



HIGH-LEVEL DIALOGUE ON  
**ENERGY**  
UNITED NATIONS, NEW YORK, SEPTEMBER 2021

THEME REPORT ON  
**ENERGY  
ACCESS**

**TOWARDS THE ACHIEVEMENT OF  
SDG 7 AND NET-ZERO EMISSIONS**

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**For further information, please contact:**  
**Secretariat of the High-level Dialogue on Energy 2021**  
**Division for Sustainable Development Goals**  
**Department of Economic and Social Affairs**  
**United Nations**  
**<https://www.un.org/en/conferences/energy2021/about>**  
**Email: [salame1@un.org](mailto:salame1@un.org)**

# ACKNOWLEDGEMENTS

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## THE TWG ON ENERGY ACCESS CONSISTED OF:

### Co-Lead organizations



United Nations Development Programme (UNDP)



United Nations Office for Least Developed, Landlocked and Small Island Developing States (UNOHRLLS)



World Bank

### TWG Members

<b>Madhusudha Adhikari</b>	Alternative Energy Promotion Centre
<b>Sohel Ahmed</b>	Grameen Shakti
<b>Mary Anderson</b>	Permanent Mission of the UK to the United Nations
<b>Ladé Araba</b>	Convergence Africa
<b>Raffaella Bellanca</b>	World Food Programme

<b>Morten Houmann Blomqvist</b>	Ministry of Foreign Affairs, Denmark
<b>Mark Carrato</b>	Power Africa, USAID
<b>Divina Chingcuanco</b>	RTI International
<b>Deborah Cornland</b>	Swedish International Development Cooperation Agency
<b>Ashvin Dayal</b>	The Rockefeller Foundation
<b>Denis Derushkin</b>	Russian Energy Agency
<b>Christine Egan</b>	CLASP
<b>Solomone Fifita</b>	Pacific Centre for Renewable Energy and Energy Efficiency
<b>Nicolas Guichard</b>	Agence Française de Développement
<b>Ghania Kaci</b>	Ministry of Energy and Mines, Algeria
<b>Svitlana Karpyshyna</b>	Energy Community
<b>Adam Kendall</b>	McKinsey & Company
<b>Shazia Khan</b>	EcoEnergy
<b>Jacqueline Kimeu</b>	Access Coalition
<b>Dymphna van der Lans</b>	Clean Cooking Alliance
<b>Chebet Lesan</b>	BrightGreen Renewable Energy, Ltd.
<b>Guangqing Liu</b>	China Alliance for Clean Cookstoves
<b>Francesca Manenti</b>	Centro Studi Internazionali
<b>Vijay Modi</b>	The Earth Institute at Columbia University
<b>Nthabiseng Mosia</b>	Easy Solar
<b>Yewande Olagbende</b>	Solad Power Group
<b>Sheila Oparaocha</b>	ENERGIA International Network on Gender and Sustainable Energy
<b>Cathy Oxby</b>	Africa GreenCo
<b>Sam Parker</b>	Shell Foundation
<b>Ignacio Perez-Arriaga</b>	MIT and Universidad Pontificia Comillas
<b>Koen Peters</b>	GOGLA
<b>Jeff Prins</b>	IKEA Foundation
<b>Hafeez Rehman</b>	VITO; VITO Arabia LLC
<b>Wale Shonibare</b>	African Development Bank
<b>Stefano Signore</b>	European Commission
<b>Kristina Skierka</b>	Power for All
<b>Natalia Soebagjo</b>	Publish What You Pay Indonesia
<b>Beniamin Strzelecki</b>	SDG7 Youth Constituency
<b>Anahí Urquiza</b>	Chile University and Energy Poverty Network
<b>Frank van der Vleuten</b>	Ministry of Foreign Affairs of the Netherlands
<b>Saskia Werther</b>	Doen Foundation
<b>Davida Wood</b>	World Resources Institute
<b>Yongping Zhai</b>	Asian Development Bank



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Additional input was received from representatives of some of the Member State Global Champions for Energy Access: the Global Champions for Energy Access are China, the European Union, Japan, Kenya, Malawi, Netherlands, Russian Federation and Saudi Arabia. The views expressed in this publication do not necessarily reflect those of the Member State Global Champions.

