cooking, with the majority of households relying on LPG. Brazil has below-average affordability of electricity but a large potential market for electric cooking. Just over 83% of Brazil's electricity is generated from renewable sources. Brazil's NDC did not include considerations for cooking but did note the diversification of energy sources as one of its intended adaptation measures.

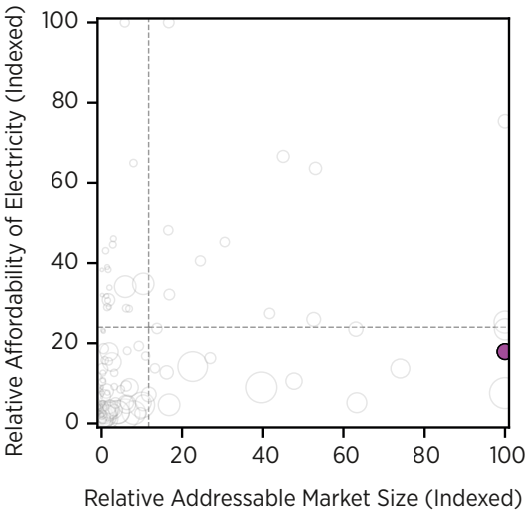
Brazil's renewable energy targets

- Qualitative target to diversify energy sources

  Updated First NDC, 2022

Profile





Population	**213 196 304**	GNI per capita	**14 480**
Access to electricity (%)	**99.7%**	Price of electricity (USD/kWh)	**17.5**
Access to clean cooking (%)	**96.4%**	Total market size (HHs)	**50 610 119**
Access to electric cooking (%)	**0.0%**	Market growth potential (HHs)	**814 759**
Households using LPG (%)	**95.9%**	Renewable energy (%)	**83.2%**

Candidate group: *Untapped*

Recommended support

- Enhance NDC or other national plan to include clean and electric cooking targets.
- Enhance enabling environment for the promotion of electric cooking technologies.
- Assess the potential of renewable energy in different sectors, including electric cooking.
- Assess the effects of renewable energy and electric cooking on the grid.

CAMBODIA

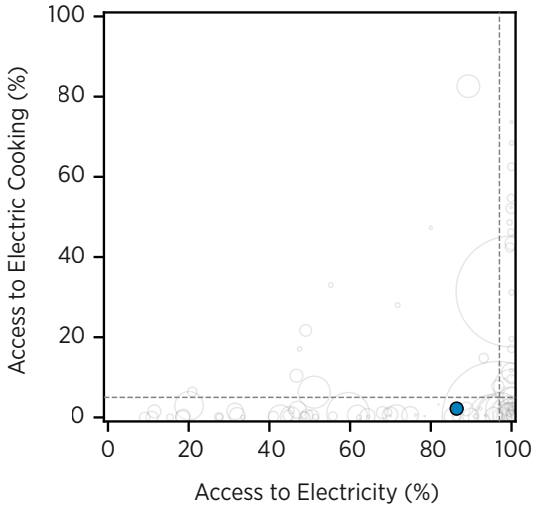
Summary of electric cooking status

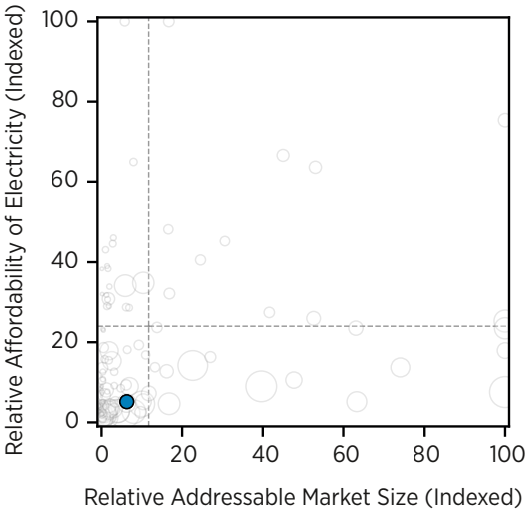
Cambodia has below-average rates of access to electricity and clean cooking, with the majority of clean cooking households using LPG. It has below-average affordability of electricity and a slightly below-average market size for electric cooking. Approximately half of Cambodia's electricity generation is from renewable sources. Cambodia noted the role of electric cooking in its Long-Term Strategy but not on its NDC.

Cambodia's electric cooking targets

- Qualitative target to create policies that incentivise a switch to electric cooking to reduce emissions
  Long-term Strategy, 2021

Profile





Population	**16 396 860**	GNI per capita	**4 330**
Access to electricity (%)	**86.4%**	Price of electricity (USD/kWh)	**18.2**
Access to clean cooking (%)	**39.3%**	Total market size (HHs)	**2 510 210**
Access to electric cooking (%)	**2.2%**	Market growth potential (HHs)	**464 624**
Households using LPG (%)	**36.6%**	Renewable energy (%)	**49.4%**

Candidate group: *Primed*

Recommended support

- Enhance NDC or other national plan to include renewable energy and electric cooking targets.
- Develop and finance projects for the promotion of electric cooking.
- Enhance long-term energy planning with considerations for transitioning to electric cooking and increasing access to electricity.

CHINA

Summary of electric cooking status

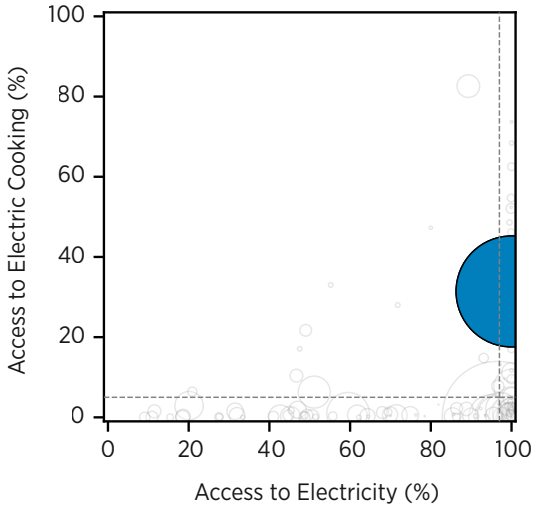
China has achieved 100% access to electricity and has a substantial percentage of households that cook with electricity. It has a large potential market size with strong growth potential and average affordability of electricity. More than a quarter of China's electricity comes from renewable sources. China's NDC includes targets for decreasing residential emissions through measures such as rooftop solar and the adoption of electric cooking.

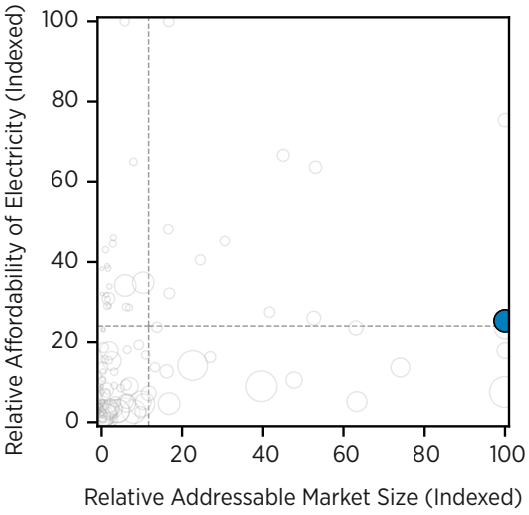
China's electric cooking targets

- Qualitative target to increase the penetration rate of electric cooking

  Updated First NDC, 2021

Profile





Population	**1 411 100 000**	GNI per capita	**17 050**
Access to electricity (%)	**100.0%**	Price of electricity (USD/kWh)	**14.6**
Access to clean cooking (%)	**81.4%**	Total market size (HHs)	**254 740 684**
Access to electric cooking (%)	**31.4%**	Market growth potential (HHs)	**3 163 835**
Households using LPG (%)	**48.6%**	Renewable energy (%)	**27.6%**

Candidate group: *Mature*

Recommended support

- Build capacity for renewable energy solution implementation with considerations for the impact of electric cooking on the electrical grid.
- Assess the potential of renewable energy in different sectors, including electric cooking.
- Develop long-term energy plans that increase the percentage of renewables in the energy mix and the adoption of electric cooking technologies.

COLOMBIA

Summary of electric cooking status

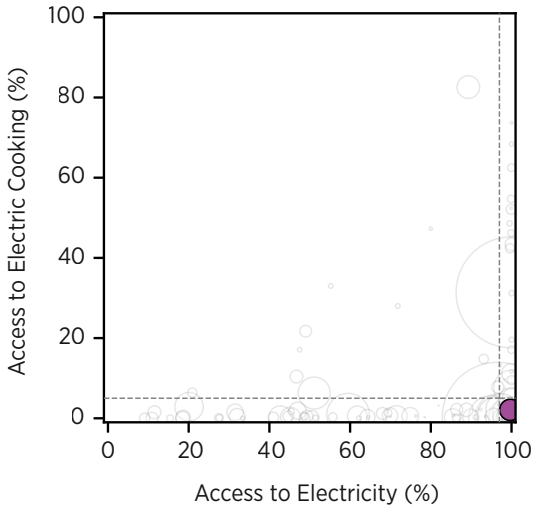
Colombia has fully achieved access to electricity and has high access to clean cooking, with most clean cooking households relying on LPG. It has an above-average market size for electric cooking and below-average affordability of electricity. A total of 65% of Colombia's electricity is generated from renewable sources. Colombia's NDC did not include electric cooking targets but did include targets for replacing inefficient woodstoves.

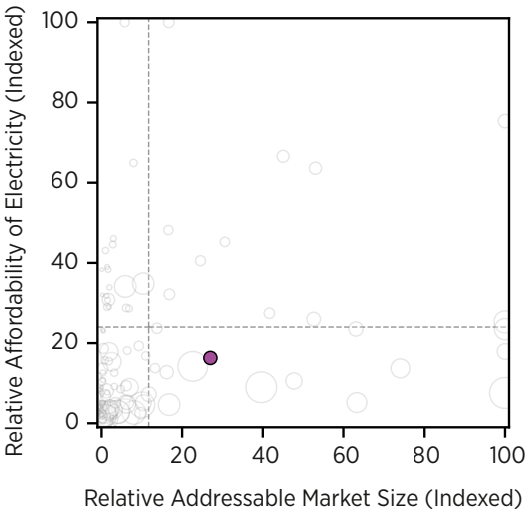
Colombia's electric cooking targets

- Quantitative targets to adopt 1 million efficient firewood stoves and transition 30% of urban firewood-using homes to LPG or other fuels

  First NDC (Updated), 2021

Profile





Population	**50 930 662**	GNI per capita	**14 980**
Access to electricity (%)	**99.7%**	Price of electricity (USD/kWh)	**19.9**
Access to clean cooking (%)	**92.8%**	Total market size (HHs)	**10 808 567**
Access to electric cooking (%)	**2.1%**	Market growth potential (HHs)	**190 629**
Households using LPG (%)	**90.3%**	Renewable energy (%)	**65.0%**

Candidate group: *Untapped*

Recommended support

- Enhance NDC or other national plan to include renewable energy and electric cooking targets.
- Develop an enabling environment for renewables and electric cooking technologies.
- Assess the potential of renewable energy in different sectors, including electric cooking.
- Develop long-term energy plans that increase the percentage of renewables in the energy mix and the adoption of electric cooking technologies.

CONGO

Summary of electric cooking status

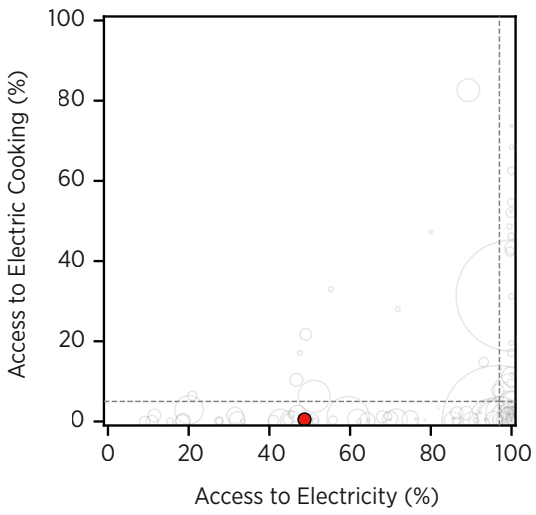
Congo has below-average access to electricity and access to clean cooking, with most clean cooking households using LPG. Congo has below-average affordability of electricity and present-day market potential. Just over 40% of Congo's electricity comes from renewable energy sources. In its NDC, Congo has targets to increase access to electric cooking appliances, as well as targets for increasing access to efficient wood and efficient charcoal stoves.

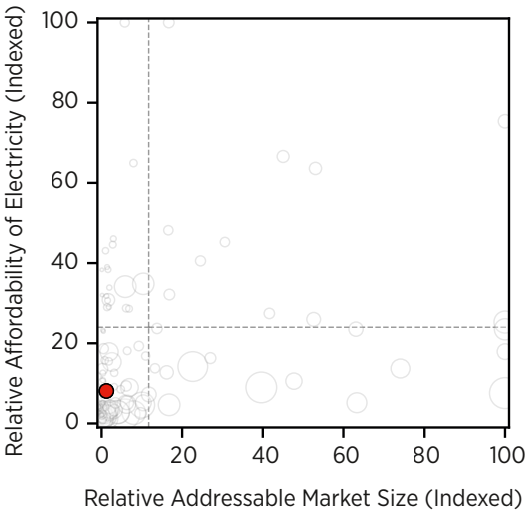
Congo's electric cooking targets

- Quantifiable target to deploy 75 000 electric stoves by 2025 and 100 000 by 2030

  First NDC (Updated), 2021

Profile





Population	**5 702 174**	GNI per capita	**3 030**
Access to electricity (%)	**48.7%**	Price of electricity (USD/kWh)	**8.1**
Access to clean cooking (%)	**34.1%**	Total market size (HHs)	**481 975**
Access to electric cooking (%)	**0.5%**	Market growth potential (HHs)	**544 571**
Households using LPG (%)	**32.9%**	Renewable energy (%)	**40.7%**

Candidate group: *Primed*

Recommended support

- Develop policy instruments and financial incentives that support increased access to electricity and access to electric cooking.
- Enhance the monitoring of clean cooking projects included in the NDC.
- Assess the potential of renewable energy in different sectors, including electric cooking.
- Support, develop and finance projects to deploy electric cookstoves and increase access to electricity.

