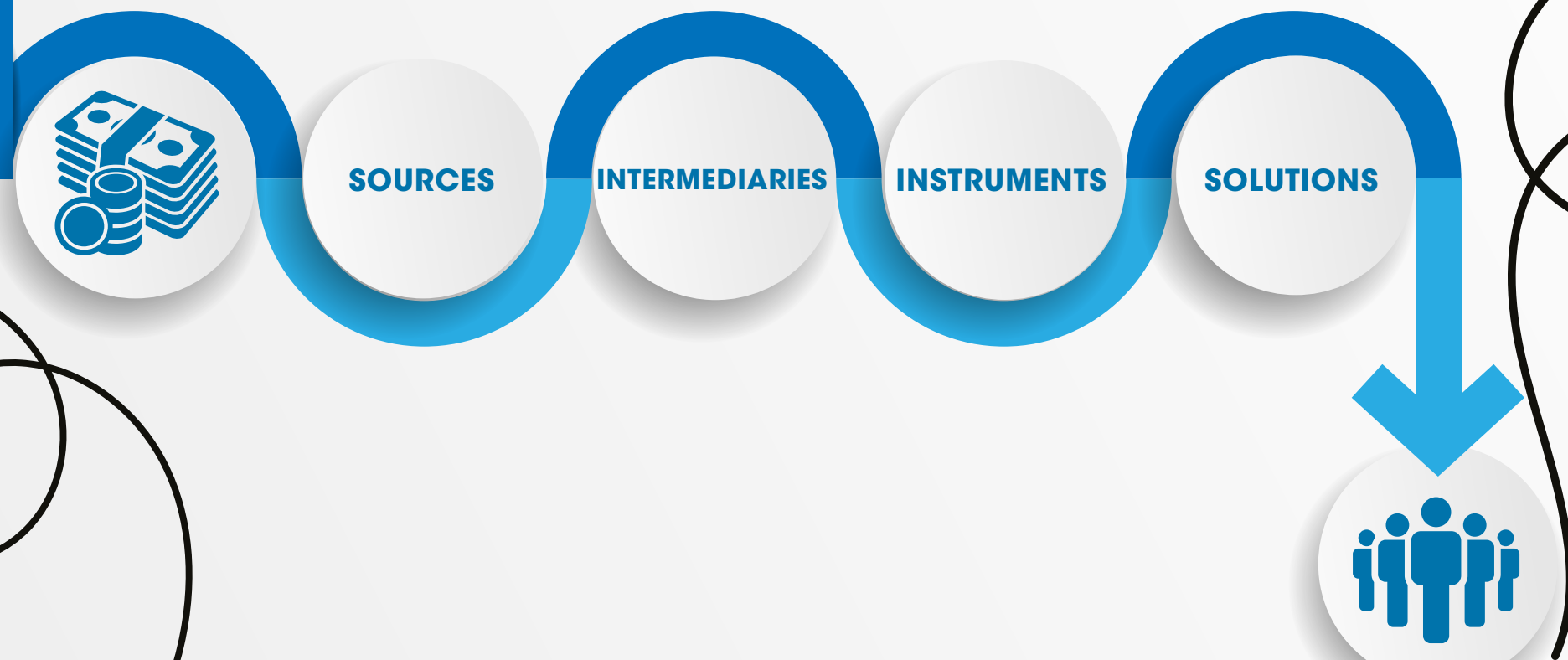


PUBLIC FINANCE FOR UNIVERSAL ENERGY ACCESS



© IRENA 2024

Unless otherwise stated, material in this publication may be freely used, shared, copied, reproduced, printed and/or stored, provided that appropriate acknowledgement is given of IRENA as the source and copyright holder. Material in this publication that is attributed to third parties may be subject to separate terms of use and restrictions, and appropriate permissions from these third parties may need to be secured before any use of such material.

ISBN: 978-92-9260-582-7

Citation: IRENA (2024), *Public finance for universal energy access*, International Renewable Energy Agency, Abu Dhabi.

About IRENA

The International Renewable Energy Agency (IRENA) serves as the principal platform for international co-operation, a centre of excellence, a repository of policy, technology, resource and financial knowledge, and a driver of action on the ground to advance the transformation of the global energy system. An intergovernmental organisation established in 2011, IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy, in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity.

www.irena.org

ACKNOWLEDGEMENTS

This report was developed under the guidance of Ute Collier (Deputy Director – Knowledge, Policy, and Finance Centre), and was authored by Ntšebo Sephelane and Faran Rana (IRENA), Divyam Nagpal (ex-IRENA) and Dalberg Advisors (consultants), with inputs from Diala Hawila and Caroline Ochieng (IRENA).

The report benefited from the reviews and inputs from: Charlie Miller (World Bank), Sarah Alexander and Felix ter Heegde (SNV), Olivia Coldrey and Jem Porcaro (ex-SEforAll), Patrick Paletko (GIZ/EnDev), Christine Eibs Singer (Catalyst Energy Advisors), Laura Fortes and Drew Corbyn (GOGLA).

The report was edited by Justin French-Brooks, with design provided by Myrto Petrou.

IRENA would like to thank the Governments of Norway and Walloon for supporting IRENA with the work that formed the basis of this report.

For further information or to provide feedback: publications@irena.org

DISCLAIMER

This publication and the material herein are provided “as is”. All reasonable precautions have been taken by IRENA to verify the reliability of the material in this publication. However, neither IRENA nor any of its officials, agents or other third-party content providers provides a warranty of any kind, either expressed or implied, and accept no responsibility or liability for any consequence of use of the publication or material herein.

The information contained herein does not necessarily represent the views of all Members of IRENA. The mention of specific companies or certain projects or products does not imply that they are endorsed or recommended by IRENA in preference to others of a similar nature that are not mentioned. The designations employed and the presentation of material herein do not imply the expression of any opinion on the part of IRENA concerning the legal status of any region, country, territory, city or area or of its authorities, or concerning the delimitation of frontiers or boundaries.

CONTENTS

- ABBREVIATIONS4**
- EXECUTIVE SUMMARY5**
 - PUBLIC FINANCE FOR UNIVERSAL ENERGY ACCESS 5
 - PUBLIC FINANCE FOR ACCESS TO ELECTRICITY 7
 - PUBLIC FINANCE FOR ACCESS TO CLEAN COOKING 7
- 1. INTRODUCTION8**
- 2. ACCESS TO ELECTRICITY CHALLENGES AND INSTRUMENTS TO CHANNEL PUBLIC FINANCE 9**
 - UNLOCKING SOLUTIONS FOR ELECTRICITY ACCESS: LEVERAGING PUBLIC FINANCE AND ITS INSTRUMENTS 9
 - PRIORITY ACTIONS..... 13
- 3. ACCESS TO CLEAN COOKING17**
 - UNLOCKING SOLUTIONS FOR CLEAN COOKING ACCESS: LEVERAGING PUBLIC FINANCE AND ITS INSTRUMENTS 17
 - PRIORITY ACTIONS.....20
- 4. FRAMEWORK FOR THE FLOW OF PUBLIC FINANCE FOR ENERGY ACCESS23**
- 5. CONCLUSION.....25**
- ANNEX26**
 - DEFINITIONS OF USES OF PUBLIC FINANCE OUTLINED IN THE FRAMEWORK26
 - METHODOLOGY26
 - LIMITATIONS OF THE REPORT.....27
- REFERENCES28**

ABBREVIATIONS

AD	anaerobic digestion
CAPEX	capital expenditure
CBO	community-based organisation
DFI	development finance institution
GIS	geographical information system
IAP	indoor air pollution
LPG	liquified petroleum gas
MSME	micro, small and medium-sized enterprise
NDC	nationally determined contribution
OPEX	operating expenditure
PAYG	pay-as-you-go
R&D	research and development
RBF	results-based finance
ROI	Return on investment
SDG	Sustainable Development Goal
SHS	solar home systems
SME	small and medium-sized enterprise
SPV	special purpose vehicle
TA	technical assistance

EXECUTIVE SUMMARY

Public finance for universal energy access

Public finance is crucial to achieving universal energy access. While a range of technological solutions already exist for electrification and clean cooking, public financing remains essential to deploy energy services in areas unaddressed by the market (e.g. planning and building the energy infrastructure). It is further needed to build the ecosystem that supports the sustainability and resilience of energy deployment (such as education, agriculture, health sectors, industrial development, capacity building, awareness raising and skills development), ensuring energy access to last-mile, underserved, remote and rural communities; bridging end-users' affordability gaps, and de-risking and catalysing private capital effectively through policy and regulatory instruments.