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For further information, please contact:

**Secretariat of the High-level Dialogue on Energy 2021**

**Division for Sustainable Development Goals**

**Department of Economic and Social Affairs United Nations**

<https://www.un.org/en/conferences/energy2021/about>

Email: [salame1@un.org](mailto:salame1@un.org)



# PREFACE

Energy can create transformational opportunities. For the 759 million people in the world who lack access to electricity, the introduction of clean energy solutions can bring vital services such as improved healthcare, better education and affordable broadband, creating new jobs, livelihoods and sustainable economic value to reduce poverty. In regions such as sub-Saharan Africa where half of secondary schools and a quarter of health facilities have no power, clean energy access will help save lives, and offer opportunities for prosperity at a transformative scale.

An energy revolution based on renewables and energy efficiency is urgently needed not just to accelerate economic progress and development, but also to slash emissions that are rapidly warming our planet. The energy sector today, dominated by fossil fuels, accounts for 73 per cent of human-caused greenhouse gas emissions. Global CO<sub>2</sub>e emissions must be halved by 2030 to avoid an increasing frequency and severity of dangerous and unprecedented weather extremes, including heatwaves, devastating floods and droughts, risks to food and water security, population displacement, and loss of lives and livelihoods.

As governments start to define a pathway out of the COVID-19 crisis, we must now ensure that all countries have the chance to be part of an energy transition that seizes the opportunity to significantly improve the wellbeing of people, and planet.

This will not be an easy task. To ensure a just transition, we must support countries and communities to adapt to a green economy through social protection and new skills, ensuring all who need to be are equipped to take advantage of the 30 million new green jobs expected by 2030.

To generate the vital momentum needed for this transition, the UN Secretary-General is convening the High-Level Dialogue on Energy in September 2021, the first such meeting in 40 years. The landmark event will offer a global stage for countries to attract new investments and forge new impact focused partnerships to drive forward this energy revolution.

As a foundation for informed deliberations, five Technical Working Groups were established on the five key themes of the High-level Dialogue: (1) Energy Access, (2) Energy Transitions, (3) Enabling SDGs through Inclusive, Just Energy Transitions, (4) Innovation, Technology and Data, and (5) Finance and Investment. These Technical Working Groups brought together leading experts on these subjects from across the world to identify key recommendations for a global roadmap towards the achievement of SDG7 and the climate objectives of the Paris Agreement.

This proposed roadmap illuminates a way forward for how the world can achieve a sustainable energy future that leaves no one behind. We hope that it will help to inspire the actions needed to get there.



**Mr. Liu Zhenmin**  
*Under-Secretary-General for  
Economic and Social Affairs and  
Dialogue Secretary-General*



**Mr. Achim Steiner**  
*UNDP Administrator and Co-chair  
of the Dialogue and UN-Energy*



**Ms. Damilola Ogunbiyi**  
*Special Representative of the  
UN Secretary-General for Sustainable  
Sustainable Energy for All and  
Co-Chair of Dialogue and UN-Energy*



# FOREWORD

The Technical Working Group on Energy Access was established as part of the High-Level Dialogue on Energy preparatory process. It is comprised of representatives from civil society, the public and private sector, donors, and governments. UNDP, UNOHRLLS and the World Bank serve as Co-Leads. The Co-Leads gratefully acknowledge the support of the High-Level Dialogue Secretariat as well as the individual contributions of working group members to this Report.

**Universal access to affordable, reliable, and modern energy services by 2030 (SDG 7.1)** is a prerequisite and catalyst for improving the living and working conditions of all the world's people, especially the poorest and most vulnerable populations who lack any modern energy services. It is integral to the transition to an inclusive, just, sustainable, secure, and net-zero emissions energy system in line with the Paris Climate Agreement.

**At the heart of Agenda 2030 is the ambition to leave no one behind.** We must invest in the most vulnerable countries to meet their energy targets and to ensure they are included in the energy transition. It is urgent to significantly increase the pace of electrification and clean cooking expansion efforts.

**Progress must be greatly accelerated through a shift to a system-level paradigm** that embraces greater commitment and innovation and challenges the habitual ways in which energy access policy and investments have been directed historically.