COSTA RICA

Summary of electric cooking status

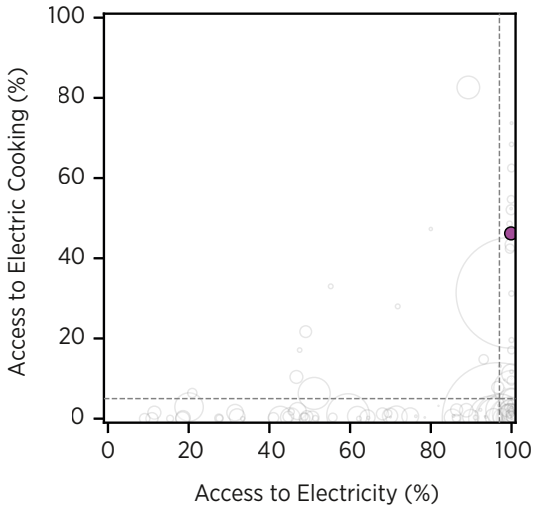
Costa Rica has high rates of access to electricity and access to clean cooking, with approximately half of clean cooking households cooking with electricity and the other half using LPG. Costa Rica has average affordability of electricity but below-average market potential. Nearly all of Costa Rica's electricity is generated from renewable sources. In its Long-Term Strategy, Costa Rica targets increased use of electricity and a reduction in the use of LPG in cooking.

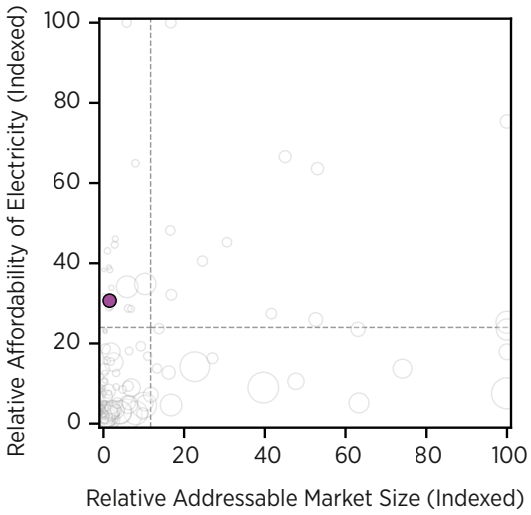
Costa Rica's electric cooking targets

- Quantifiable target to have 50% of commercial, residential and institutional buildings using electricity or renewable energy in cooking
- Qualitative target to reduce LPG usage in cooking

  Long-Term Strategy, 2019

Profile





Population	**5 123 105**	GNI per capita	**20 390**
Access to electricity (%)	**99.9%**	Price of electricity (USD/kWh)	**14.4**
Access to clean cooking (%)	**95.7%**	Total market size (HHs)	**611 357**
Access to electric cooking (%)	**46.2%**	Market growth potential (HHs)	**14 973**
Households using LPG (%)	**48.9%**	Renewable energy (%)	**99.8%**

Candidate group: *Mature*

Recommended support

- Enhance policies and financial instruments for reducing emissions from buildings and the use of carbonising technologies.
- Assess the potential of renewable energy in different sectors, including electric cooking.
- Assess the effects of renewable energy and electric cooking on the grid.

CUBA

Summary of electric cooking status

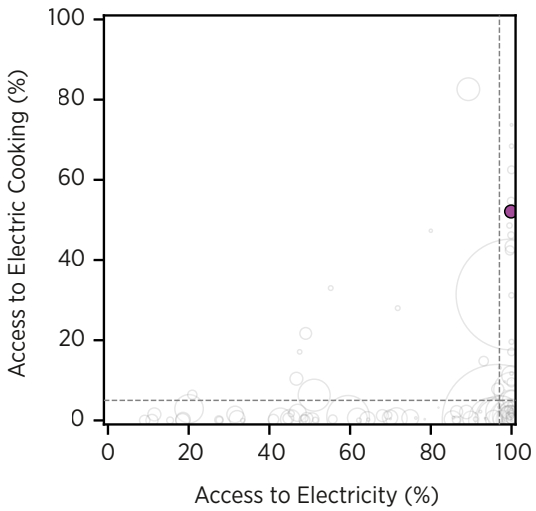
Cuba has high rates of access to electricity and access to electric cooking, with more households cooking with electricity than LPG. Cuba has a low percentage of its electricity generated by renewable sources. Its NDC includes a target for replacing inefficient electric cooking appliances with more efficient devices.

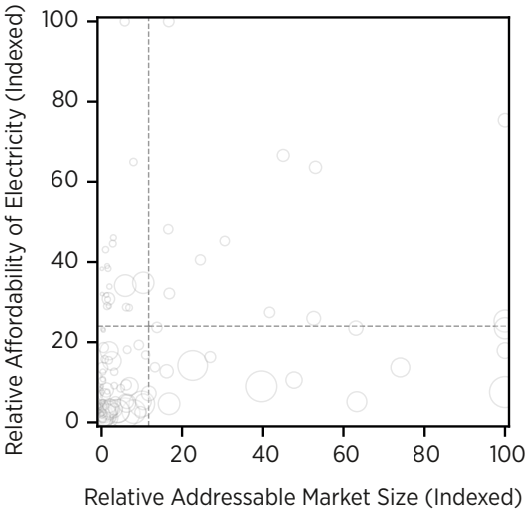
Cuba's electric cooking targets

- Quantifiable target to replace 2 million resistance-driven electric cookers with energy-efficient induction cookers

  First NDC (Updated), 2020

Profile





Population	**11 300 698**	GNI per capita	**N/A**
Access to electricity (%)	**99.9%**	Price of electricity (USD/kWh)	**N/A**
Access to clean cooking (%)	**94.3%**	Total market size (HHs)	**1 175 092**
Access to electric cooking (%)	**52.1%**	Market growth potential (HHs)	**24 610**
Households using LPG (%)	**39.1%**	Renewable energy (%)	**4.8%**

Candidate group: *Mature*

Recommended support

- Develop and finance projects for increasing energy efficiency and penetration of electric cooking appliances.
- Assess the overall readiness for scaling up renewables with considerations for the energy demands of electric cooking.
- Develop long-term plans for increasing the proportion of electricity generated by renewables.

DEMOCRATIC REPUBLIC OF THE CONGO

Summary of electric cooking status

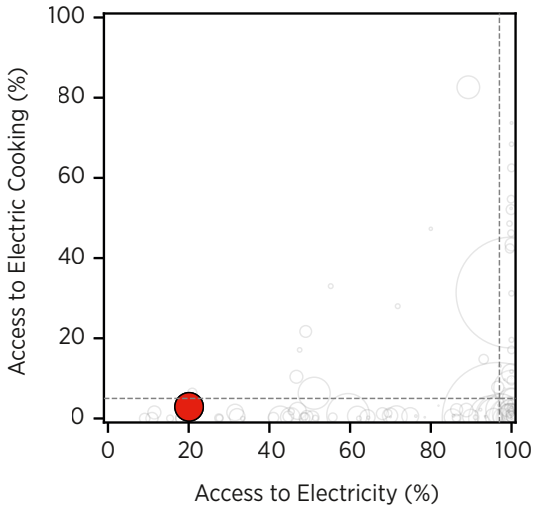
The Democratic Republic of the Congo has low rates of access to electricity and access to clean cooking. It has below-average affordability of electricity and market potential due to low rates of electrification, but has high market growth potential. Nearly all of DR Congo's electricity is generated from renewable sources. In its NDC, DR Congo includes a target to develop a national energy framework to increase access to clean and electric cooking and increase the use of renewables.

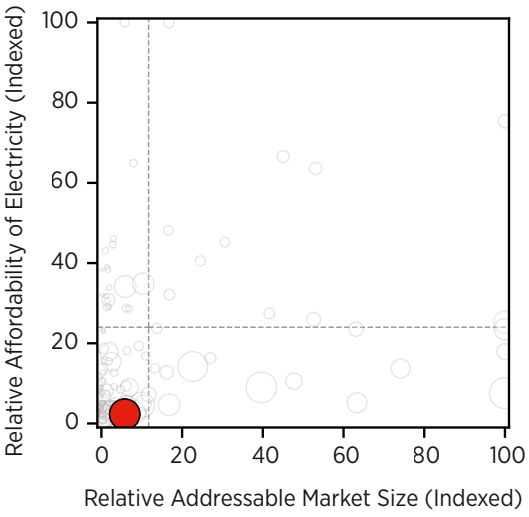
DR Congo's electric cooking targets

- Qualitative target to promote LPG and electric cooking by 2030

  First NDC (Updated), 2021

Profile





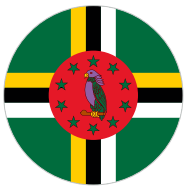
Population	**92 853 164**	GNI per capita	**1 070**
Access to electricity (%)	**20.1%**	Price of electricity (USD/kWh)	**10.0**
Access to clean cooking (%)	**4.3%**	Total market size (HHs)	**2 311 072**
Access to electric cooking (%)	**2.9%**	Market growth potential (HHs)	**11 325 034**
Households using LPG (%)	**0.4%**	Renewable energy (%)	**99.1%**

Candidate group: *Primed*

Recommended support

- Develop a national energy framework that promotes renewable energy and electric cooking.
- Develop project concepts and facilitate finance for the promotion of electric cooking and access to electricity.
- Develop long-term plans for increasing access to electricity alongside access to electric cooking.

DOMINICA



Summary of electric cooking status

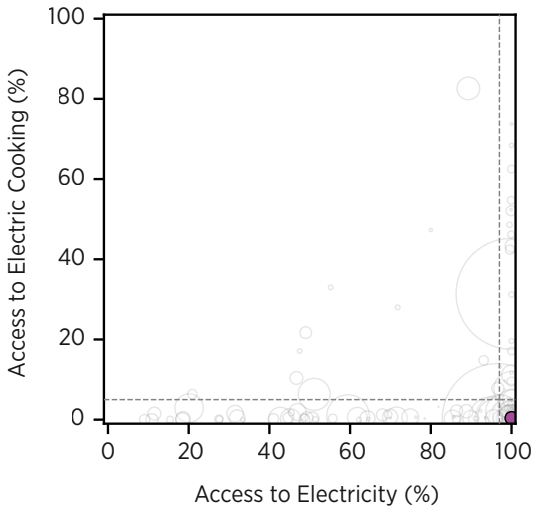
Dominica has high rates of access to electricity and clean cooking, the majority of which is done with LPG. It has below-average affordability of electricity and a small overall market. Just over 20% of Dominica's electricity is generated with renewable sources. Dominica's NDC includes targets to increase the use of renewable energy sources and to increase food preparation from renewable electricity.

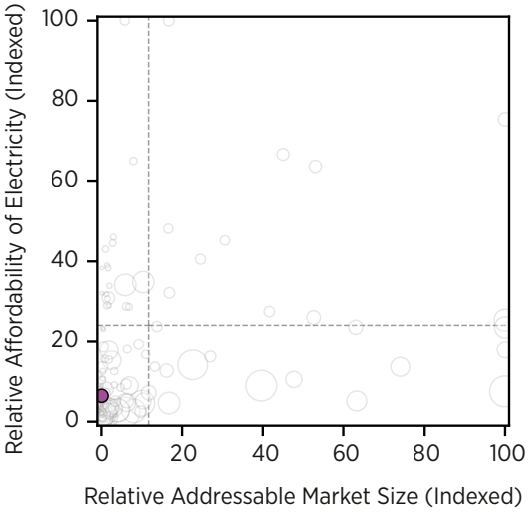
Dominica's electric cooking targets

- Qualitative target to encourage electricity usage in food preparation

  First NDC, 2022

Profile





Population	**71 995**	GNI per capita	**10 970**
Access to electricity (%)	**100.0%**	Price of electricity (USD/kWh)	**36.8**
Access to clean cooking (%)	**89.5%**	Total market size (HHs)	**15 588**
Access to electric cooking (%)	**0.4%**	Market growth potential (HHs)	**209**
Households using LPG (%)	**86.6%**	Renewable energy (%)	**20.4%**

Candidate group: *Primed*

Recommended support

- Develop policy frameworks to promote the use of renewable energy and electric cooking technologies.
- Develop project concepts and facilitate finance for the promotion of electric cooking.
- Assess the potential for renewable energy to be used in different sectors, including cooking.
- Develop long-term plans for increasing the percentage of renewable energy in the electricity mix and reducing reliance on LPG for cooking.