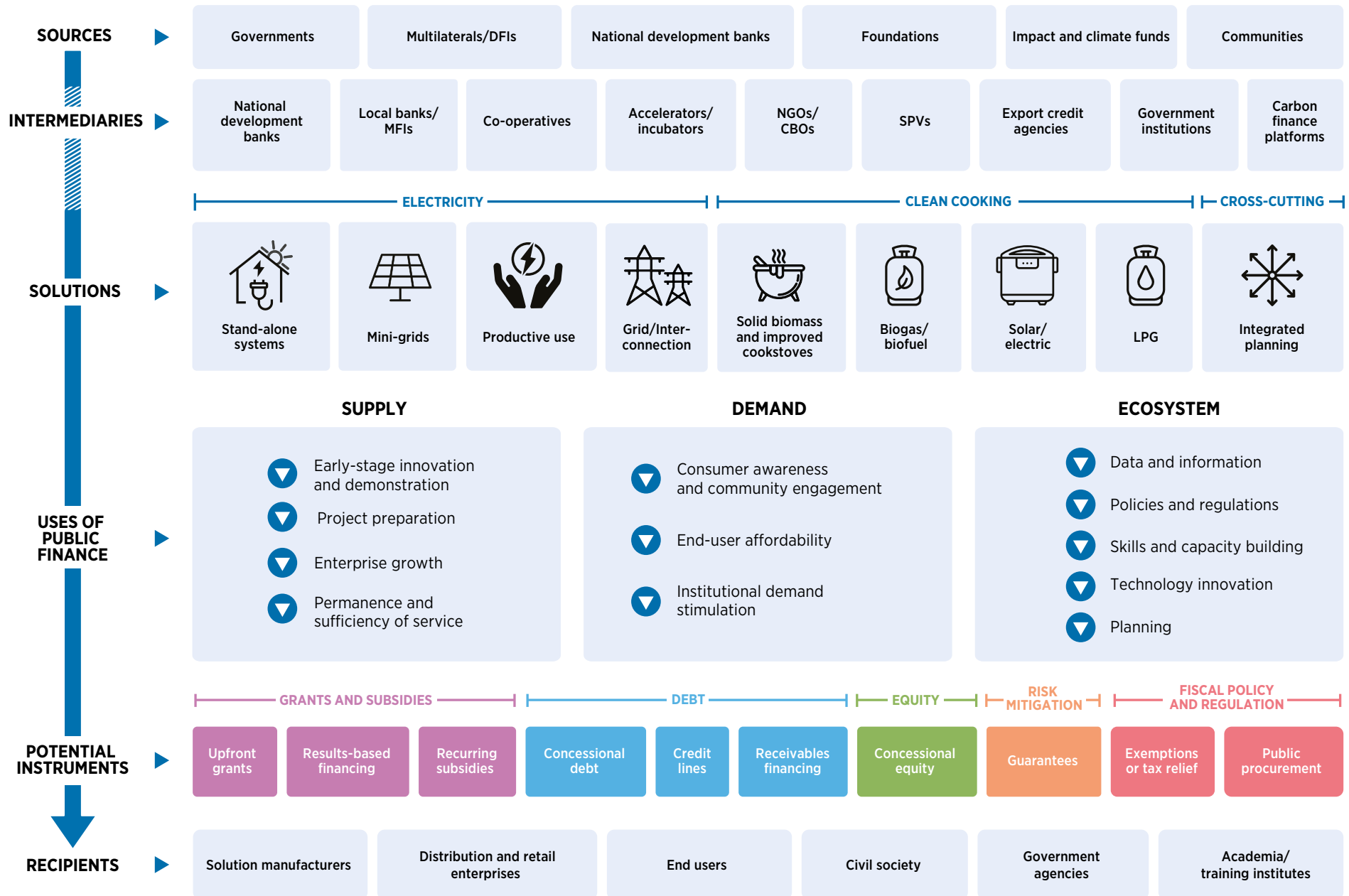
To achieve SDG 7, public finance commitments and appropriate instruments need to be scaled up significantly. Public finance needs vary depending on the technology solution (stand-alone systems, mini-grids, clean cooking solutions) and the stakeholders in the ecosystem, including end users and enterprises.

Existing frameworks do not adequately track or analyse public finance for energy access to ascertain whether sufficient volume is being mobilised and deployed through the right instruments. Tailored financing instruments will be key to scaling universal energy access and building sustainable energy markets. This report offers a framework to guide policy makers and public financiers in identifying the public finance needed to advance energy access. It seeks to (a) map the public finance needs across the energy access ecosystem, (b) identify challenges in scaling up public finance for energy access, and (c) identify stakeholder preferences across public finance instruments, intermediaries and recipients (Figure S1).

The report answers the following questions for both electricity (covering stand-alone systems, mini-grids) and productive use applications and clean cooking (covering improved cookstoves, biogas/biofuel and solar/electric solutions):

- The reasons energy access solutions have not reached their full potential for recipients, and the challenges hampering progress;
- The potential uses for public finance in addressing these challenges; and
- How public finance might be operationalised in terms of specific instruments, sources and intermediaries.

Figure S1 Framework for the use of public finance for expanding energy access



Notes: CBO = community-based organisation; DFI = development finance institution; LPG = liquefied petroleum gas; NGO = non-governmental organisation; SPV = special purpose vehicle.

Public finance for access to electricity

Investments in the electricity access sector have seen notable pre-commercialisation funding, specifically in off-grid initiatives, and particularly in research and development (R&D) and pilot endeavours aimed at stimulating the market, lowering costs and enhancing efficiency. Future investments should focus on improving inclusion for the demand side, market sustainability for the supply side and co-ordination across the ecosystem. Priorities for public finance for access to electricity include:

- **On the supply side:** Small and nascent players, including women and minority entrepreneurs, find it difficult to secure investor funds. Moreover, they may lack resources and technical competency for project planning. At the same time, energy service providers have low incentives to expand into remote geographies due to low return on investment (ROI) and high cost of maintenance and repair services. Public finance (such as results-based financing [RBF]) can be leveraged to give large players the incentive to expand their footprint and unlock private capital for smaller suppliers through awareness-raising programmes, concessional loans and credit lines through local banks.
- **On the demand side:** Electricity demand is low in rural communities. Additionally, low-income households in these communities show sensitivity to the high costs of electricity and underutilise electricity to avoid recurring costs. Therefore, demand for electricity services and electricity-using products and appliances is also typically low, which weakens the economic case for companies to service these segments. Public finance can provide targeted subsidies, consumer loans and tax exemptions to stimulate demand.
- **Regarding the ecosystem:** Given that the sector is rapidly evolving with innovative business and financing models, there is a need for robust enterprise performance data and market intelligence for informed decision-making and the execution of outcomes-based financing. Moreover, clear, and effective rural electrification policies such as simplified licensing, productive regulations, and fiscal incentives such as tax exemptions are needed to incentivise more players to enter and expand operations. Public finance can also be used to support integrated electrification planning and cross-agency co-ordination.

Public finance for access to clean cooking

Clean cooking is less developed than electricity access and requires more support. Priorities for public finance for access to clean cooking include:

- **On the supply side:** Clean cooking solution providers face challenges related to user adoption due to prevailing user traditions and beliefs about cooking, access to working capital, and the lack of developed after-sales services. Moreover, the absence of distribution infrastructure for biofuels and repair assistance for household biodigesters restrict the supply of renewable biofuel solutions. Direct R&D grants, contingent grants for infrastructure development and concessional loans to service providers are promising public finance measures to solve supply barriers.
- **On the demand side:** Adoption of clean cooking solutions is hindered by affordability, awareness regarding the potential and benefits of clean cooking technologies, and fuel availability. Remote and rural communities follow varied cooking traditions influenced by their socio-cultural contexts. They often find themselves with no options but to use polluting cooking fuels due to the lack of alternative options. Additionally, low-income households face affordability constraints both in acquiring and maintaining clean cooking solutions. Awareness campaigns and targeted subsidies (especially for women) can be provided to generate higher demand.
- **Regarding the ecosystem:** Policy makers and funders may face difficulty in planning and implementing national policies and programmes to drive a clean cooking transition due to the lack of standardised data, understanding and shared learnings, as well as institutional capacity constraints for large-scale implementation. Upfront grants for capacity development along with investment in integrated planning and cross-agency co-ordination are instrumental in developing a strong enabling environment.

1. INTRODUCTION

Access to energy has increased significantly over the past decade, but the world is not on track to achieve SDG 7 by 2030. Progress towards achieving universal access to electricity grew significantly, with the number of people without electricity dropping by almost half, from about 1.1 billion in 2010 to 675 million in 2021. Despite this noteworthy progress, 660 million people are projected to still lack electricity by 2030. Efforts to achieve universal access to clean cooking fuels and technologies have also proven challenging. Although the global population without access to clean cooking decreased from 2.9 billion in 2010 to 2.3 billion in 2021, the current trajectory suggests that 1.9 billion individuals will still lack access to clean cooking by 2030 (IEA *et al.*, 2023). The SDG 7 target therefore remains elusive.

To reach universal access to clean, modern energy by 2030, the world will have to drastically increase efforts by scaling up finance, investment and policy support. An estimated USD 30 billion in annual funding is needed between 2021 and 2030 in grid/mini-grid and standalone renewable generation, transmission and distribution infrastructure, and around USD 6 billion in clean cooking technology and fuels (IEA *et al.*, 2023).

Private and public investment are essential for energy access and have continued to pick up over the last decade. In 2019 public finance accounted for approximately 50% of the funding directed towards improving access (SEforAll and CPI, 2021). Public finance remains essential to bridge funding gaps, particularly in areas that are not yet considered investible by the private sector. For instance, the off-grid renewables sector faced various financial and operational risks during the COVID-19 pandemic. Disruptions in the supply chain led to increased manufacturing and distribution costs, particularly for solar home systems (SHS), resulting in an inflationary impact on consumer prices across the sector. Simultaneously, pandemic-related economic challenges lowered household incomes, leading to an increase in bill defaults by customers. This left companies grappling with liquidity constraints, needing to secure working capital while a significant portion of their capital remained tied up in receivables (ESMAP, NG, 2022) (IRENA and AfDB, 2022). Consequently, private investment activity slowed down in 2020-2021, but the sector received a vital boost from the public sector, especially from development finance institutions (DFIs). DFIs' contribution nearly quadrupled from USD 62 million in 2019 to USD 220 million in 2021. Public finance's share rose from 30% during 2015-2019 to 44% during 2020-2021, offsetting the decrease in private investment activity and thereby ensuring the sector's resilience amidst challenges (IRENA and CPI, 2023).

Public finance refers to funding from non-market sources including government, multilateral agencies, national development banks, climate funds and foundations. It can be deployed as grants, (concessional) debt, equity, risk mitigation, and/or fiscal policy and regulatory instruments. Public finance has a core role to play in deploying energy services to areas unaddressed by the market (e.g. planning and building the energy infrastructure); investing in the ecosystem that support and influence the sustainability and resilience of energy deployment (such as education, agriculture, health sectors, industrial development, capacity building, awareness raising and skills development); ensuring access to last-mile, underserved, remote and rural communities; bridging end-user affordability gaps; and de-risking and catalysing private capital effectively through policy and regulatory instruments. To ensure that public finance is most effective, the guiding principles of public finance include:

- Having an integrated approach that supports collaboration across multiple players, agencies and solutions for optimum development outcomes.
- Targeting and improving access for underserved stakeholders, whether on the supply or demand side.
- Ensuring flexibility to adjust design as needed, adapting to learnings from implementation and evolutions in the market.
- Maintaining proportionality to incentivise desired actions, while avoiding crowding out other investments.
- Exercising oversight and monitoring to push for results, manage risks and ensure efficiency.
- Making provisions for “removability” with a phase-out strategy in place while ensuring sufficiency and permanence of access.

2. ACCESS TO ELECTRICITY: CHALLENGES AND INSTRUMENTS TO CHANNEL PUBLIC FINANCE

This section provides details on key challenges to achieving universal access to electricity and relevant instruments to channel public finance into supply, demand and the ecosystem. The section is informed by the following reports: State of the Global Mini-grids Market Report (Bloomberg NEF and SEforAll, 2020), Designing Public Funding Mechanisms in the Off-grid Solar Sector (ESMAP, 2022), Financing Facility for Productive Use Appliances (CLASP, 2022), Productive Use of Energy: Moving to scalable business cases (ENDEV, 2020) and Establishing Tariffs for Mini-Grids (USAID, 2023).

Unlocking solutions for electricity access: Leveraging public finance and its instruments

Table 1 presents the challenges facing universal electricity access, potential uses of public finance to address the challenges and the instruments that can be used to channel public funds to the suppliers of technology, consumers and the ecosystem in general.

Table 1 Electricity access challenges, public finance to address them and potential instruments

		CHALLENGES	POTENTIAL USES OF PUBLIC FINANCE	POTENTIAL INSTRUMENTS TO CHANNEL PUBLIC FUNDS
SUPPLY	Early-stage innovation and demonstration	<p>Local enterprises face challenges in accessing early-stage support and funds, with a few large players dominating many markets</p> <p>Lack of high-risk capital to support technology innovation and demonstration, with a focus on both energy technologies and appliances</p>	<p>Regional/national incubators and accelerators to support local early-stage innovation, targeting capacity building and financing gaps</p> <p>Fiscal and financial incentives to support market creation efforts, enhance affordability and encourage new enterprise development</p> <p>Support for technology-agnostic local resource assessments to identify suitable access solutions</p>	<p>Upfront grants from foundations via incubators/accelerators</p> <p>Risk mitigation via first loss guarantees</p> <p>Tax exemptions via fiscal policy</p>
	Project preparation	<p>Long lead times for project development and lack of financial and technical resources for feasibility studies, community engagement, project planning, procurement, etc.</p>	<p>Introduce integrated electrification planning and dedicated regulations to reduce transaction costs and timelines for project development</p> <p>Create investment portfolios for mini-grid projects under development to leverage economies of scale and unlock patient capital during the pre-operation phase</p> <p>Design incentive disbursements to mitigate/reduce bridge financing needs for enterprises (e.g. staged RBF payments)</p>	<p>Upfront grants from DFIs and multilateral agencies</p> <p>Concessional equity and debt financing via impact investors and local/international DFIs</p> <p>Risk mitigation via guarantees</p>

SUPPLY	Enterprise growth	Lack of access to long-term capital for enterprises to scale up while also being incentivised to expand to rural, isolated and low-income geographies.	<p>Reduce transaction costs and time required for enterprises to access existing public finance and incentives</p> <p>Establish dedicated funds, preferably local currency facilities, accessible to energy access enterprises delivering long-term infrastructure financing</p>	<p>RBF via foundations and multilateral agencies</p> <p>Upfront grants for small companies via foundations, government, and multilateral agencies (e.g. procurement subsidies)</p> <p>Carbon finance through government and donors</p> <p>Concessional equity via impact investors and DFIs</p>
		Lack of infrastructure financing for the mini-grid sector to support a significant scale-up beyond current levels (thousands to tens of thousands of mini-grids per year)	<p>Complement existing RBF facilities with dedicated funds to deliver concessional corporate or project-level debt and equity for mini-grid projects</p> <p>Develop and deploy innovative public-private partnership models (e.g. split-asset¹) to reduce risks and improve the viability of new and existing projects</p> <p>Support demand aggregation facilities to lower CAPEX and cost of service delivery for developers and solution providers</p>	<p>Mix of upfront grants, RBF and tariff subsidies via governments, multilateral agencies and multi-donor facilities</p> <p>Grants to capitalise demand aggregation facilities</p> <p>Receivables financing for off-grid enterprises²</p> <p>Concessional and patient equity via impact investors and DFIs</p>
		Currency devaluation risks due to the lack of local currency capital (especially working capital) to cover local receivables since enterprise financing is typically in hard currency	<p>Incentivise local funding through policy and financial mandates/incentives (e.g. lending requirements), while lowering local currency financing costs by building bankers' awareness through co-financing and risk mitigation facilities and their technical capacity</p> <p>Leverage currency exchange funds like The Currency Exchange (TCX) to mitigate currency and interest rate risks to attract and lock in long-term private equity and debt in local currency</p>	<p>Grants for awareness-building programmes for local banking professionals on sector solutions and business models</p> <p>Concessional loans through local banks to provide local currency financing</p> <p>Risk mitigation via currency exchange funds</p>
	Permanency and sufficiency of service	<p>High cost of maintenance and repair in rural areas due to inaccessibility and difficulty to train and maintain local teams</p> <p>Adapting systems to meet potentially growing aspirations of communities in rural areas over time</p>	<p>Invest in training institutes and academia to develop a local pool of talent for the sector that can be leveraged to improve efficiency and reduce cost of operation and maintenance</p> <p>Devise financing and regulatory mechanisms that enable developers and operators to make additional CAPEX investments with recovery aligned with a reflective cost of service</p>	<p>Upfront upskilling grants from governments, foundations and DFIs</p> <p>Capitalised grant facilities to bridge the gap between approved tariff revenues and cost-of-service on ongoing basis for operators</p>

¹ A split-asset public-private partnership (PPP) model is a type of partnership arrangement where the assets required for a project are divided between the public and private sectors. In this model, the responsibilities for financing, construction, operation, and maintenance of the project are shared between the public sector and private sector entities. Split asset mini-grid delivery models have been introduced under the government-led Rural Renewable Energy Project (RREP) in Sierra Leone, to attract foreign direct investment (FDI), and scale up mini-grid deployment, with distribution assets including household connections financed and owned by the Ministry of Energy, while the private sector finances and owns the generation assets (GET.Transform, 2020).

² Receivables based financing is a form of asset-backed financing. It involves the use of the borrower's future sales to secure short term loans. In the context of distributed renewable energy assets, "receivables" refer to the anticipated future cash flows derived from payments expected from the sale of off-grid solar products via PAYGO arrangements or electricity payments from mini grid customers. (UNDP, 2024).