ECUADOR

Summary of electric cooking status

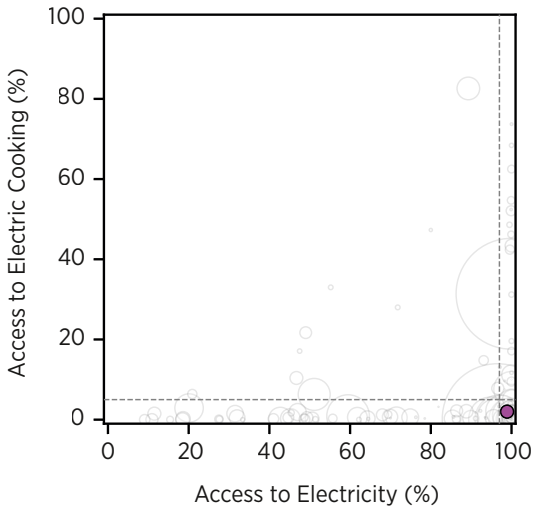
Ecuador has high rates of access to electricity, access to clean cooking and households cooking with LPG. It has slightly below-average affordability and an average market size for electric cooking. Nearly 80% of Ecuador's electricity is generated from renewable sources. In its NDC, Ecuador targeted replacing LPG cooking with electric cooking and increasing renewable energy from wind, solar and biogas.

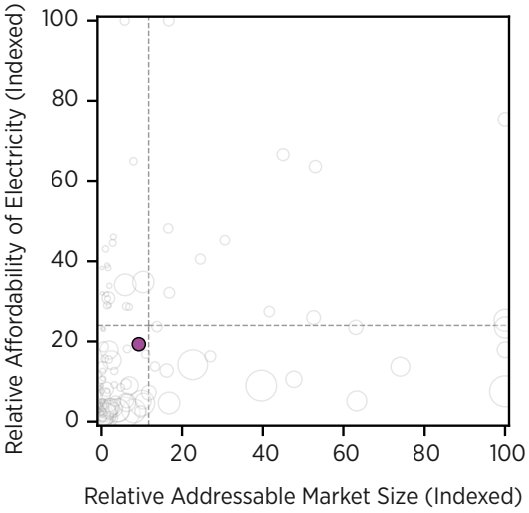
Ecuador's electric cooking targets

- Qualitative target to replace LPG with electric induction stoves

  First NDC, 2019

Profile





Population	**17 588,595**	GNI per capita	**10 610**
Access to electricity (%)	**98.9%**	Price of electricity (USD/kWh)	**11.9**
Access to clean cooking (%)	**94.6%**	Total market size (HHs)	**3 703 164**
Access to electric cooking (%)	**2.0%**	Market growth potential (HHs)	**109 114**
Households using LPG (%)	**91.8%**	Renewable energy (%)	**79.7%**

Candidate group: *Primed*

Recommended support

- Develop policy frameworks to promote the use of electric cooking over LPG.
- Develop and finance projects that promote the replacement of LPG with electric cooking technologies.
- Develop long-term plans that promote the generation of electricity from renewable energy sources and the use of renewable electricity for cooking.

EGYPT

Summary of electric cooking status

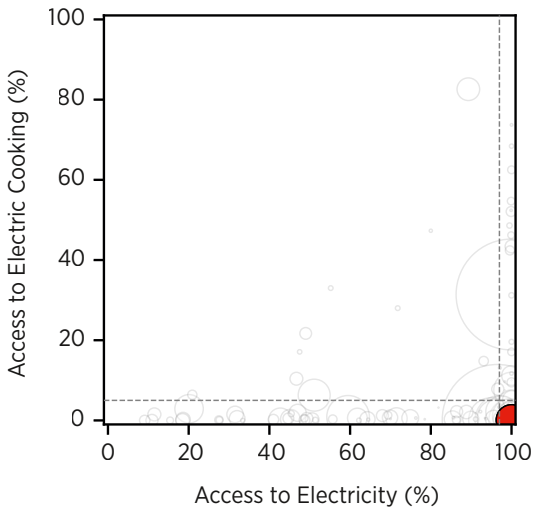
Egypt has high rates of access to electricity and clean cooking, with nearly all households cooking with LPG. Egypt has average affordability of electricity and an above-average market size for electric cooking. Just over 12% of Egypt's electricity is generated from renewable sources. Egypt's NDC does not include a target for electric cooking but does include targets for increasing the use of renewables.

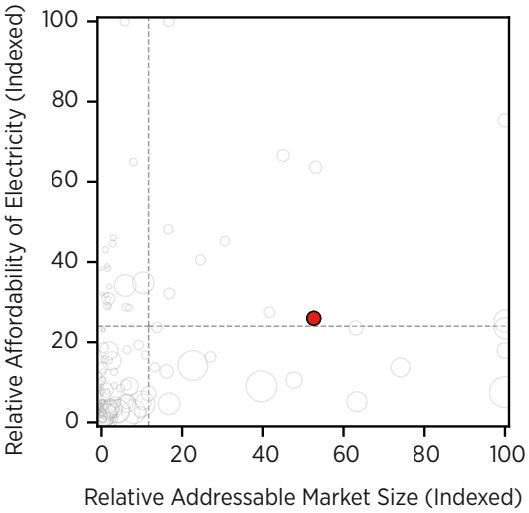
Egypt's renewable energy targets

- Qualitative target to promote renewable energy and energy efficiency

  Updated NDC, 2022

Profile





Population	**107 465 134**	GNI per capita	**11 630**
Access to electricity (%)	**100.0%**	Price of electricity (USD/kWh)	**9.7**
Access to clean cooking (%)	**99.9%**	Total market size (HHs)	**21 050 523**
Access to electric cooking (%)	**0.1%**	Market growth potential (HHs)	**485 721**
Households using LPG (%)	**99.3%**	Renewable energy (%)	**12.1%**

Candidate group: *Untapped*

Recommended support

- Enhance NDC or other national plan to include renewable energy and electric cooking targets.
- Assess the overall readiness for scaling up renewables with considerations for the energy demands of electric cooking.
- Enhance policies for reducing emissions and promoting the use of renewable energy.

ERITREA

Summary of electric cooking status

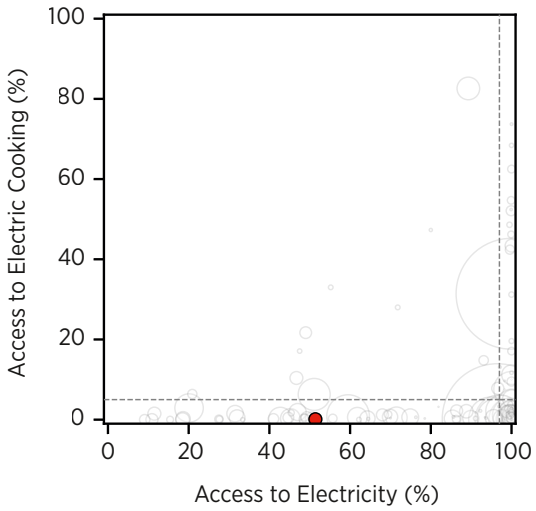
Eritrea has below-average access to electricity and access to clean cooking, with most clean cooking households using LPG. Eritrea has a limited market size and 5% of its electricity generated from renewable sources. In its NDC, Eritrea included a measure for increasing efficient electric stoves, as well as measures for replacing woodstoves with LPG and increasing renewable energy sources.

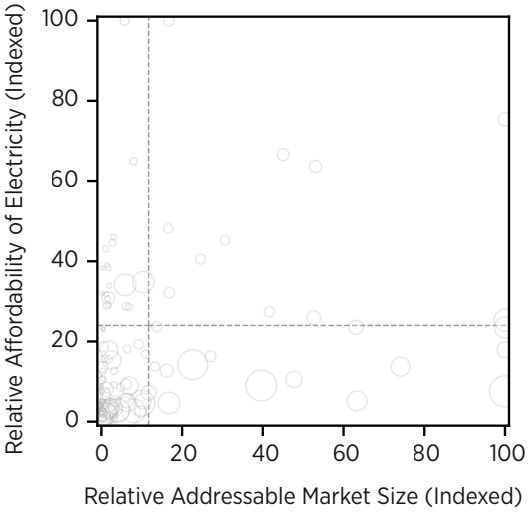
Eritrea's electric cooking targets

- Qualitative target proposed for abating emissions by using efficient electric stoves

  NDC, 2018

Profile





Population	**3 555 868**	GNI per capita	**N/A**
Access to electricity (%)	**51.4%**	Price of electricity (USD/kWh)	**N/A**
Access to clean cooking (%)	**11.1%**	Total market size (HHs)	**278 456**
Access to electric cooking (%)	**0.1%**	Market growth potential (HHs)	**279 466**
Households using LPG (%)	**10.6%**	Renewable energy (%)	**5.3%**

Candidate group: *Primed*

Recommended support

- Assess the overall readiness for scaling up renewables with considerations for the energy demands of electric cooking.
- Enhance policies for reducing emissions and promoting the use of renewable energy.
- Develop concepts and facilitate finance for projects that increase access to electricity and the use of electric cooking technologies.

ETHIOPIA

Summary of electric cooking status

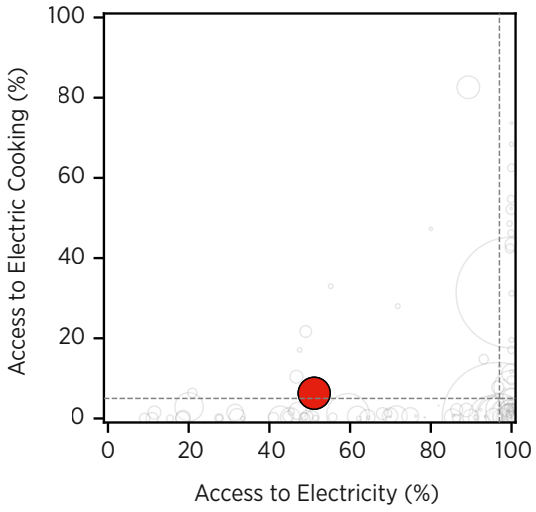
Ethiopia has low rates of access to electricity and access to clean cooking, but still has an above-average rate of electric cooking. Ethiopia has an above-average market size for electric cooking with significant growth potential but below-average affordability of electricity. All (100%) of Ethiopia's electricity comes from renewable sources. In its NDC, Ethiopia includes targets to transition households from unsustainable biomass to electric cooking and other renewable fuels.

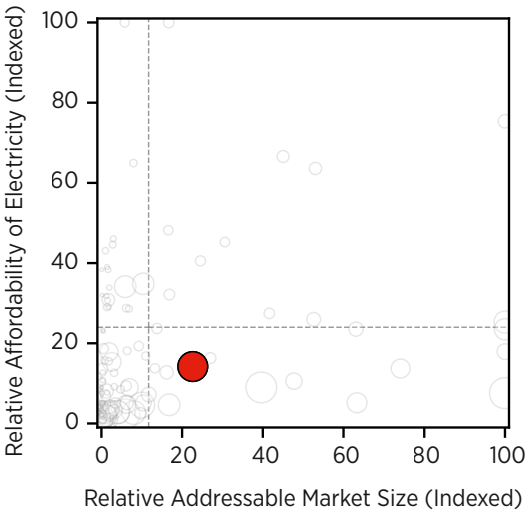
Ethiopia's electric cooking targets

- Qualitative target to switch from unsustainable biomass to electric stoves and renewable biofuels

  Updated NDC, 2021

Profile





Population	**117 190 911**	GNI per capita	**2 360**
Access to electricity (%)	**51.1%**	Price of electricity (USD/kWh)	**3.6**
Access to clean cooking (%)	**6.8%**	Total market size (HHs)	**9 060 998**
Access to electric cooking (%)	**6.3%**	Market growth potential (HHs)	**10 533 726**
Households using LPG (%)	**0.1%**	Renewable energy (%)	**100.0%**

Candidate group: *Mature*

Recommended support

- Enhance policies for promoting access to electricity and the use of electric cooking.
- Develop and finance projects that increase access to electricity and the use of electric cooking technologies.
- Develop long-term plans for increasing access to electricity and the use of electric cooking technologies.

FIJI

Summary of electric cooking status

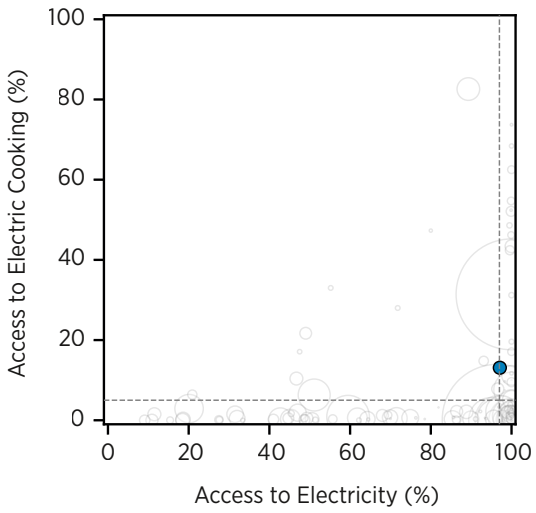
Fiji has achieved full access to electricity. Fiji has above-average rates of electric cooking even though only half of its households have access to clean cooking, and the majority of those rely on LPG. Fiji has below-average affordability of electricity and a limited market size for electric cooking. Just over 54% of Fiji's electricity comes from renewable sources. In its Long-Term Strategy, Fiji targets displacing open fire and woodstoves with electric stoves.