DEMAND	Community awareness and engagement	Lack of community engagement and awareness of available solutions and options for consumptive and productive use of electricity	<p>Support partnership with local community groups to hold awareness campaigns on electricity access solutions through demonstration and piloting</p> <p>Recognise and strengthen incentives for communities to establish community-based organisations (CBOs) to own, operate and/or maintain solutions</p>	<p>Upfront grants for concession holders, developers and community-focused groups for awareness raising</p> <p>Upfront grants or patient capital for early-stage community engagement and building capacity of CBOs</p>
	End-user affordability	High upfront cost impedes uptake of products and services, especially among low-income rural consumers	<p>Improve access to concessional consumer financing solutions like PAYG, direct cash transfers and tailored consumer financing products (through intermediaries)</p> <p>Make supply-side interventions, like tax exemptions and financial investments to reduce CAPEX, which may be passed on to consumers as a subsidy.</p> <p>Unlock carbon revenues to finance supplier operations, lowering their costs and the costs to consumers.</p>	<p>Carbon credit sale mechanisms that allow service providers not only to finance their operation but also lower the costs of the offered solution, effectively passing this low cost to the consumer as a subsidy</p> <p>Consumer loans delivered through local banks and other intermediary financing institutions</p> <p>PAYG financing options and advisory support in partnership with local financial institutions</p> <p>Fiscal incentives such as tax exemptions via government policy</p>
	Institutional demand stimulation	Low demand for electricity, especially among low-income rural consumers, leads to underutilisation and limited viability for operators and inhibits the full range of applications possible with electricity access	<p>Support demand stimulation efforts through promotion of consumptive and productive use across sectors.</p> <p>Energy-efficient equipment purchase support for energy off-takers, such as households, micro, small and medium-sized enterprises (MSMEs), and public institutions (healthcare centres, schools, street lighting, etc.)</p>	<p>Upfront grants to undertake assessments of consumptive and productive loads</p> <p>Long-term budgets/grants to public facilities for electricity access products and services over system lifetime</p> <p>Concessional consumer financing facilities for productive use appliances</p> <p>Fiscal incentives to enhance the affordability of appliances</p>

ECOSYSTEM	Data and information	Up-to-date market intelligence data influencing system siting and design, planning and investment mobilisation is limited and often unreliable in the dispersed and fast-evolving sector	Carry out local surveys periodically and create comprehensive datasets to guide electrification planning and public procurement processes Invest in shared digital platforms or leverage existing services for data collection and reporting	Capital grants by DFIs/multilateral agencies to national government to build public data infrastructure
		Policies and regulations	Lack of cost-of-service regulations, which limits viability and scale for energy access solution providers	Commit long-term public finance to bridge the viability gap between developer revenues generated under regulated tariffs and reflective cost-of-service
	Lack of dedicated policy and regulations guiding the development of decentralised renewable energy solutions, including licensing, tariff setting and main grid arrival		Design and legislate dedicated policies and regulations for decentralised renewable energy solutions	Invest in planning for integrating decentralised systems into national and regional electrification strategies by setting up committees of experts
	Disbursement of public funding faces high transaction costs and delay risks due to long processes and cumbersome requirements relative to deal size		Make capital investments to automate and digitalise fund management systems and processes to reduce transaction costs and risks of delay, including via a portfolio licensing approach	Capital grants to help governments and providers set up shared digital platforms Government funds to set up and operate rural electrification agencies
	Lack of stability and challenges in accessing public finance incentives for the sector		Reduce uncertainties of public finance outlay for announced fiscal and other incentives	Cross-cutting subsidies amongst different electricity consumers
	Lack of long-term protective regulations that enable mini-grid planning and protect providers if the main grid arrives		Build robust policies and regulations around interconnected mini-grids and grid arrival, and a compensation plan to protect mini-grid assets	Risk mitigation by providing future guarantees Tariff structures and licensing through government regulation
	Skills and capacity building	Lack of locally available technical and non-technical skills for installation, operation and maintenance of systems, as well as other activities along the value chain	Support the development and adoption of standardised job task analysis covering various roles in the energy access sector Mainstream energy access technologies in curriculum within national technical and vocational education and training facilities Support the development of vocational skills and training initiatives	Learning grant schemes, energy related educational scholarships, levy grant schemes, etc, to develop local skills and job specialisations.
		Limited institutional capacity within public sector entities (including regulators) to implement programmes and processes at scale	Strengthen the capacity of regulators and public institutions to process approvals in a timely manner	
	Supply chains, technology and innovation	Lack of standards and certification infrastructure, particularly for decentralised renewable energy solutions and appliances	Develop and enforce standards for decentralised renewable energy solutions and appliances	Public procurement and grant based initiatives and programmes for the development of standards and quality assurance policies, and Research and Development initiatives.
		Lack of funding for energy-efficient appliance innovation, piloting and testing suitable for coupling with decentralised solutions	Invest in technology testing and certification infrastructure and make it accessible and affordable	
		Lack of local supply chains resulting in import dependency for products and components	Strengthen the innovation ecosystem for energy-efficient appliances through partnerships with local practitioners, academia and private sector	

ECOSYSTEM	Planning	Uncoordinated development of various electrification solutions often leads to conflicts and adds to investor risks	Support the development of integrated electricity access plans leveraging Geographic Information System (GIS) tools and up-to-date data, and optimising for available solutions and resources	Public procurement, with the involvement of experts, to facilitate the development of co-ordinated plans across the energy sector.
		Limited cross-sector collaboration to enhance complementarities of electricity access across sectors and uses, including healthcare and agriculture	Strengthen partnership between ministries and public entities to integrate opportunities for electrification of consumptive and productive use facilities as part of electrification plans	

Priority actions

Across electrification solutions, inclusiveness, affordability, and integrated planning remain top public investment priorities. In addition, SHSs require more local currency support, while productive use applications require demand stimulation investments. Priority areas for public finance investment in mini grids include project preparation, regulations, and standards. Priorities include to:

Incentivise mini-grid, SHS, and productive use solutions providers to expand services to hard-to-reach populations.

There is a need for mini-grid, SHS and productive use solution providers to expand services to hard-to-reach populations, yet currently available debt and equity structures do not sufficiently address suppliers' CAPEX and OPEX needs for expansion into remote areas. Potential instruments to channel public funds to incentivise solution providers to expand to these areas include:

- RBF in tandem with other incentives for suppliers to serve remote areas.
- Special purpose vehicles (SPVs) that employ receivables from current/future systems like PAYG.
- Concessions that remunerate suppliers based on cost-of-service for delivering a predetermined level of access.

Example: Kenya Off-Grid Solar Project (KOSAP)

Government-initiated KOSAP provides electricity services to remote, low-density and traditionally underserved areas through a combination of RBF and credit lines. This includes USD 12 million in RBF to compensate companies for initial and ongoing risks, and a USD 30 million debt facility to support hardware inventory costs and consumer financing.

Source: (KOSAP, 2018).

Deploy consumer- and supplier-facing public finance to improve affordability for low-income, underserved populations.

Market-based instruments like PAYG have addressed some consumer affordability hurdles by spreading overall costs over a longer timeframe, for instance, but monthly instalments remain out of reach for the most marginalised. Furthermore, addressing enterprise finance necessary for scaling up operations continues to pose a significant challenge. Potential instruments that can be used to deploy consumer- and supplier-related challenges include:

- Short-term consumer subsidies designed to reduce market distortion risks.
- Supply-side interventions, like tax exemptions and carbon revenues, to reduce costs, which can be passed on as consumer savings or additional revenues to complement (lower) consumer tariffs.

Example: Togo's CIZO Programme for SHSs

Given the nascency of the off-grid solar sector in Togo, the government utilised several subsidy schemes to improve supply and adoption of SHS. This included targeted end-user subsidies such as cash transfers and vouchers, supply-side subsidies such as grants for RBF and enabling environment interventions such as VAT exemptions.

Source: (Bauer and White, 2021).

Invest in integrated electrification planning and co-ordination to align solutions and ensure efficiency.

Multiple energy access solutions are often deployed independently, which leads to fragmented efforts and stagnated progress. Potential instruments that can be used to achieve integrated electrification planning include:

- Public finance to develop an integrated electrification plan and operate a unified project management unit for electrification programmes. It is important to provide capacity building and technical assistance to support the developers of these plans. Equipping developers with the necessary knowledge and skills to effectively implement and manage electrification initiatives promotes long-term viability and success.
- Capital grants to invest in digital data platforms or leverage existing services for data collection and reporting.
- Invest in cross-functional collaboration across other sectors and ministries, *e.g.* agriculture and microfinance.

Example: Nigeria Integrated Energy Planning Tool

In collaboration with SEforAll and the Rockefeller Foundation, the government of Nigeria launched the data-driven interactive Nigeria Integrated Energy Planning Tool in 2020, which uses geospatial modelling and optimisation, and provides actionable intelligence for stakeholders to plan the expansion of least-cost access to electricity and clean cooking.

Source: (SEforAll, 2021).

Facilitate local currency financing to mitigate the risk of currency mismatches and volatile exchange rates/inflation.

Electricity service enterprises often receive debt and equity financing in hard currency (mostly USD, EUR or GBP) from donors and multilateral agencies but generate revenues in local currency. The risk of local currency depreciation against the hard currency can increase the real value of debt repayments, which deters enterprises and investors. Instruments to facilitate local currency financing include:

- Partnerships with DFIs and local banks to reduce/eliminate risk, encourage funding through financial and fiscal incentives, and build bankers' awareness.
- Currency hedging facilities and currency exchange funds.