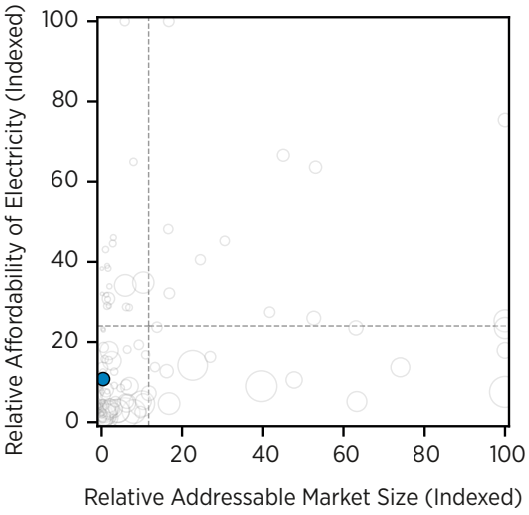
Fiji's electric cooking targets

- Quantifiable target to reduce open-fire and woodstove usage by 2030 by replacing them with electric stoves in urban areas and electric stoves and LPG in rural areas

  First NDC (Updated), 2021

Profile





Population	**920 422**	GNI per capita	**10 840**
Access to electricity (%)	**97.1%**	Price of electricity (USD/kWh)	**21.8**
Access to clean cooking (%)	**49.8%**	Total market size (HHs)	**154 680**
Access to electric cooking (%)	**13.1%**	Market growth potential (HHs)	**8 903**
Households using LPG (%)	**34.8%**	Renewable energy (%)	**54.6%**

Candidate group: *Mature*

Recommended support

- Enhance policies for promoting the adoption of electric cooking technologies.
- Develop long-term plans for increasing renewable energy and the use of electric cooking technologies.
- Develop and finance projects that promote clean and electric cooking technologies.

HONDURAS

Summary of electric cooking status

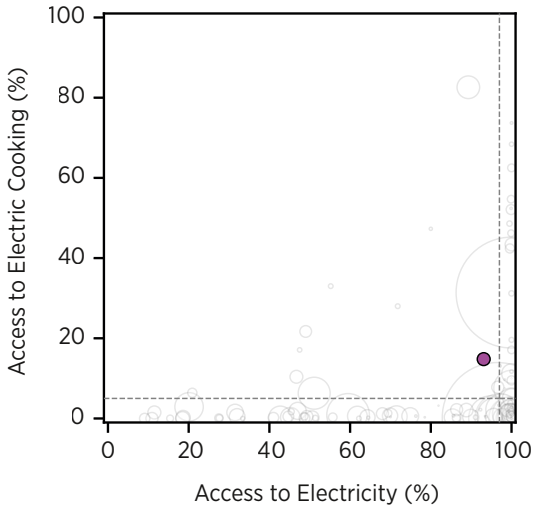
Honduras has an above-average rate of electric cooking despite not yet achieving full access to electricity and having below-average access to clean cooking. Honduras's market size for electric cooking and affordability of electricity are both below average. A total of 56% of electricity in Honduras is generated from renewable sources. Honduras's NDC includes a target to reduce firewood use by 39% through the adoption of electric cooking appliances and LPG.

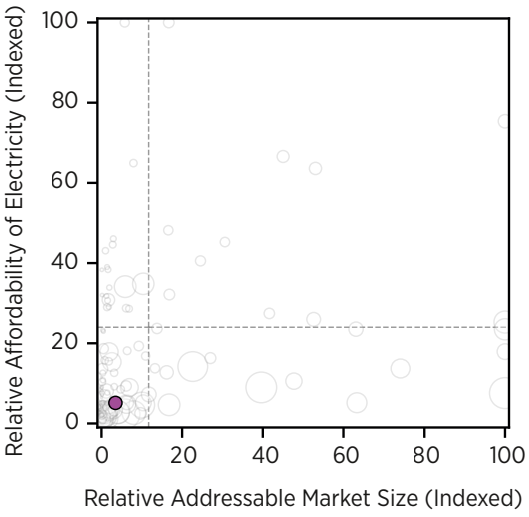
Honduras's clean cooking targets

- Qualitative target to reduce firewood in homes through substitution with electric and LPG stoves

  First NDC (Updated), 2021

Profile





Population	**10 121 763**	GNI per capita	**4 930**
Access to electricity (%)	**93.1%**	Price of electricity (USD/kWh)	**20.8**
Access to clean cooking (%)	**49.1%**	Total market size (HHs)	**1 390 192**
Access to electric cooking (%)	**14.8%**	Market growth potential (HHs)	**160,663**
Households using LPG (%)	**33.6%**	Renewable energy (%)	**56.6%**

Candidate group: *Mature*

Recommended support

- Develop and finance projects that increase access to electricity and the use of electric cookstoves.
- Enhance the enabling environment for the promotion of electric cooking technologies.
- Develop long-term energy plans that involve increased rates of electric cooking technologies and renewable energy in the electricity mix.

INDIA

Summary of electric cooking status

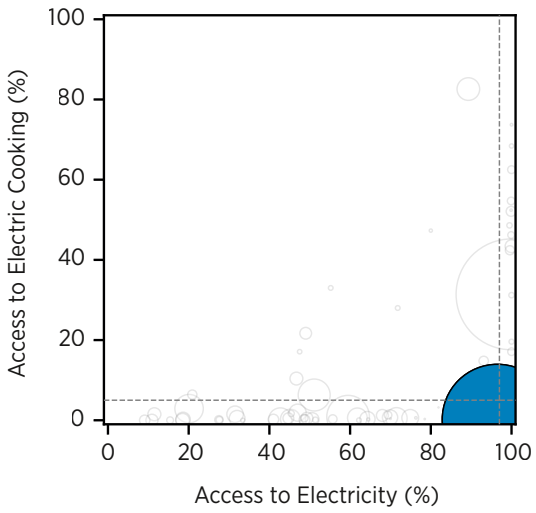
India has almost fully achieved access to electricity but has below-average rates of access to clean cooking, with most clean cooking households using LPG. India has a large market size for electric cooking but below-average affordability of electricity. A total of 18% of India's electricity is generated from renewable sources. India's Long-Term Strategy notes initiatives such as subsidies to increase the penetration of LPG cooking. India launched the Go Electric Campaign in 2021 that promoted the use of electricity in vehicles, charging devices and electric cooking appliances.

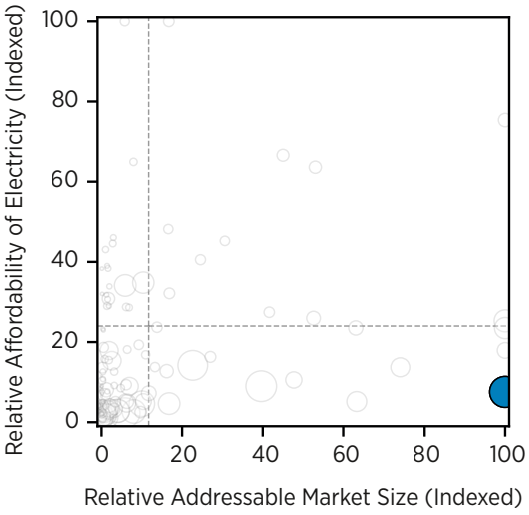
India's clean cooking targets

- Quantitative target to expand an LPG cooking fuel programme to an additional 10 million households

  Updated First NDC, 2021

Profile





Population	**1 396 387 127**	GNI per capita	**6 360**
Access to electricity (%)	**96.5%**	Price of electricity (USD/kWh)	**18.2**
Access to clean cooking (%)	**67.3%**	Total market size (HHs)	**231 848 414**
Access to electric cooking (%)	**0.2%**	Market growth potential (HHs)	**12 416 289**
Households using LPG (%)	**66.8%**	Renewable energy (%)	**18.4%**

Candidate group: *Untapped*

Recommended support

- Enhance the enabling environment for the promotion of electric cooking technologies.
- Develop and finance projects that increase the use of electric cookstoves.
- Develop long-term energy plans that involve increased rates of electric cooking technologies and renewable energy in the electricity mix.

INDONESIA

Summary of electric cooking status

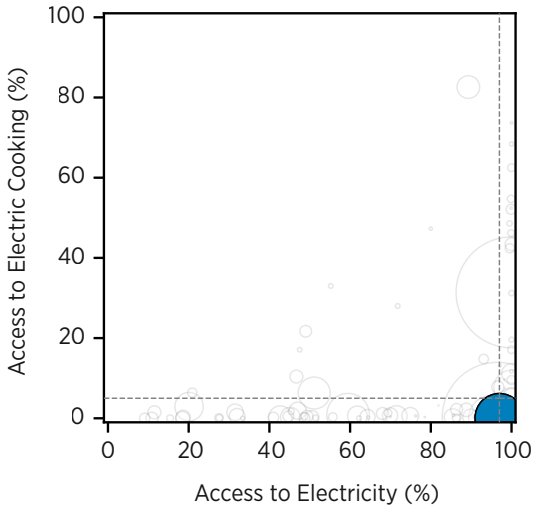
Indonesia has achieved full access to electricity and has access to clean cooking rates above 80%, with the majority of clean cooking households relying on LPG. Indonesia has a large market size for electric cooking and has below-average affordability of electricity. A total of 18% of Indonesia's electricity is generated from renewable sources. Indonesia's NDC includes a target to displace kerosene cooking with LPG and has had a planned programme to replace LPG stoves with electric cooking appliances.

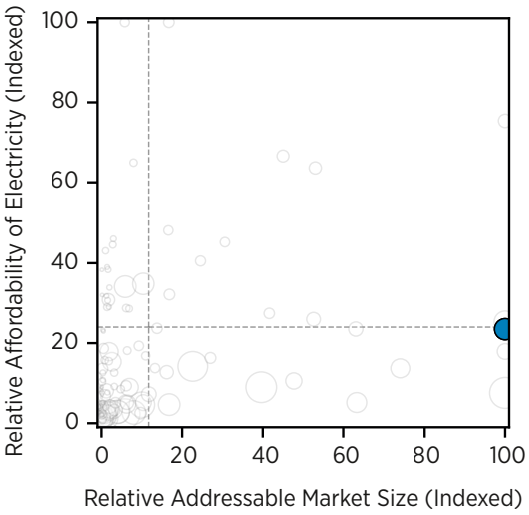
Indonesia's clean cooking targets

- Qualitative target to construct a natural gas pipeline to substitute kerosene used in residential and commercial cooking

  First NDC (Updated), 2021

Profile





Population	**271 857 970**	GNI per capita	**11 820**
Access to electricity (%)	**97.0%**	Price of electricity (USD/kWh)	**10.9**
Access to clean cooking (%)	**84.4%**	Total market size (HHs)	**56 020 094**
Access to electric cooking (%)	**0.1%**	Market growth potential (HHs)	**2 727 198**
Households using LPG (%)	**83.9%**	Renewable energy (%)	**18.0%**

Candidate group: *Untapped*

Recommended support

- Enhance the enabling environment for the promotion of electric cooking technologies.
- Design projects that replace LPG stoves with electric cooking appliances.
- Develop long-term energy plans that involve increased rates of electric cooking technologies and renewable energy in the electricity mix.

ISLAMIC REPUBLIC OF IRAN

Summary of electric cooking status

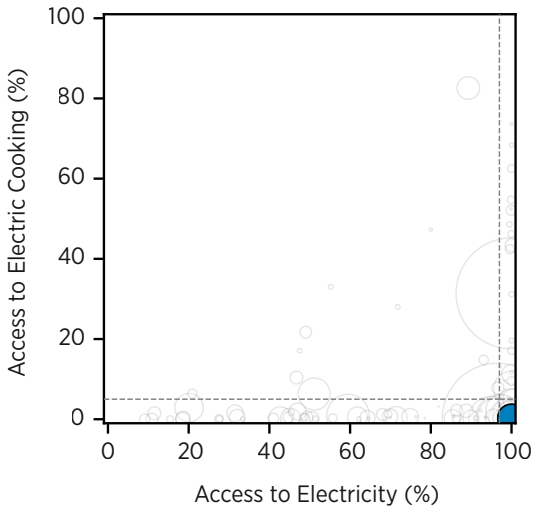
The Islamic Republic of Iran has high rates of access to electricity and clean cooking, with the majority of its population relying on LPG. It has a large market size for electric cooking with affordable electricity. A total of 7% of the Islamic Republic of Iran's electricity is generated from renewable sources. The Islamic Republic of Iran's NDC does not include considerations for cooking but does include strategies to increase the percentage of renewables in the energy mix through policy.

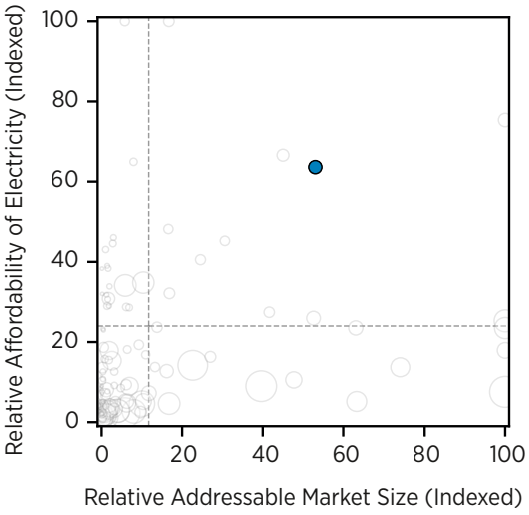
The Islamic Republic of Iran's renewable energy targets

- Qualitative target to increase the use of renewable energy resources, biofuels, biogas and waste to energy

  Intended NDC, 2015

Profile





Population	**87 290 193**
Access to electricity (%)	**100.0%**
Access to clean cooking (%)	**96.6%**
Access to electric cooking (%)	**0.3%**
Households using LPG (%)	**94.0%**

GNI per capita	**15 270**
Price of electricity (USD/kWh)	**5.2**
Total market size (HHs)	**21 226 420**
Market growth potential (HHs)	**302 982**
Renewable energy (%)	**7.0%**

Candidate group: *Untapped*

Recommended support

- Enhance NDC or other national plan to include renewable energy and electric cooking targets.
- Enhance the enabling environment for the promotion of renewable energy and electric cooking technologies.
- Develop long-term energy plans that involve increased rates of electric cooking technologies and renewable energy in the electricity mix.
- Assess the potential of renewable energy in different sectors, including electric cooking.

IRAQ

Summary of electric cooking status

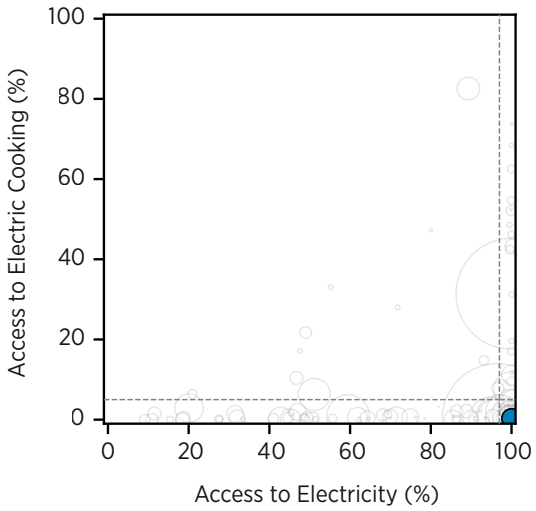
Iraq has high rates of access to electricity and access to clean cooking but a low rate of access to electric cooking, with the majority of households relying on LPG. Iraq has an above-average market size for electric cooking and average affordability of electricity. Only 5% of Iraq's electricity is generated from renewable sources. Iraq's NDC did not include cooking targets but did include targets to increase renewable energy.

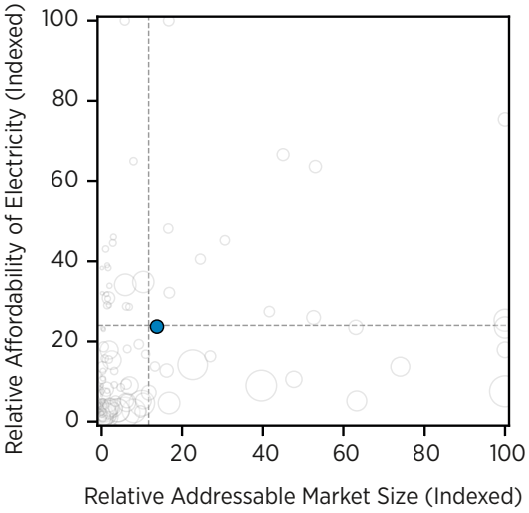
Iraq's renewable energy targets

- Qualitative target to increase renewable energy, particularly solar

  NDC, 2021

Profile





Population	**42 556 984**	GNI per capita	**9 300**
Access to electricity (%)	**100.0%**	Price of electricity (USD/kWh)	**8.5**
Access to clean cooking (%)	**99.2%**	Total market size (HHs)	**5 510 300**
Access to electric cooking (%)	**0.3%**	Market growth potential (HHs)	**153 271**
Households using LPG (%)	**97.7%**	Renewable energy (%)	**5.3%**

Candidate group: *Untapped*

Recommended support

- Enhance NDC or other national plan to include renewable energy and electric cooking targets.
- Enhance the enabling environment for the promotion of renewable energy and electric cooking technologies.
- Develop long-term energy plans that involve increased rates of electric cooking technologies and renewable energy in the electricity mix.
- Assess the potential of renewable energy in different sectors, including electric cooking.

KENYA

Summary of electric cooking status

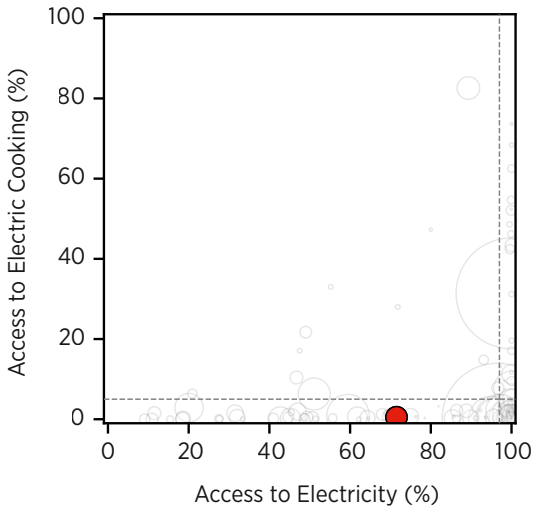
Kenya has below-average access to electricity and clean cooking, with the majority of clean cooking households relying on LPG. It has below-average affordability of electricity but an above-average market size with high growth potential. The majority of Kenya's electricity comes from renewable sources. Kenya's NDC did not include considerations for electric cooking but does include measures to promote gender-responsive technologies. Kenya has a planned national strategy for electric cooking.

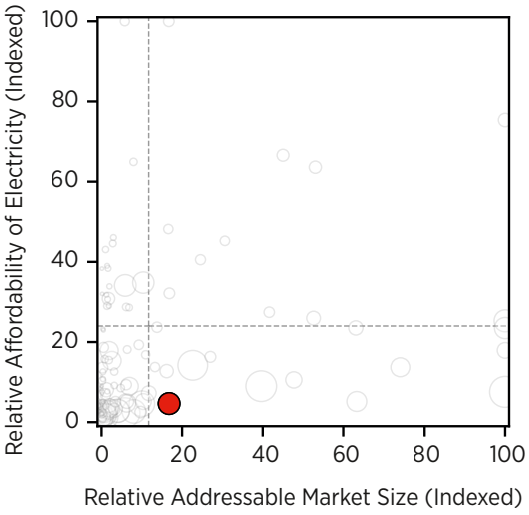
Kenya's gender targets

- Qualitative target to promote gender-responsive technologies and innovations

  NDC, 2020

Profile





Population	**51 985 780**	GNI per capita	**4 660**
Access to electricity (%)	**71.5%**	Price of electricity (USD/kWh)	**21.7**
Access to clean cooking (%)	**21.7%**	Total market size (HHs)	**6 710 203**
Access to electric cooking (%)	**0.5%**	Market growth potential (HHs)	**2 959 133**
Households using LPG (%)	**20.9%**	Renewable energy (%)	**91.4%**

Candidate group: *Untapped*

Recommended support

- Enhance NDC or other national plan to include renewable energy and electric cooking targets.
- Design projects that replace LPG stoves with electric cooking appliances.
- Assess the effects of electric cooking on the grid and modeling for how to expand access to electricity.
- Develop long-term energy plans that increase access to electricity and adoption of electric cooking technologies.

MALAWI

Summary of electric cooking status

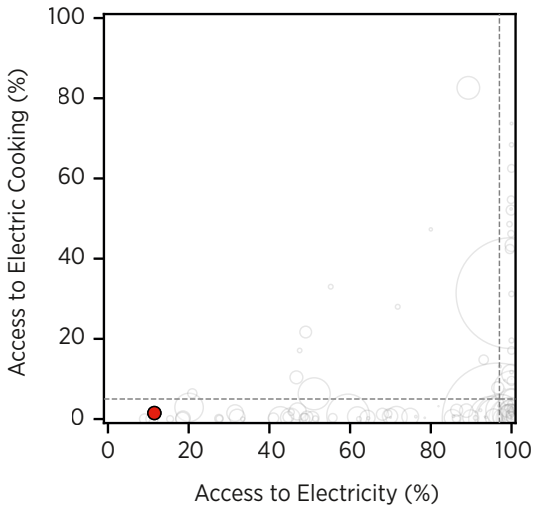
Malawi has below-average access to electricity and clean cooking, with the majority of clean cooking households relying on electric cooking. It has below-average affordability of electricity and market size but high growth potential. Almost 80% of Malawi's electricity comes from renewable sources. Malawi's NDC did not include considerations for electric cooking but does include targets around improved cookstoves. Malawi's SDG 7 Energy Compact does specifically list electric cooking as a mode of decreasing the use of unsustainable fuels.

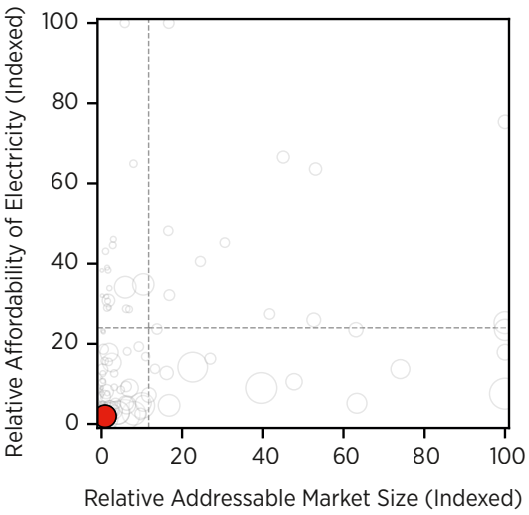
Malawi's clean cooking targets

- Quantitative target to deploy 2 million high-efficiency charcoal stoves

  First NDC (Updated), 2021

Profile





Population	**19 377 061**	GNI per capita	**1 550**
Access to electricity (%)	**11.5%**	Price of electricity (USD/kWh)	**17.2**
Access to clean cooking (%)	**1.7%**	Total market size (HHs)	**352 310**
Access to electric cooking (%)	**1.5%**	Market growth potential (HHs)	**3 235 029**
Households using LPG (%)	**0.0%**	Renewable energy (%)	**79.3%**

Candidate group: *Primed*

Recommended support

- Enhance NDC or other national plan to include renewable energy and electric cooking targets.
- Design projects that replace LPG stoves with electric cooking appliances.
- Develop an enabling environment for electric cooking technologies.

MALAYSIA

Summary of electric cooking status

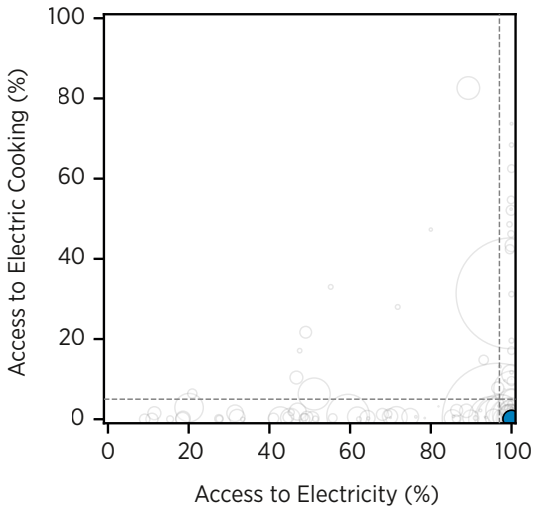
Malaysia has high rates of access to electricity and clean cooking, with the majority of households relying on LPG. Malaysia has an above-average market size and above-average affordability of electricity. Less than 20% of Malaysia' electricity is generated from renewable sources. Malaysia's NDC does not include clean or electric cooking targets but does include more ambitious targets for reducing GHGs.

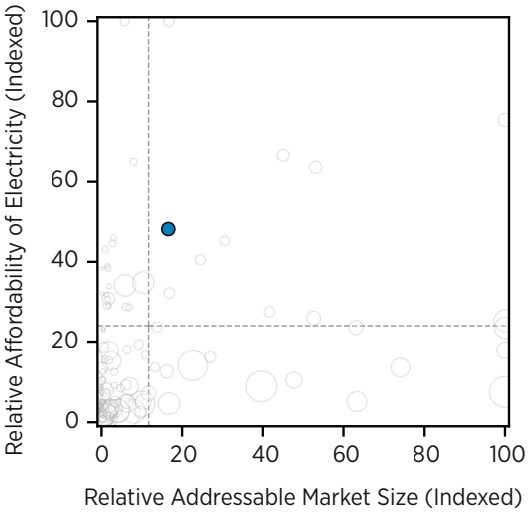
Malaysia's emissions targets

- Quantitative target to reduce economy-wide carbon intensity against GDP by 45% in 2030 compared to 2005

  Revised NDC, 2021

Profile





Population	**33 199 993**	GNI per capita	**26 700**
Access to electricity (%)	**100.0%**	Price of electricity (USD/kWh)	**12.0**
Access to clean cooking (%)	**94.2%**	Total market size (HHs)	**6 633 359**
Access to electric cooking (%)	**0.1%**	Market growth potential (HHs)	**102 369**
Households using LPG (%)	**88.6%**	Renewable energy (%)	**17.8%**

Candidate group: *Untapped*

Recommended support

- Enhance NDC or other national plan to include renewable energy and electric cooking targets.
- Enhance the enabling environment for electric cooking and developing electric cooking targets to be included in NDCs.
- Identify the most promising technologies for increasing the percentage of renewables in the energy mix.
- Assess the potential of renewable energy in different sectors, including electric cooking.