Example: d.light's local currency financing vehicle to accelerate rural electrification in East Africa

d.light's new financing vehicle, Brighter Life Kenya 2 Limited (BLK2), will provide multi-currency financing of up to USD 238 million in face-value receivables, over a commitment period of two years. This will provide continued access to sustainable and affordable receivables financing for its stand-alone system business in Kenya as well as enable its expansion into other African countries. BLK2 is expected to benefit 2.8 million people, with improved access to clean energy for 1.9 million people.

Source: (Takouleu, 2022).

Build consumer readiness by investing in awareness campaigns and user driven design and establishing trust by leveraging local communities for support and maintenance.

The perceived complexity of productive use products, low trust in after-sales service, and complex social and gender dynamics lead to low demand and adoption. There is also lack of awareness and skills regarding potential opportunities. Potential instruments that can help build consumer readiness include:

- Direct grants for NGOs to build awareness campaigns and for companies to prepare marketing material for targeted groups.
- RBF to incentivise enterprises to develop the last leg of the supply chain – after-sales service and quality assurance.

Example: Solar water pumps in Ghana

Women stand to benefit the most from access to reliable and low-cost irrigation solutions like solar water pumps. However, lack of awareness, availability, after-sales service and financing in rural areas has led to low adoption of this solution. PEG Africa worked with SNV to leverage women's groups such as village savings and loan associations to drive awareness in Ghana. Additionally, PEG staff located across the country ensure timely installation of pumps and resolution of technical issues. As of 2022 PEG Africa has over 700 000 daily users of solar pumps across Ghana, Côte d'Ivoire, Senegal and Mali.

Source: (Agbejule *et al.*, 2022).

Enable financial and technical assistance to prepare projects, engage communities and develop loads.

Preparing an energy access project such as a mini-grid requires financial and technical resources for feasibility studies, project planning and community engagement for load acquisition. This makes it difficult for smaller enterprises to attract investment. Potential instruments to enable financial and technical assistance initiatives include:

- Concessional equity investments in portfolios of mini-grid companies that can leverage economies of scale and reduce risks.
- Upfront grants from DFIs and multilateral agencies to support project planning and development by building technical knowledge for feasibility studies and investing in community engagement.
- Regional incubators and accelerators that can facilitate project preparation and development through access to debt, equity, and technical assistance (TA).

Example: Engie and CrossBoundary Energy Access (CBEA) portfolio investment in Nigeria

Engie and CBEA committed to build a USD 60 million portfolio of mini-grids in Nigeria. As the largest mini-grid project finance transaction in Africa to date, they expect to connect more than 150 000 people to electricity. Using a blended finance approach, CBEA will provide private capital along with performance-based grants (PBG), funded by the World Bank and administered by the Nigeria Electrification Project and the Rural Electrification Agency, to finance project development planning and construction activities.

Source: (CrossBoundary, 2022)

Prioritise investment and improvements in regulation and standards to de-risk and grow the sector.

The lack of flexibility in tariff setting for mini-grid projects, complex and lengthy licensing processes and lack of long-term regulations that protect mini-grids after grid arrival make the market unattractive to new and existing enterprises. Potential instruments that can help prioritise investment and improvement in regulations and standards to de-risk and grow the sector include:

- Streamline the licensing process and relax size thresholds for required licensing.
- Direct and crosscutting subsidies and flexible tariffs structures to make electricity more affordable to low-income households.
- Mitigate risk to operators via robust policies and planning on grid arrival, site demarcation and land acquisitions, grid interactivity, and a guaranteed compensation plan to protect mini-grid assets.

Example: Rwanda Utilities Regulatory Authority (RURA)

RURA has developed a dedicated mini-grid regulatory framework with tiered licensing based on the mini-grid size, along with flexible tariffs. The regulation provides several options to operators in case the main grid arrives. RURA also mediates conflicts in case the utility and mini-grid operators cannot reach an agreement on the purchase price. RURA is mandated to consider the mini-grid operator's investments in awareness and demand-building efforts, in addition to infrastructural investments.

Source: IRENA, 2016)

3. ACCESS TO CLEAN COOKING: CHALLENGES AND INSTRUMENTS TO CHANNEL PUBLIC FINANCE

This section provides details on the key challenges to achieving universal access to clean cooking, and relevant instruments to channel public finance into supply, demand and the ecosystem. This section was informed by the following reports: Advancing renewables-based clean cooking solutions: Key messages and outcomes (IRENA, 2024), Roadmap for Access to Clean Cooking Energy in India (Patnaik *et al.*, 2019), Clean Cooking RBFs: Key Design Principles (Clean Cooking Alliance and MECS, 2021), Financing Renewable Energy: Options for Developing Financing Instruments Using Public Funds (World Bank and Climate Investment Funds, 2011), The clean cooking systems strategy: Accelerating universal access to clean cooking (Clean Cooking Alliance, 2021), Clean cooking sector strategy: Emerging insights from user research (Clean Cooking Alliance, 2020), Entrepreneurship development programme in clean cooking (MECS, 2022), Uganda eCookbook (Chapungu, 2022), Techno-policy spaces for e-cooking in Kenya (Atela *et al.*, 2021), and Energizing finance: Understanding the landscape (SEforAll *et al.*, 2021).

Unlocking solutions for clean cooking access: Leveraging public finance and its instruments

Table 2 presents the challenges facing universal access to clean cooking, potential uses of public finance to address the challenges and the instruments that can be used to channel public funds to the suppliers of technology, consumers and the ecosystem in general.

Table 2 Clean cooking access challenges, public finance to address them and potential instruments

	WHAT CHALLENGES	WHY POTENTIAL USES OF PUBLIC FINANCE	HOW POTENTIAL INSTRUMENTS
SUPPLY	<p>Early-stage innovation and demonstration</p> <p>Many cookstove models do not address user needs, given various socio-cultural factors such as cooking traditions and beliefs</p>	<p>Build a user insights lab on a national/regional scale to research and design product and marketing improvements. Additionally, in-field testing to collect actual user experience in the actual cooking environment would help move beyond the lab.</p>	<p>Direct R&D grants to concerned clean cooking labs</p>
	<p>Renewables-based cookstove technologies are nascent and require significant investment in R&D to (a) increase cooking efficiency, (b) lower per-unit emissions, and (c) lower costs</p>	<p>Incentivise and incubate new technology/experiments to improve the efficiency of improved cookstoves.</p> <p>Promote innovation and demonstration via grant challenges</p>	<p>Contingent project development grants and concessional equity through innovation accelerators</p> <p>Upfront grants to tech coalitions, research organisations and companies</p>
	<p>Project preparation</p> <p>Absence of infrastructure to generate, market and distribute biofuels to households for clean cooking use cases</p>	<p>Work with stakeholders to develop a biofuel supply chain from sourcing and distribution of fuels, to manufacturing cookstoves</p>	<p>Contingent project development grants to large-scale domestic biofuel programme implementers</p>

SUPPLY	Enterprise growth	<p>Difficult to secure debt or equity for working capital from investors, banks and other private players. Most clean cooking entrepreneurs operate solely on donations and grants from foundations and multilateral agencies, with some input from carbon finance sources</p>	<p>Provide TA for clean cooking entrepreneurs, especially women, to build sustainable business models and support their competitiveness in securing credit from financial institutions</p> <p>Increase liquidity and reduce the risk for private lenders to allow capital loan disbursements to clean cooking businesses</p>	<p>Venture capital and TA through accelerators and venture capital funds</p> <p>Credit lines for banks and other commercial financial institutions</p> <p>Liquidity guarantees to ease private investors' concerns</p>
	Permanency and sufficiency of service	<p>Centralised repair infrastructure does not exist. Companies are small-scale and cannot afford to offer their own repair service or their service is low quality</p> <p>Owners of clean cooking systems are not trained to resolve breakdowns</p>	<p>Invest in multi-product/provider helplines for households to report breakdowns and guarantee repair timelines to streamline easy operation and maintenance for existing biogas plants</p> <p>Provide training in maintenance to local entrepreneurs and workers and in plant operation to users</p>	<p>Upfront grants to service providers</p> <p>Grants/concessional loans to skilling institutions and TA agencies to reduce training costs</p>
DEMAND	Community awareness and engagement	<p>Reaching remote communities requires additional efforts such as translation and awareness campaigns</p> <p>Socio-cultural factors such as cooking traditions, gender norms, and beliefs often stall product acceptance, usage and impact</p> <p>Low awareness among poor households that indoor air pollution (IAP) is a potentially deadly health risk, and insufficient prioritisation of health of women (often responsible for cooking)</p>	<p>Partnership with village agents and local NGOs to establish awareness campaigns on IAP and promote clean cooking alternatives</p>	<p>Upfront grants to run targeted campaigns to reach consumers and drive demand</p>
		<p>High failure rate of older biodigester models led to poor perceptions among households and funders</p>	<p>Organise demonstrations for households and private financiers that showcase modern technologies and differences from older models</p>	<p>Upfront grants through NGOs/industry associations</p>
	End-user affordability	<p>Steep cost of acquiring a cookstove, often seen as a high trade-off for low-cost labour required for traditional cooking (often led by women)</p> <p>Household funding (e.g. for biogas) is largely provided through collateral loans with high interest rates by commercial banks, thus limiting access for low-income households</p> <p>Lack of incentives for sustained use – subsidies are a small fraction of the operation cost (e.g. refill/battery), which is not enough in most cases for rural households</p>	<p>Disburse subsidies and deploy short-term promotions for installation of fuel connections and stoves to lower upfront costs</p> <p>Provide low-interest loans to households for installations through local banks, along with flexible payment plans</p> <p>Carry out bulk procurement of fuel to implement a PAYG model for end consumers to improve affordability</p>	<p>Direct subsidies through national schemes promoting installations</p> <p>Concessional loans through national public banks</p> <p>Bulk procurement through government-led cooking PAYG scheme in partnership with suppliers</p>