MARSHALL ISLANDS

Summary of electric cooking status

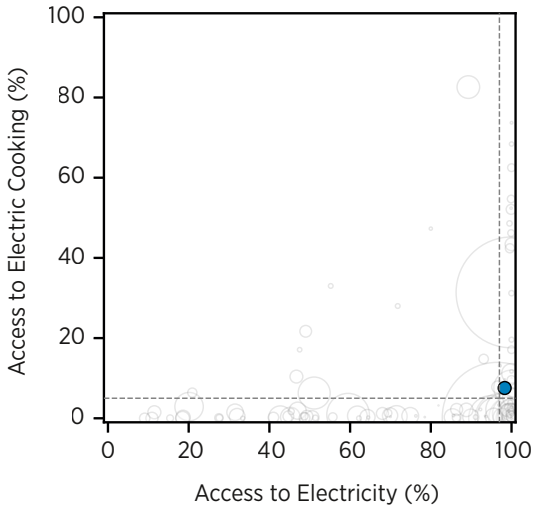
The Marshall Islands has high rates of access to electricity and above-average rates of access to electric cooking, despite below-average rates of access to clean cooking. It has a small overall market size and a small proportion of its electricity generated from renewable sources. The Marshall Islands' NDC includes a target to transition households cooking with LPG to instead cook with electricity with a greater proportion of electricity generated from solar.

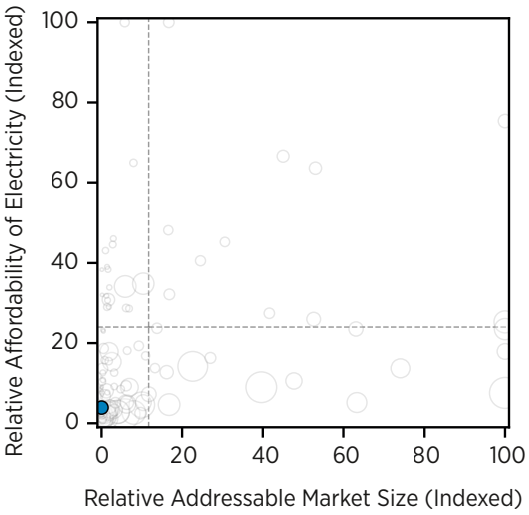
Marshall Islands' electric cooking targets

- Qualitative target to convert LPG cooking to electric cooking and explore the use of solar power and time-of-use tariffs to stimulate demand during off-peak hours

  Long-Term Strategy, 2018

Profile





Population	**43 413**	GNI per capita	**7 330**
Access to electricity (%)	**98.3%**	Price of electricity (USD/kWh)	**40.6**
Access to clean cooking (%)	**66.2%**	Total market size (HHs)	**7 876**
Access to electric cooking (%)	**7.6%**	Market growth potential (HHs)	**325**
Households using LPG (%)	**52.4%**	Renewable energy (%)	**2.4%**

Candidate group: *Mature*

Recommended support

- Enhance the enabling environment for electric cooking and develop policies and financial instruments that support the adoption of electric cooking.
- Identify promising technologies for increasing the percentage of renewables in the energy mix.
- Assess the potential of renewable energy in different sectors, including electric cooking.
- Develop and finance projects that increase the percentage of renewables in the electricity mix and increase access to electric cooking.

MAURITANIA

Summary of electric cooking status

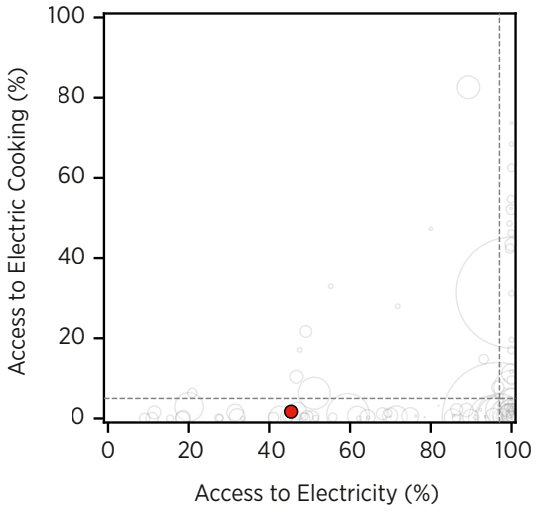
Mauritania has below-average rates of electricity and clean cooking, with most clean cooking households relying on LPG. It has below-average affordability of electricity and market size for electric cooking. Approximately 19% of Mauritania's electricity is generated from renewable sources. In its NDC, Mauritania targeted distribution of efficient electric stoves and an increase in the share of renewables in the energy mix to 50% by 2030.

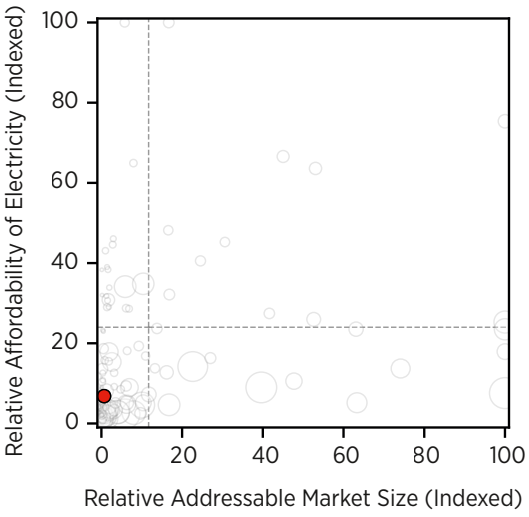
Mauritania's electric cooking targets

- Quantifiable target to distribute 10 000 efficient electric stoves by 2030

  First NDC (Updated), 2021

Profile





Population	**4 498 604**
Access to electricity (%)	**45.4%**
Access to clean cooking (%)	**47.7%**
Access to electric cooking (%)	**1.7%**
Households using LPG (%)	**45.3%**

GNI per capita	**5 540**
Price of electricity (USD/kWh)	**17.6**
Total market size (HHs)	**265 661**
Market growth potential (HHs)	**352 245**
Renewable energy (%)	**18.9%**

Candidate group: *Primed*

Recommended support

- Enhance monitoring of electing cooking adoption targeted in NDC as well as the measurement of the emissions reduction achieved through the switch to electric cooking.
- Identify the most promising technologies for increasing the percentage of renewables in the energy mix.
- Develop an enabling environment for renewables and electric cooking technologies.

MEXICO

Summary of electric cooking status

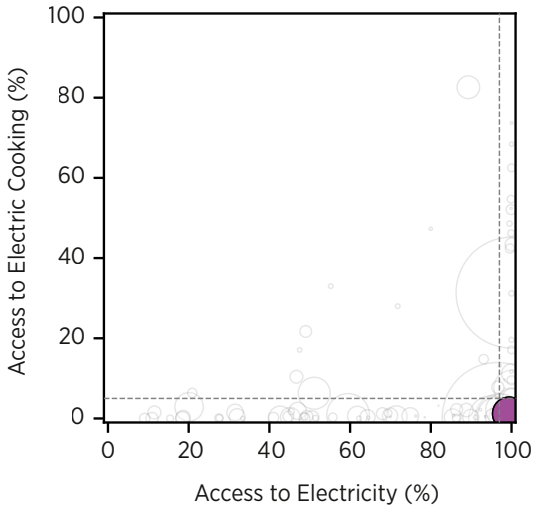
Mexico has full access to electricity but has not yet achieved full access to clean cooking, with few households cooking with electricity and the majority relying on LPG. Mexico has an above-average market size for electric cooking and an average affordability of electricity. Just over 21% of Mexico's electricity is generated from renewable sources. Mexico's NDC and Long-Term Strategy do not include electric cooking targets but its Long-Term Strategy includes a target for efficient stoves.

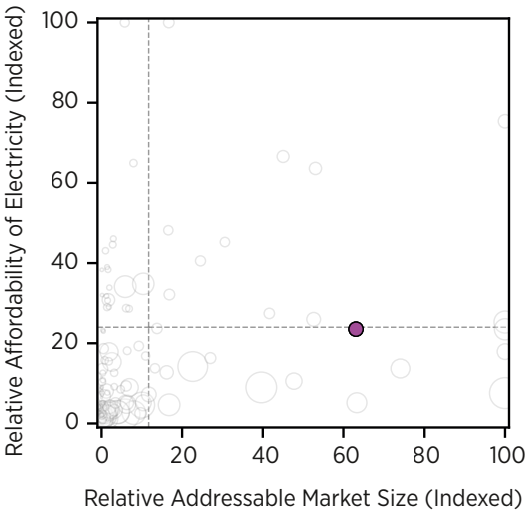
Mexico's electric cooking targets

- Qualitative target to substitute open-fire wood cooking with efficient, low-emission stoves

  Long-Term Strategy, 2016

Profile





Population	**125 998 302**	GNI per capita	**17 920**
Access to electricity (%)	**99.4%**	Price of electricity (USD/kWh)	**16.5**
Access to clean cooking (%)	**84.5%**	Total market size (HHs)	**25 251 088**
Access to electric cooking (%)	**1.2%**	Market growth potential (HHs)	**554 521**
Households using LPG (%)	**83.0%**	Renewable energy (%)	**21.3%**

Candidate group: *Untapped*

Recommended support

- Enhance NDC or other national plan to include renewable energy and electric cooking targets.
- Develop an enabling environment for renewables and electric cooking technologies.
- Identify the most promising technologies for increasing the percentage of renewables in the energy mix.
- Develop long-term energy plans that increase the percentage of renewables in the energy mix and the adoption of electric cooking technologies.

NEPAL

Summary of electric cooking status

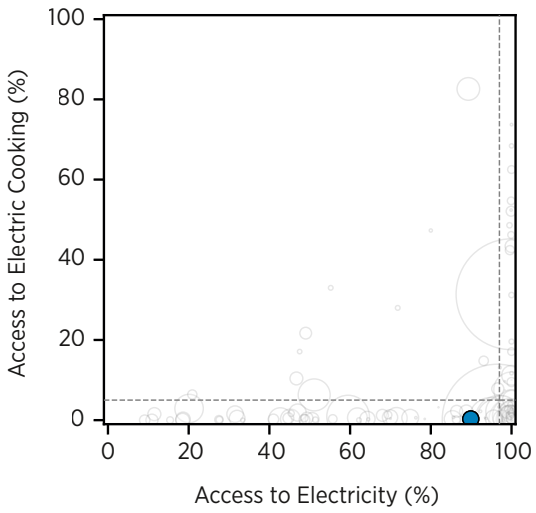
Nepal has a high percentage of its population with electricity access, but a below-average rate of access to clean cooking, with most clean cooking households relying on LPG. It has an average market size for electric cooking with below-average affordability of electricity. All of Nepal's electricity is generated from renewable sources. Nepal targets increasing the percentage of households cooking with electricity in its NDC and it currently has projects to increase access to electric cooking.

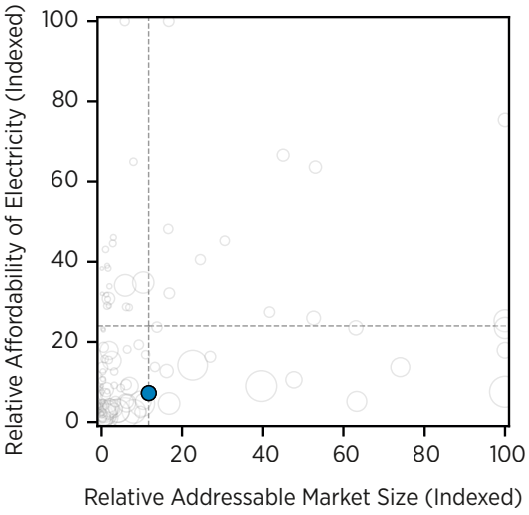
Nepal's electric cooking targets

- Quantifiable target to ensure 25% of households use electric stoves as their primary mode of cooking by 2030

  Second NDC, 2021

Profile





Population	**29 348 627**	GNI per capita	**4 010**
Access to electricity (%)	**89.9%**	Price of electricity (USD/kWh)	**12.0**
Access to clean cooking (%)	**34.1%**	Total market size (HHs)	**4 695 780**
Access to electric cooking (%)	**0.3%**	Market growth potential (HHs)	**637 494**
Households using LPG (%)	**33.4%**	Renewable energy (%)	**100.0%**

Candidate group: *Primed*

Recommended support

- Develop an enabling environment for electric cooking technologies.
- Quantify the impact and effects of different cooking technologies and cooking access projects.
- Assess the effects of electric cooking on the grid.
- Initiate a technical capacity-building programme on renewable energy technology to facilitate NDC implementation with a focus on planning and capacity requirement to scale up the adoption of electric cooking.

NIGERIA

Summary of electric cooking status

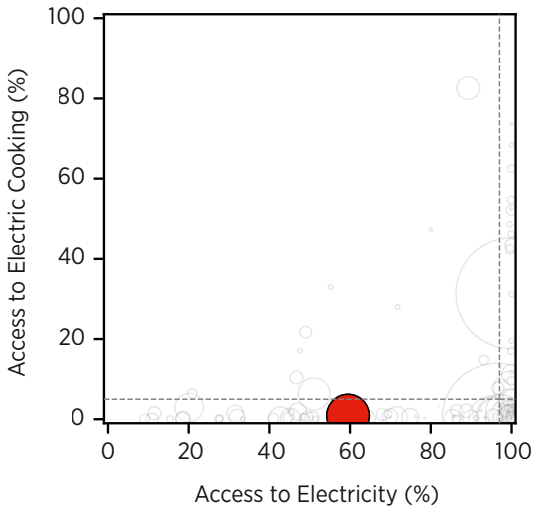
Nigeria has below-average rates of access to electricity, clean cooking and electric cooking, with the majority of clean cooking households relying on LPG. Nigeria has below-average affordability of electricity but a large market size for electric cooking with significant growth potential. A total of 22% of Nigeria's electricity is generated from renewable sources. Nigeria's NDC did not include specific targets for electric cooking but did include clean cooking targets related to displacing firewood cooking through LPG adoption.

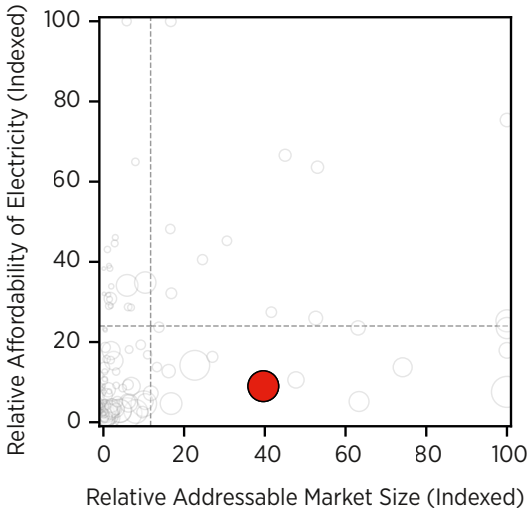
Nigeria's clean cooking targets

- Quantitative target to reach 48% adoption of LPG and 13% adoption of improved cookstoves by 2030

  First NDC (Updated), 2021

Profile





Population	**208 327 405**
Access to electricity (%)	**59.5%**
Access to clean cooking (%)	**14.9%**
Access to electric cooking (%)	**0.9%**
Households using LPG (%)	**13.5%**

GNI per capita	**4 940**
Price of electricity (USD/kWh)	**11.9**
Total market size (HHs)	**15 854 527**
Market growth potential (HHs)	**11 971 169**
Renewable energy (%)	**22.6%**

Candidate group: *Untapped*

Recommended support

- Enhance NDC or other national plan to include renewable energy and electric cooking targets.
- Identify the most promising technologies for increasing the percentage of renewables in the energy mix.
- Assess the potential of renewable energy in different sectors, including electric cooking.
- Develop long-term energy plans that involve increased rates of electric cooking technologies and renewable energy in the electricity mix.

PAKISTAN

Summary of electric cooking status

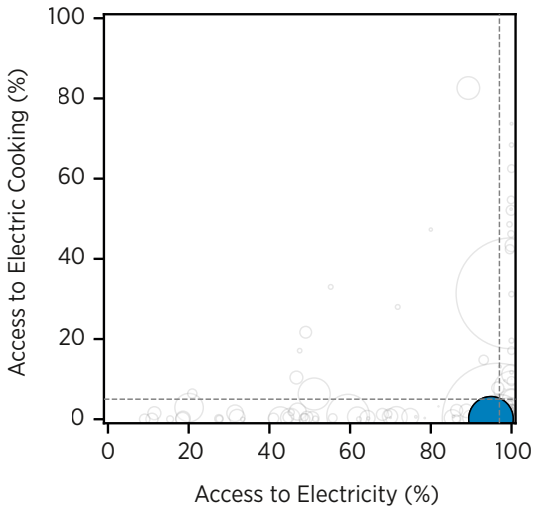
Pakistan has below-average rates of access to electricity and access to clean cooking, with most clean cooking households relying on LPG and almost no households cooking with electricity. Pakistan has an above-average market size for electric cooking but below-average affordability of electricity. A total of 32% of Pakistan's electricity is generated from renewable sources. Pakistan's NDC did not explicitly include electric cooking but did include a target to pilot cooking technologies.

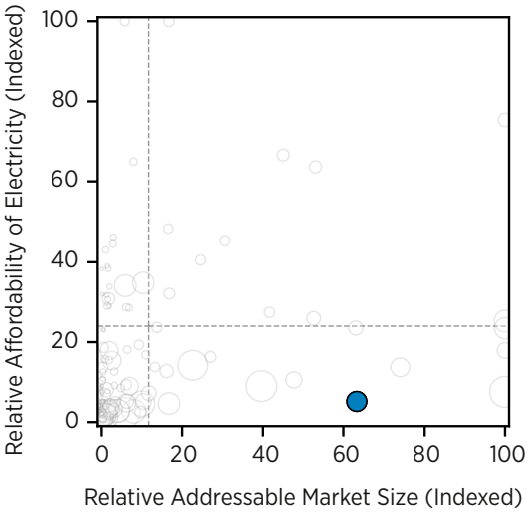
Pakistan's clean cooking targets

- Qualitative target to pilot low-cost, energy-efficient cooking technologies

  First NDC (Updated), 2021

Profile





Population	**227 196 741**
Access to electricity (%)	**94.9%**
Access to clean cooking (%)	**49.0%**
Access to electric cooking (%)	**0.1%**
Households using LPG (%)	**48.5%**

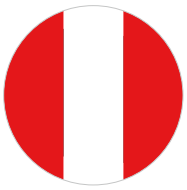
GNI per capita	**5 180**
Price of electricity (USD/kWh)	**21.7**
Total market size (HHs)	**25 345 229**
Market growth potential (HHs)	**2 104 601**
Renewable energy (%)	**32.1%**

Candidate group: *Untapped*

Recommended support

- Enhance NDC or other national plan to include renewable energy and electric cooking targets.
- Identify the most promising technologies for increasing the percentage of renewables in the energy mix.
- Assess the potential of renewable energy in different sectors, including electric cooking.
- Develop and finance projects related to increasing access to low-cost electric cooking technologies.

PERU



Summary of electric cooking status

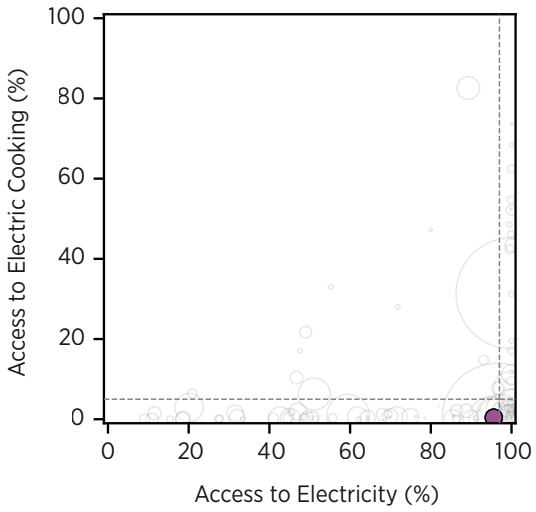
Peru has high rates of access to electricity and access to clean cooking but low rates of electric cooking, with the majority of households relying on LPG. Peru has an above-average market size for electric cooking and below-average affordability of electricity. A total of 64% of Peru's electricity is generated from renewable sources. Peru's updated NDC did not include cooking-related targets but did strengthen its unconditional commitment to reduce emissions beyond that of its first NDC.

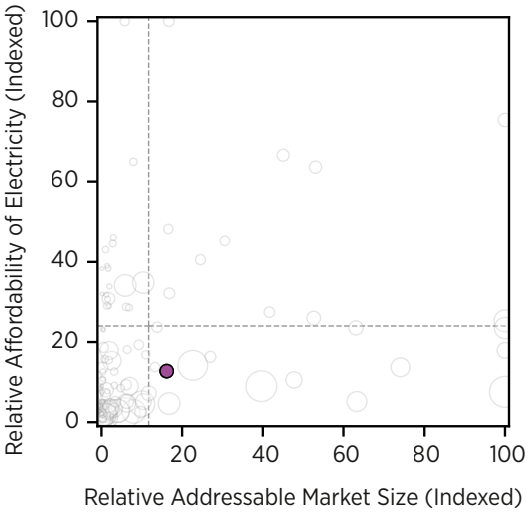
Peru's emissions targets

- Quantitative target to unconditionally limit GHG emissions to a maximum level of 208.8 $MtCO_2eq$ by 2030

  Revised NDC, 2020

Profile





Population	**33 304 756**	GNI per capita	**11 480**
Access to electricity (%)	**95.6%**	Price of electricity (USD/kWh)	**19.5**
Access to clean cooking (%)	**83.9%**	Total market size (HHs)	**6 470 638**
Access to electric cooking (%)	**0.4%**	Market growth potential (HHs)	**420 272**
Households using LPG (%)	**83.2%**	Renewable energy (%)	**64.4%**

Candidate group: *Untapped*

Recommended support

- Enhance NDC or other national plan to include renewable energy and electric cooking targets.
- Develop an enabling environment for electric cooking technologies.
- Assess the potential of renewable energy in different sectors, including electric cooking.
- Develop long-term energy plans that involve increased rates of electric cooking technologies and renewable energy in the electricity mix.

PHILIPPINES

Summary of electric cooking status

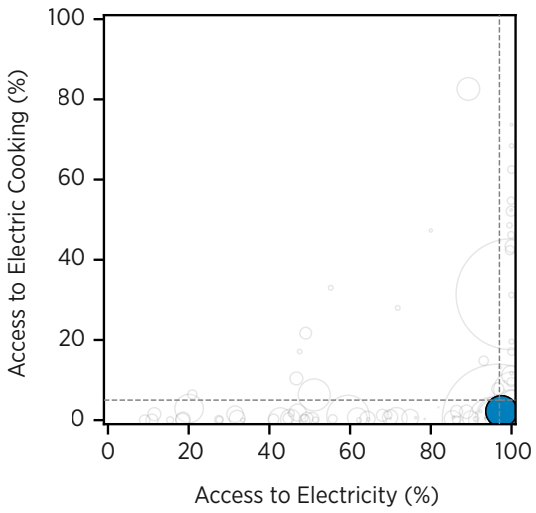
The Philippines has a high rate of access to electricity but below-average rates of access to clean cooking and access to electric cooking, with most clean cooking households relying on LPG. The Philippines has an above-average market size for electric cooking but below-average affordability of electricity. Just over 20% of the Philippines' electricity is generated from renewable sources. The Philippines' NDC did not include cooking-related targets but did include mitigation measures related to technology and sustainable consumption.

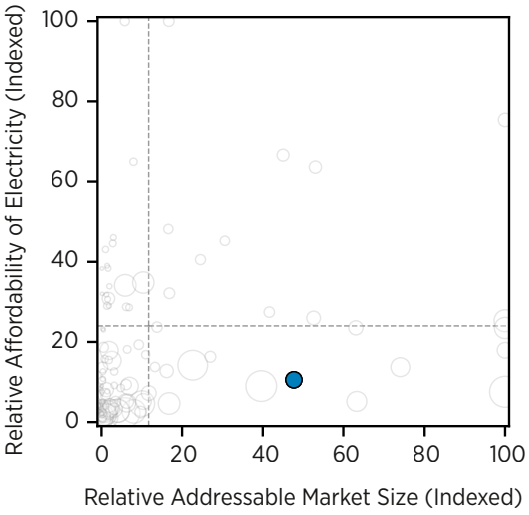
Philippines' climate targets

- Qualitative target to enhance technology development and transfer and to improve policies and measures on the uptake of sustainable consumption and production practices

  Revised NDC, 2020

Profile





Population	**112 190 977**	GNI per capita	**8 820**
Access to electricity (%)	**97.5%**	Price of electricity (USD/kWh)	**18.1**
Access to clean cooking (%)	**47.1%**	Total market size (HHs)	**19 090 492**
Access to electric cooking (%)	**2.2%**	Market growth potential (HHs)	**944 393**
Households using LPG (%)	**44.1%**	Renewable energy (%)	**20.7%**

Candidate group: *Untapped*

Recommended support

- Enhance NDC or other national plan to include renewable energy and electric cooking targets.
- Develop an enabling environment for electric cooking technologies.
- Assess the potential of renewable energy in different sectors, including electric cooking.

THAILAND

Summary of electric cooking status

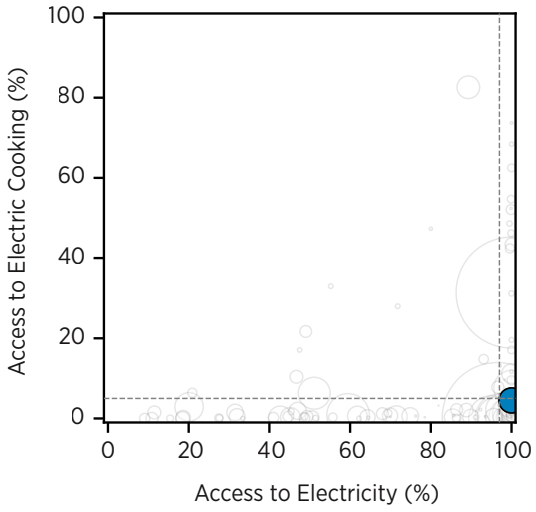
Thailand has full access to electricity but 84.2% access to clean cooking, with an average rate of access to electric cooking and most clean cooking households instead relying on LPG. Thailand has an above-average market size for electric cooking and above-average affordability of electricity. Nearly 18% of Thailand's electricity is generated from renewable sources. Thailand's NDC includes a target to shift households away from LPG to electric cooking.