ECOSYSTEM	Data	Lack of up-to-date data on costs and impact metrics of clean cooking solutions to inform policy, planning and financing decision making	Large-scale verification and market analyses of national and locally implemented clean cooking programmes and their impact not only on energy but also on adjacent sectors Harmonisation of methodology for crediting emissions reductions from clean cooking projects to enhance accountability and transparency	Grants to ecosystem players to strengthen data gathering and reporting frameworks and harmonisation efforts
	Institutional awareness and intelligence	Lack of shared learnings from clean cooking projects results in repetition of failed models in new markets and geographies, and inefficient use of available ecosystem funding Lack of understanding of localised user preferences and global market dynamics affecting fuel costs result in simplistic global approaches that do not adequately meet the needs of all user segments or reflect local realities	Build public country-level intelligence on innovation successes and failures among enterprises and investors, to help governments develop national targets, plans and strategies Develop knowledge materials for financing stakeholders that set realistic expectations on clean cooking solutions and risks involved	Capital grants by DFIs/multilateral agencies to national government to build public data infrastructure and intelligence
	Policies and regulations	Clean cooking is often not a part of national integrated energy planning or nationally determined contributions (NDCs)	Convene institutional meetings to support governments to quantify the mitigation potential of clean cooking solutions, elevate finance for clean cooking and integrate into NDCs	Upfront grants to alliances and national advocacy agencies to convene institutional meetings among governments
		Lack of common quality and technical standards , especially solution-agnostic standards and testing/certification	Build a standards and testing programme to (a) help countries translate international performance standards into local policy, and (b) strengthen local testing expertise and harmonisation through capacity building	TA grants to international standard-setting bodies to assist governments in setting national certification requirements and testing infrastructure
	Skills and capacity building	National governments face challenges such as co ordination, financing, and institutional and political capacity that prevent them from adopting and/or implementing ambitious and viable clean cooking transitions	Establish and support formal network-building opportunities among key country-level stakeholders, including local and international advocacy organisations, civil society groups, industry representatives, investors and enterprises, to co ordinate, leverage and streamline efforts, and strengthen connections with the government	Ecosystem building grants to national governments
		Lack of central accountability for clean cooking targets and outcomes, which are often spread across multiple ministries and agencies	Set up integrated planning mechanisms and a national delivery unit network to establish and support national delivery and programme implementation units dedicated to clean cooking	Grants by DFIs/multilateral agencies to national governments to fund integrated delivery and national delivery unit networks
		Weak linkages among private stakeholders and the government, leading to a lack of co-ordination and implementation of effective large-scale policy building and programmes		
		Unpredictable adoption patterns of clean cooking solutions in real-use conditions, increasing the risk and cost of implementing large-scale programmes	Pilot field testing and impact evaluations of lab-tested clean cooking solutions in new population segments	Upfront grants to programme implementation and distribution players

Priority actions

For clean cooking, early-stage market development and awareness raising have emerged as top public investment priorities. Integrated planning with the electricity sector, and innovation across technology solutions also present a promising opportunity for public finance providers. Public finance can be used in creative ways to unlock private sector finance to respond to the following priorities:

Unlock private capital by building investor awareness, interest, and trust in clean cooking solutions

Enterprises struggle to raise sufficient private funding owing to perceived high risks and misalignments in risk-return profiles for clean cooking investments, unproven business models, and lack of trust in solution efficacy. Potential instruments that can be used to unlock private capital for the scale-up of clean cooking solutions include:

- Develop and strengthen private sector enterprises through results-based public financing.
- Deliver knowledge and tools that drive market growth, including realistic projections of ROI and impact.
- Build infrastructure and mechanisms that help crowd in more enterprises.

Example: World Bank carbon RBF that rewards and showcases climate ROI

Carbon Initiative for Development (Ci-Dev) is a World Bank-administered trust fund that makes payments based on the amount of greenhouse gas emissions that has been avoided. The clean cooking programs in this fund cover efficient cooking appliances, biogas, and ethanol, and are based in Burkina Faso, Ethiopia, Lao PDR, and Madagascar.

Source: (World Bank, 2020).

Improve household demand and bridge affordability gaps through awareness programs and subsidies

Rural households often have low awareness about indoor air pollution risks, and low adoption of clean fuels. Reaching key target audiences, especially women, and ensuring affordability for sustained household use remains challenging. Potential instruments that can be used to improve household demand and bridge affordability gaps include:

- Organise broad-based awareness campaigns and targeted programs to drive behavioural change
- Support marketing campaigns conducted by clean cooking suppliers
- Provide demand subsidies for households to cover the extra cost of clean fuels

Example: Uganda's initiative to improve e-cooking demand

The Charcoal to Power Project in Uganda is an initiative of the Electricity Regulatory Authority, aimed at growing demand and usability of electricity through special reduced tariffs for cooking with electricity in households, institutions, and commercial establishments. Under the project, the ERA wants to convert 50 000 households, 500 institutions, and commercial enterprises from biomass to electricity as the primary source of energy for cooking or heating.

Source: (IRENA, 2022).

Empower and support national governments to lead clean cooking transitions through integrated planning

Clean cooking typically cuts across the mandates of numerous government agencies, leading to limited attention, expertise, and capacity to implement policies and investments for a national transition. Potential instruments that can be used to empower and provide support to integrated planning for clean cooking solutions include:

- Empower and support national governments to develop and execute integrated and holistic clean cooking strategies
- Build country-level intelligence on innovation successes and failures as a public good
- Establish a formal network among various stakeholder groups within a country or region to streamline efforts

Example: Kenya's initiatives to champion clean cooking as part of broader energy agendas

Though energy policy in Kenya has been disconnected across sectors, Kenya updated its NDCs in 2020, clearly highlighting the need to connect clean cooking and electrification goals. The Government of Kenya also took a leading role at global high-level political forums, including HEPA (Health and Energy Platform for Action) and COP 27, championing the clean cooking agenda and highlighting the need to drive progress by connecting with the electrification sector.

Source: (Ministry of Environment and Forestry, 2020).

Foster rapid and effective innovation to advance clean cooking solutions and business models

Clean cooking solutions (especially Tier 4-5) are relatively nascent and need targeted R&D support to improve efficiency, user design, and affordability. Potential instruments that can be used to foster rapid and effective innovation to advance clean cooking solutions and their business models include:

- Support the continued development of user-centric, high-performing clean cooking solutions and commercially sustainable business models.
- Provide grants for clean cooking solution developers to test new products and markets.

Example: Promoting early clean cooking businesses in India

Modern Energy Cooking Services (MECS), a UKAid-funded programme launched an Entrepreneurship Development Program in India to identify, nurture, fund, and scale clean cooking ideas and solutions into sustainable and scalable businesses. Under the program, 13 entrepreneurs were selected, trained, and mentored for up to three months to help them in creating a strategy and business plan, and cash grants of INR 2.5 lakhs (~USD 3 000) were awarded to the top three entrepreneurs.

Source: (Ministry of Micro, Small & Medium Enterprises, 2019).

Mobilise and diversify investment in supporting local ecosystems and solutions.

Biogas and biofuel projects often depend on critical public finance commitments to develop supply chains, mobilise the participation of local enterprises, and develop distribution networks (for ethanol) to improve rural access. Potential instruments to support the mobilisation and diversification of investments include direct public funding to build the end-to-end supply chain for local enterprises, including setting up digesters (industrial or residential), distribution networks for biofuel, cookstove manufacturing and distribution, and operation and maintenance services.

Example: Cambodian National Biodigester Program for large-scale plant construction

The Cambodian National Biodigester Program was set up in 2006 by the Cambodian Ministry of Agriculture, Forestry and Fisheries (MAFF) and SNV, to establish independent enterprises in rural areas and build their capacity on marketing and promotion, internal quality control, and after-sales services. Between 2006-2021, nearly 29 000 biodigesters were constructed under this program through 118 micro-enterprises. The programme was one of the first large scale biogas projects to be certified by Gold Standard. Starting from 2017, MAFF has been using funds generated through the sale of carbon credits to sustain and broaden the scope of the programme.

Source: (SNV, 2024).

Establish stronger partnerships with the electricity sector to advance electric cooking

Electric and solar cooking receive low volumes of committed and disbursed finance, mostly driven by carbon markets. These solutions can provide fully renewable and higher tier access and warrant higher public funding to build necessary infrastructure and maturity for private investment. Potential instruments to support the establishment of stronger partnerships between electric cooking and the electricity sector include:

- Program designs that meet both electricity and clean cooking goals through implementation partnerships across both sectors
- Subsidies to meet household appliance financing needs to encourage a switch to electric cooking

Example: Uganda's electric cooking tariff

In 2021, Uganda's Minister of Energy and Mineral Development launched an amended electricity tariff structure that includes the introduction of the cooking tariff, applicable to customers served by the utility, Umeme Ltd. The tariff is a deliberate strategy by the government to displace charcoal and other biomass sources of cooking fuel, by making the cost of electric cooking lower. The tariff was introduced under a declining block tariff structure, which allows for differentiated tariff levels based on the amount of energy consumed, whereby the units of electricity consumed by a domestic customer beyond a set monthly threshold, announced by the authority, are charged at a lower tariff. With the cooking tariff, consumers pay 412 Ugandan shillings (UGX) for each unit of electricity in the threshold approved by the Electricity Regulatory Authority (from 81 kilowatt-hours [kWh] to 150 kWh).

Source: (IRENA, 2024).

4. FRAMEWORK FOR THE FLOW OF PUBLIC FINANCE FOR ENERGY ACCESS

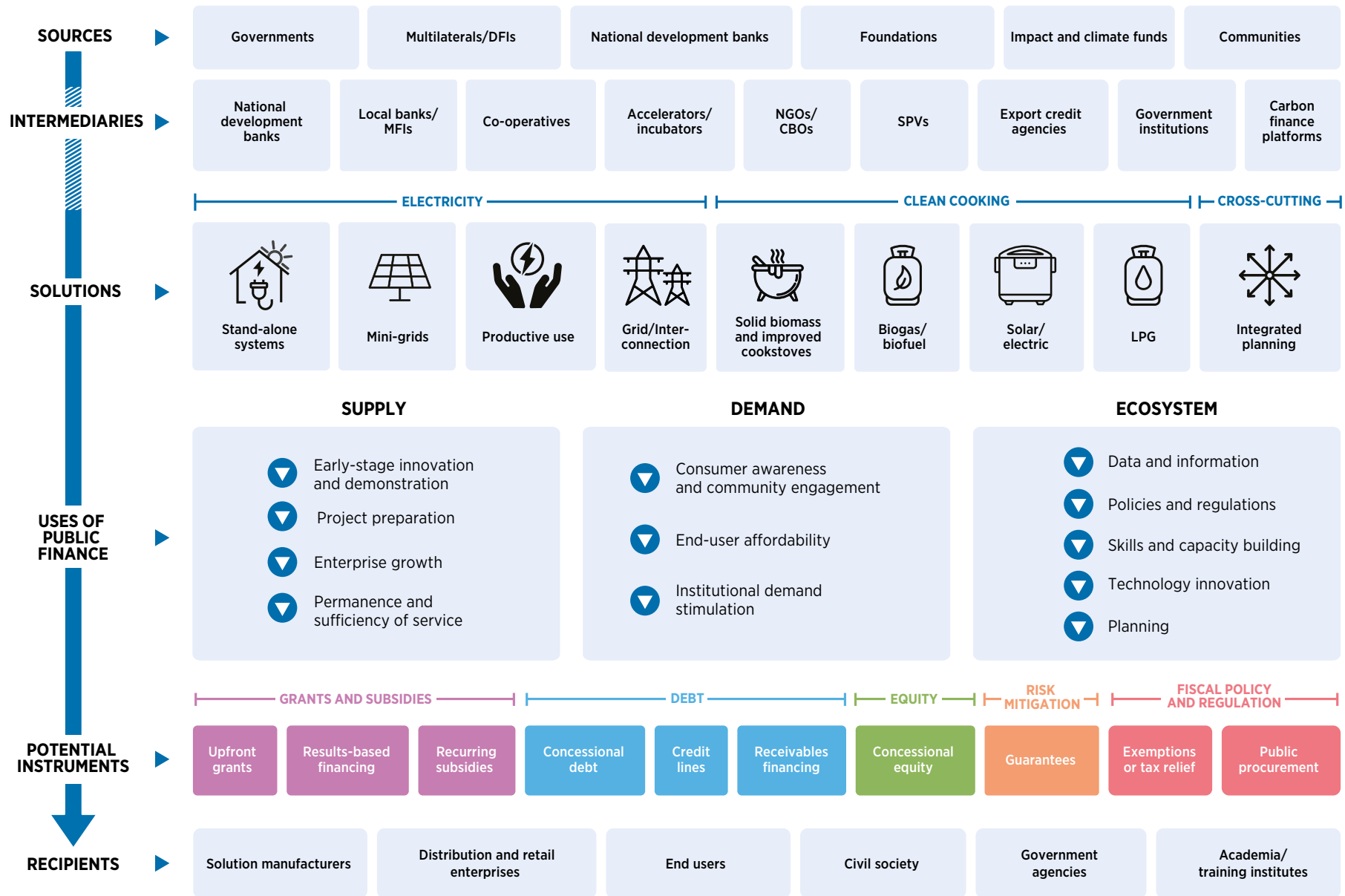
The framework proposed in this brief provides a foundation for policy makers and public financiers to map the public finance needs across the energy access ecosystem, identify the preferences of stakeholders including suppliers and recipients regarding public finance instruments, and assess existing public finance flows throughout the whole ecosystem. In line with this objective, the report offers an actionable framework applicable to a variety of contexts and uses, such as varying levels of energy access and market maturity. The framework provides wide (but non-exhaustive) visibility on the range of public finance sources, intermediaries, uses, and instruments to channel them towards suppliers and consumers and throughout the energy access ecosystem (Figure 1). It contextualises public finance needs for universal energy access within the broader context of the need for international collaboration to achieve a just and inclusive energy transition.

The framework has six levels illustrating the range of components through which funding may flow, from source to recipient. The categories in the framework provide a holistic view of the public finance landscape, but are neither exhaustive nor mutually exclusive, given that many solutions and instruments are often deployed together.

The framework illustrates the following:

- **Sources:** Primary sources of public funding, from donor governments and multilateral institutions, sometimes in combination
- **Intermediaries:** Global, regional, national and local institutional channels through which funding may flow. Actors across these channels typically add services, value and/or expertise in addition to enhancing accessibility.
- **Solutions:** Specific solutions and services in the access to energy space (this report focuses on access to electricity, clean cooking and integrated energy access planning)
- **Uses of public finance:** Opportunities to deploy public funding to address the needs of providers (supply), end users (demand), as well as the broader ecosystem support (see annex for detailed definitions)
- **Potential instruments:** Types of financial and public finance instruments that can be deployed.

Figure 1 Framework for the use of public finance for expanding energy access



Notes: CBO = community-based organisation; DFI = development finance institution; LPG = liquefied petroleum gas; NGO = non-governmental organisation; SPV = special purpose vehicle.

5. CONCLUSION

Public finance has a critical role to play in addressing gaps in access to clean, modern energy and ensuring inclusive and sustainable outcomes for providers, end-users of energy and the sector at large. Such investments should be designed holistically to ensure broad-based benefits in pursuit of SDG 7.

In doing so, well-designed public finance investments should: emphasise an integrated approach across stakeholders, agencies and solutions; target the underserved; be flexible to changes in the market; ensure proportionality between public and private funds; invest in results monitoring; and have an exit plan in place where feasible.

This framework has sought to shed light on the breadth of stakeholders and tools available to policy makers and investors seeking to deploy public finance to improve modern energy access for all.

Next steps for further research include:

- A more in-depth and comprehensive assessment of the challenges and public finance solutions across supply, demand and the ecosystem, including a focused assessment of priority technology solutions.
- Specific guidance on the design and operationalisation of specific public finance instruments.
- The differential roles that various actors can play, and how they can work together and with private finance providers to optimise investments most efficiently.
- Application of the framework to account for regional and other context-specific nuances.
- How to mobilise funds from both domestic and international sources to address the supply, demand and ecosystem needs highlighted in this report.

ANNEX

Definitions of uses of public finance outlined in the framework

Supply	Demand	Ecosystem
Innovation and demonstration: Pre-commercial funds/risk capital to develop and deploy solutions	Consumer awareness and community engagement: Awareness building and demand creation in underserved areas	Data: Improvement in real-time integrated data collection and reporting for decisions
Project preparation: Coverage of shared costs to move from feasibility planning to implementation	End-user affordability: Direct support to low-income households for services/products and fuels/inputs for inclusive outcomes	Institutional awareness and intelligence: Investing in market reports to build sector buy-in and help stakeholders improve services
Enterprise growth: Access to financing and fiscal support for companies (especially local SMEs) to address CAPEX and OPEX needs and/or to enter/increase penetration in underserved geographies	Institutional demand stimulation: Equipment purchase support for large energy offtakers, such as farms, agri- and non-agri MSMEs, and public institutions (hospitals, schools, etc.)	Policies, planning and regulations: Framework for investments and division of roles and responsibilities; standards to guide practice
Maintenance support: Enable after-sales service and support for sustained use		Capacity building and implementation: TA and support for execution of programmes, policies and incentives; enterprise advisory support; sectoral skills development

Methodology

Intended audience:

- Primary audience: Policy makers.
- Secondary audience: Donors (including philanthropies), public financiers, industry think tanks and intermediaries.