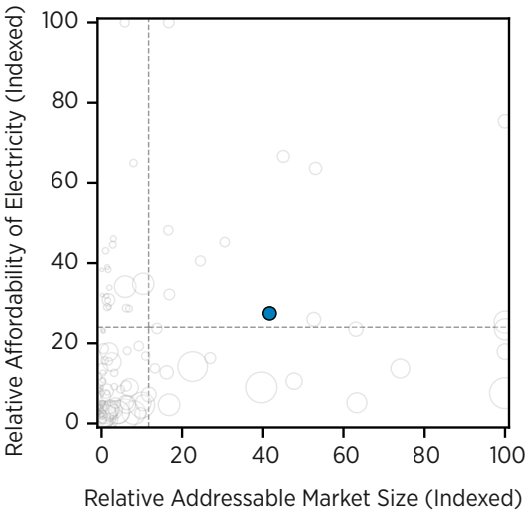
Thailand's electric cooking targets

- Qualitative target to electrify end-use technologies and shift cooking from LPG to electricity

  First NDC (Updated), 2022

Profile





Population	**71 475 664**
Access to electricity (%)	**100.0%**
Access to clean cooking (%)	**84.2%**
Access to electric cooking (%)	**4.5%**
Households using LPG (%)	**79.1%**

GNI per capita	**17 360**
Price of electricity (USD/kWh)	**13.7**
Total market size (HHs)	**16 648 600**
Market growth potential (HHs)	**160 071**
Renewable energy (%)	**17.7%**

Candidate group: *Primed*

Recommended support

- Enhance the enabling environment for electric cooking technology adoption.
- Develop and finance projects that increase access to electric cooking.
- Track the progress and impact of increasing access to electric cooking.
- Develop long-term energy plans that increase the percentage of renewable energy in the electricity mix and increase access to electricity and electric cooking.

TOGO

Summary of electric cooking status

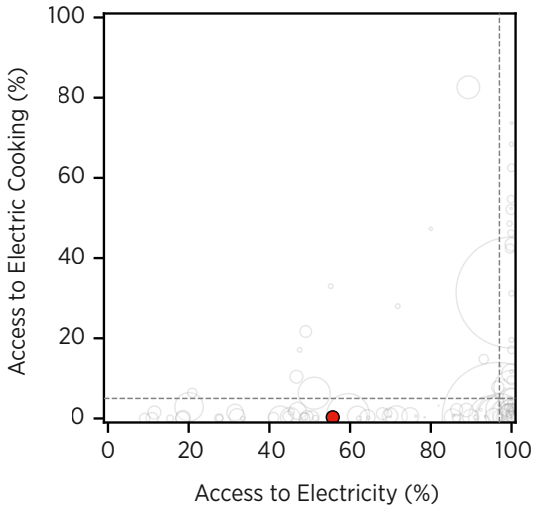
Togo has low rates of access to electricity and access to electric cooking, with the majority of clean cooking households relying on LPG. It has below-average affordability of electricity and a below-average market size for electric cooking, with some potential for growth. In its NDC, Togo targets increasing access to clean cooking with fuels including electricity.

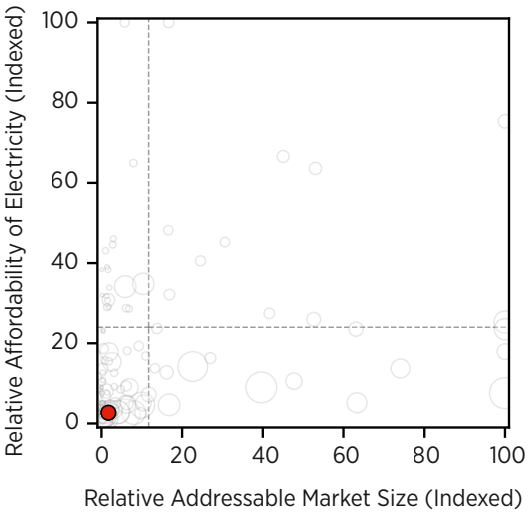
Togo's electric cooking targets

- Qualitative target to increase the number of households using improved efficiency biomass stoves, LPG and electricity.

  First NDC (Updated), 2022

Profile





Population	**8 442 580**	GNI per capita	**2 180**
Access to electricity (%)	**55.7%**	Price of electricity (USD/kWh)	**17.6**
Access to clean cooking (%)	**10.5%**	Total market size (HHs)	**688 320**
Access to electric cooking (%)	**0.3%**	Market growth potential (HHs)	**589 616**
Households using LPG (%)	**9.7%**	Renewable energy (%)	**14.9%**

Candidate group: *Primed*

Recommended support

- Enhance NDC targets and monitor the impact of increasing access to electric cooking.
- Develop and finance projects to increase access to electricity and electric cooking.
- Assess the potential of renewable energy in different sectors, including electric cooking.

TÜRKIYE

Summary of electric cooking status

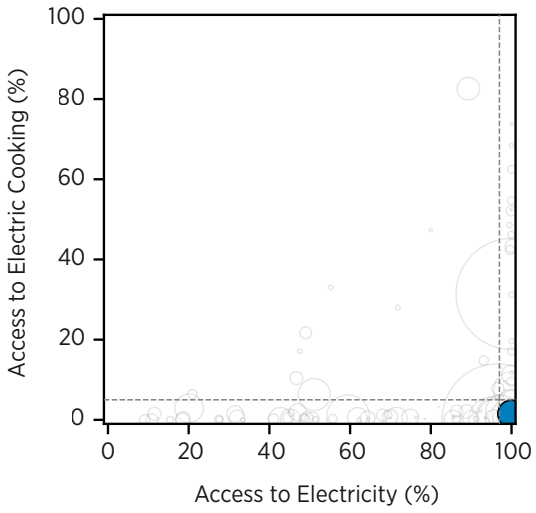
Türkiye has high rates of access to electricity and clean cooking, with the majority of households cooking with LPG. It has an above-average market size for electric cooking and above-average affordability of electricity. Nearly 42% of Türkiye's electricity is generated from renewable sources. Türkiye's NDC did not include any cooking-related targets but did include targets for increasing power generation from renewable sources.

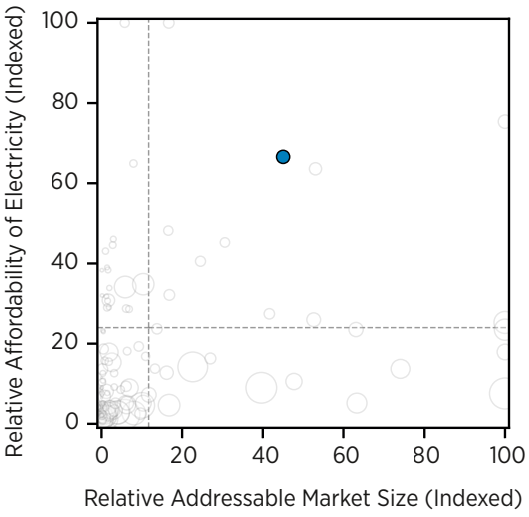
Türkiye's renewable energy targets

- Quantitative targets to increase electricity generation from solar to 10 gigawatts and wind to 16 gigawatts by 2030
- Qualitative target to increase hydroelectric power

Updated NDC, 2022

Profile





Population	**84 135 428**	GNI per capita	**27 360**
Access to electricity (%)	**100.0%**	Price of electricity (USD/kWh)	**8.9**
Access to clean cooking (%)	**95.4%**	Total market size (HHs)	**18 015 956**
Access to electric cooking (%)	**1.5%**	Market growth potential (HHs)	**274 958**
Households using LPG (%)	**78.1%**	Renewable energy (%)	**41.9%**

Candidate group: *Untapped*

Recommended support

- Develop or update NDC, Long-Term Strategy or other national energy plans to include renewable energy and electric cooking targets.
- Develop an enabling environment for promoting adoption of electric cooking technologies and a transition of households away from LPG.
- Assess the potential of renewable energy in different sectors, including electric cooking.
- Develop long-term energy plans that involve increased rates of electric cooking technologies and renewable energy in the electricity mix.

UGANDA

Summary of electric cooking status

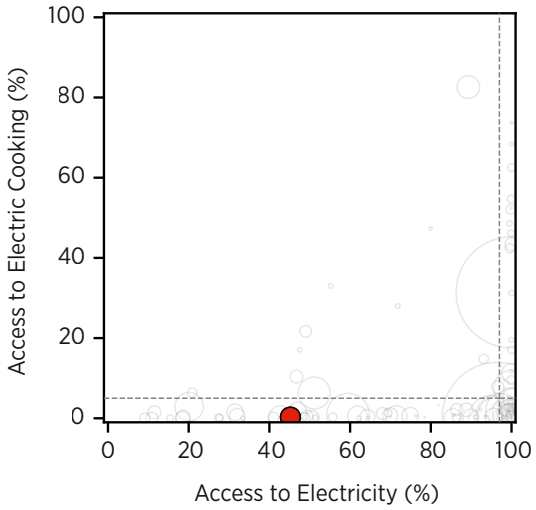
Uganda has below-average access to electricity, electric cooking and affordability of electricity, meaning that it faces economic challenges in scaling up electric cooking. A high percentage of Uganda's population cooks with biomass. A large percentage of its emissions therefore results from wood fuels used in cooking. Uganda has a high percentage of renewable energy and a below-average market size for electric cooking. The market for electric cooking has strong growth potential, and Uganda has made strong commitments to scaling up electric cooking in its NDC and in its policies.

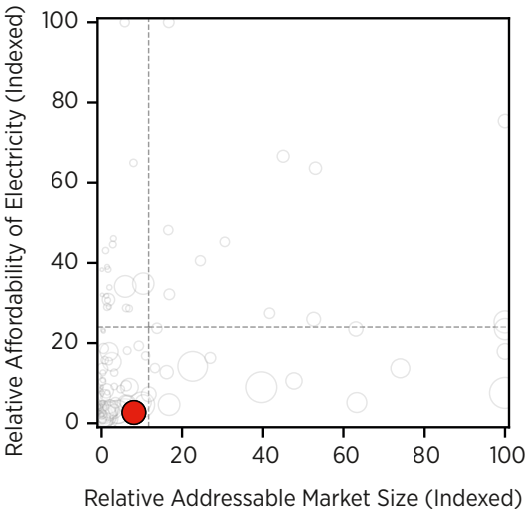
Uganda's electric cooking targets

- Quantifiable target to reach 50% penetration of electric cooking by 2025

  Updated NDC, 2022

Profile





Population	**44 404 611**	GNI per capita	**2 100**
Access to electricity (%)	**45.2%**	Price of electricity (USD/kWh)	**16.9**
Access to clean cooking (%)	**0.7%**	Total market size (HHs)	**3 217 211**
Access to electric cooking (%)	**0.3%**	Market growth potential (HHs)	**4 190 137**
Households using LPG (%)	**0.3%**	Renewable energy (%)	**98.7%**

Candidate group: *Primed*

Recommended support

- Ensure the achievement of the target to scale up electric cooking penetration to 50% by 2030.
- Enhance the monitoring of electric cooking adoption targeted in NDC and measurement of emissions reduction achieved by switching to electric cooking from unsustainable wood fuel use.
- Plan grid expansion to ensure adequate energy supply and achievement of 100% access to electricity.

UZBEKISTAN

Summary of electric cooking status

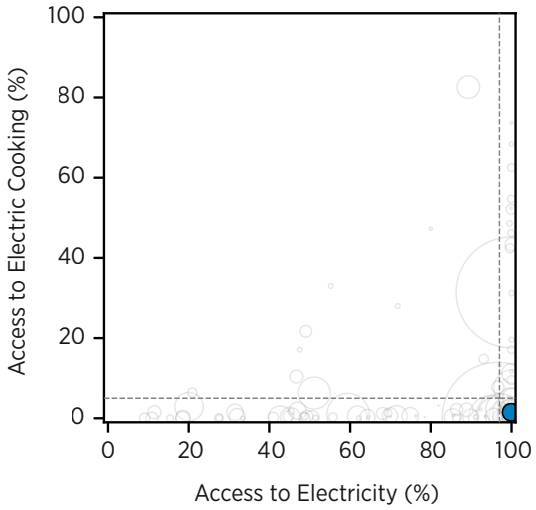
Uzbekistan has high rates of access to electricity and access to clean cooking but a below-average rate of access to electric cooking, with the majority of households relying on LPG. Uzbekistan has an above-average market size for electric cooking and above-average affordability of electricity. A total of 9.5% of Uzbekistan's electricity is generated from renewable sources. Uzbekistan's NDC does not include electric cooking targets but does include targets to increase the percentage of renewables in the electricity mix.

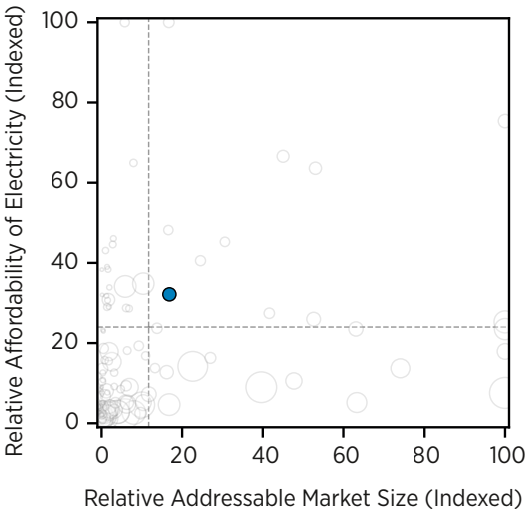
Uzbekistan's renewable energy targets

- Quantitative target to have 25% of power generated from renewable sources, including solar, wind and hydropower

  Updated NDC, 2021

Profile





Population	**34 232 050**	GNI per capita	**7 720**
Access to electricity (%)	**99.9%**	Price of electricity (USD/kWh)	**5.2**
Access to clean cooking (%)	**83.2%**	Total market size (HHs)	**6 736 867**
Access to electric cooking (%)	**1.5%**	Market growth potential (HHs)	**175 268**
Households using LPG (%)	**76.4%**	Renewable energy (%)	**9.5%**

Candidate group: *Untapped*

Recommended support

- Assess the potential of renewable energy in different sectors, including electric cooking.
- Develop an enabling environment for promoting adoption of electric cooking technologies.
- Identify the most promising technologies for increasing the percentage of renewables in the energy mix.
- Assess the potential of renewable energy in different sectors, including electric cooking.

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