Primary sources

- Desk review: We have relied on a range of recent documents from leading organisations in this sector, such as IRENA, SEforAll and ESMAP, among others.
- Expert consultation: We conducted interviews with seven experts across the sector to seek current insights, validate assumptions and align on priorities. We also relied on consultation and input from Dalberg's internal roster of energy experts.

Limitations of the report

- Not an exhaustive or in-depth landscape. Many other solutions and nuances remain important in these markets.
- Offers illustrative but non-comprehensive insights:
 - Solutions: LPG cooking and grid electricity are important parts of the access-to-energy menu and feature in the framework but are not discussed in the document detail.
 - Instruments: Offers examples but not an exhaustive list of potential tools; policy makers and financiers are encouraged to explore lesser-known and innovative instruments for public and blended finance.
 - Case studies: Provide directional, qualitative estimates of in-country flows, but do not provide a comprehensive assessment of flows or needs to date.
- Does not identify tracking methods on how the funds can be collected, managed and disbursed.
- Does not identify key metrics for assessing the success or impact of public finance investments.

REFERENCES

- Atela, J., et al. (2021)**, "Techno-policy spaces for e-cooking in Kenya", <https://mecs.org.uk/publications/techno-policy-spaces-for-e-cooking-in-kenya>.
- Bauer, G., and White, Z. (2021)**, "Smart subsidies and digital innovation: Lessons from Togo's off-grid solar subsidy scheme", Mobile for Development, www.gsma.com/mobilefordevelopment/programme/digital-utilities/smart-subsidies-and-digital-innovation-lessons-from-togos-off-grid-solar-subsidy-scheme (accessed 20 February 2024).
- Bloomberg NEF, and SEforAll (2020)**, *State of the Global Mini-grids Market Report 2020*, www.seforall.org/system/files/2020-06/MGP-2020-SEforALL.pdf (accessed 20 February 2024).
- Chapungu, V. (2022)**, "Uganda eCookbook", <https://mecs.org.uk/wp-content/uploads/2022/04/Uganda-eCookbook-.pdf>.
- CLASP (2022)**, "Press Release: CLASP & Nithio Launch Financing Facility for Productive Use Appliances", CLASP, www.clasp.ngo/updates/press-release-clasp-nithio-with-support-from-the-global-energy-alliance-for-people-and-planet-launch-financing-facility-for-productive-use-appliances (accessed 20 February 2024).
- Clean Cooking Alliance (2020)**, *Clean cooking sector strategy: Emerging insights from user research*, https://docs.google.com/presentation/d/e/2PACX-1vQ9-Rv9FG72q4yVjXKtUB8v80TnZiiTe5-7lwADpp___MU8cdg7n6Sgb2HnrPKaUBCE9DfWIDs87Q5H/pub?start=false&loop=false&delayms=60000&slide=id.g8ddf309ae0_0_0&usp=embed_facebook (accessed 20 February 2024).
- Clean Cooking Alliance (2021)**, *The Clean Cooking Systems Strategy: Accelerating universal access to clean cooking*, <https://cleancooking.org/wp-content/uploads/2022/10/CCA-Clean-Cooking-Systems-Strategy-Horizon-1-Theory-of-Transformation-October-2022.pdf> (accessed 20 February 2024).
- Clean Cooking Alliance, and MECS (2021)**, *Clean Cooking RBFs: Key design principles*, <https://cleancooking.org/wp-content/uploads/2022/10/CCA-Clean-Cooking-RBFs-Report-2022.pdf> (accessed 20 February 2024).
- CrossBoundary (2022)**, "CrossBoundary Energy Access and ENGIE Energy Access Sign Largest Mini-Grid Project Finance Transaction in Africa to Build \$60M of Mini-Grids in Nigeria", <https://crossboundary.com/wp-content/uploads/2023/09/CBEA-ENGIE-Nigeria-Announcement-Press-Release-Final.pdf> (accessed 4 April 2024).
- ENDEV (2020)**, *Productive Use of Energy: Moving to scalable business cases*, https://endev.info/wp-content/uploads/2021/03/EnDev_Learning_Innovation_PUE.pdf (accessed 20 February 2024).
- ESMAP (2022)**, *Designing Public Funding Mechanisms in the Off-Grid Solar Sector*, Washington D.C., World Bank, <https://documents1.worldbank.org/curated/en/099300005162263450/pdf/P17515006776e102308e980bb2d798ca5c3.pdf> (accessed 20 February 2024).

- ESMAP, N. G. (2022)**, *Off-grid solar market trends report 2022: State of the sector*, No. DOE/EE--0989, 1220825 (p. DOE/EE--0989, 1220825), <https://doi.org/10.2172/1220825>.
- GET.Transform (2020)**, "Sierra Leone: A Cost-Reflective Mini-Grid Tariff Framework", www.get-transform.eu/sierra-leone-case-study-a-cost-reflective-mini-grid-tariff-framework.k
- IEA, et al. (2023)**, *Tracking SDG7: The energy progress report 2023*, International Energy Agency, International Renewable Energy Agency, United Nations Statistics Division, the World Bank and World Health Organization, Geneva, www.irena.org/Publications/2023/Jun/Tracking-SDG7-2023.
- IRENA (2016)**, *Policies and regulations for private sector renewable energy mini-grids*, International Renewable Energy Agency, Abu Dhabi, www.irena.org/publications/2016/Sep/Policies-and-regulations-for-private-sector-renewable-energy-mini-grids (accessed 31 January 2022).
- IRENA (2024)**, *Advancing renewables-based clean cooking solutions: Key outputs from IRENA's webinar series*, International Renewable Energy Agency, Abu Dhabi.
- IRENA and AfDB (2022)**, *Renewable Energy Market Analysis: Africa and its Regions*, www.irena.org/publications/2022/Jan/Renewable-Energy-Market-Analysis-Africa (accessed 18 August 2022).
- IRENA, and CPI (2023)**, *Global landscape of renewable energy finance 2023*, International Renewable Energy Agency and Climate Policy Initiative, Abu Dhabi, www.irena.org/Publications/2023/Feb/Global-landscape-of-renewable-energy-finance-2023.
- KOSAP (2018)**, "Kenya Off-Grid Solar Access Project", www.kosap-fm.or.ke (accessed 4 April 2024).
- MECS (2022)**, *Entrepreneurship Development Programme in Clean Cooking*, <https://mecs.org.uk/wp-content/uploads/2022/07/Entrepreneurship-Development-Programme-in-Clean-Cooking.pdf> (accessed 20 February 2024).
- Ministry of Environment and Forestry (2020)**, "Kenya's First NDC (updated version)", <https://unfccc.int/sites/default/files/NDC/2022-06/Kenya%27s%20First%20%20NDC%20%28updated%20version%29.pdf> (accessed 4 April 2024).
- Ministry of Micro, Small & Medium Enterprises (2019)**, "Entrepreneurship and Skill Development Programs", <https://msme.gov.in/entrepreneurship-and-skill-development-programs> (accessed 4 April 2024).
- ORENA, A. G. (2022)**, "ERA targets 50,000 homes to shift from charcoal to power", The Observer - Uganda, <https://observer.ug/news/headlines/73411-era-targets-50-000-homes-to-shift-from-charcoal-to-power> (accessed 4 April 2024).
- Patnaik, S., et al. (2019)**, "Roadmap for Access to Clean Cooking Energy in India", www.ceew.in/publications/roadmap-access-clean-cooking-energy-india-0.
- SEforAll (2021)**, "Nigeria Integrated Energy Planning Tool", <https://nigeria-iep.sdg7energyplanning.org> (accessed 4 April 2024).
- SEforAll, and CPI (2021)**, "Energizing Finance: Understanding the Landscape 2021", www.seforall.org/publications/energizing-finance-understanding-the-landscape-2021.

SNV (2024), "National Biogas Programme (NBP) - Cambodia", <https://snv.org/project/national-biogas-programme-nbp-cambodia> (accessed 4 April 2024).

UNDP (2024), *Financial Aggregation for Distributed Renewable Energy in East Africa: Regional Assessment and Action Plan*, <https://www.undp.org/publications/financial-aggregation-distributed-renewable-energy-east-africa-overview-region> (accessed 26 March 2024).

USAID (2023), "Establishing Tariffs for Mini-Grids", U.S. Agency for International Development, www.usaid.gov/energy/mini-grids/regulation/tariffs (accessed 20 February 2024).

World Bank (2020), *Carbon Initiative for Development*, www.ci-dev.org/who-we-are (accessed 4 April 2024).

World Bank, and Climate Investment Funds (2011), *Financing Renewable Energy: Options for Developing Financing Instruments Using Public Funds*, <https://documents1.worldbank.org/curated/zh/196071468331818432/pdf/765560WPOFinan00Box374373B00PUBLIC0.pdf> (accessed 20 February 2024).



www.irena.org

Copyright © IRENA 2024