**It is in this context that the Technical Working Group on Energy Access has developed a set of strategic recommendations to attract more focused investment. They include** enhancing socio-economic inclusiveness of energy access; aligning costs, reliability, quality, and affordability of energy services; as well as harnessing and redirecting energy access financing.

The energy access challenge is complex, multi-dimensional, and multi-sectoral. It cannot be resolved by fragmented and piecemeal efforts. It requires a bold, system-level approach.

**Achieving universal access to affordable, reliable, and modern energy services by 2030 can be – must be – met.** Billions of people are depending on it and failure is not an option.



**Mr. Achim Steiner**  
*UNDP Administrator and Co-chair  
of the Dialogue and UN-Energy*



**Fekitamoeloa Katoa 'Utoikamanu**  
*High Representative  
UN OHRLLS*



**Pablo Fajnzylber**  
*Acting Infrastructure  
Vice President  
The World Bank*



# CONTENTS

<b>1. Priority Recommendations</b>	<b>1</b>
<b>2. Results and Action Matrix</b>	<b>4</b>
<b>3. Goal</b>	<b>16</b>
The Role of SDG 7.1	16
System-level Paradigm Shift for Increasing the Pace of Progress towards Universal Access	17
<b>4. Context</b>	<b>19</b>
Access to Electricity Services	19
Access to Clean Cooking Services	21
COVID-19 Pandemic Impact on Energy Access	22
<b>5. Challenges</b>	<b>23</b>
Inadequate and Suboptimal Enabling Policy and Regulatory Frameworks	23
Incomplete Social-Economic Inclusiveness of Energy Access	25
Misaligned Costs, Reliability, Quality, and Affordability of Energy Services	27
Insufficient and misdirected Energy Access Financing	30
<b>6. Recommendations</b>	<b>33</b>
Strategic Recommendations for a Paradigm Shift	33
Key Building Blocks	39
Building Block 1: Reinforcing the Enabling Policy and Regulatory Frameworks	39
Building Block 2: Increased Social-Economic Inclusiveness of Energy Access	43
Building Block 3: Aligning the Costs, Reliability, Quality, and Affordability of Energy Services	49
Building Block 4: Catalysing, Harnessing, and Redirecting Energy Access Financing	53

<b>7. Impacts</b>	<b>59</b>
Impact on Poverty and Economic Growth	59
Impact on Human Capital	61
Impact on Environment	63
<b>8. References</b>	<b>64</b>
<b>Endnotes</b>	<b>68</b>

# 1

# PRIORITY RECOMMENDATIONS

**Universal access to affordable, reliable, and modern energy services by 2030 (SDG 7.1)** is a prerequisite and a catalyst for improving the living and working conditions of all the world's people, especially the poorest and most vulnerable populations who lack any modern energy services. Universal access to energy is integral to the transition to an inclusive, just, sustainable, secure, and net-zero-emissions energy system in line with the Paris Climate Agreement. Universal access will sustain the transition and will, in turn, be sustained by it.

SDG 7.1 will not be achieved, however, if today's slow pace of electrification and clean cooking deployment continues. **Progress must be greatly accelerated through the shift to a system-level paradigm that not only embraces greater commitment and innovation but also challenges the habitual ways in which energy-access policy and investments are directed.**

Significantly increasing the pace of electrification and clean cooking expansion efforts is an urgent matter. The electricity access rate, in access-deficit countries, **must increase from 82% in 2019 to 94% by 2025 to achieve 100% access by 2030.** This means a yearly gain of two percentage points, or electrification being brought to about 150 million people between now and 2025. This represents a 33% increase: an extra 0.5 percentage points or additional 40 million people per year over the current rate of progress.

The clean cooking access rate in access-deficit countries **must increase from 66% in 2019 to 82% by 2025 to achieve 100% by 2030,** meaning a yearly gain of 3.0 percentage points or about 230 million people. This represents a 66% increase, an extra 1.2 percentage points, or an additional 90 million people per year over the current rate of progress.

The paradigm shift to achieve this increased pace will be realized by acting on the following **strategic recommendations:**

## RECOMMENDATION 1

**Align energy policy and investment with energy transition pathways that accomplish universal access to electricity and clean cooking by 2030.** In a joint global effort, this means we must provide access to electricity to 759 million people who currently have no electricity and also access to clean cooking solutions for 2.6 billion people who currently depend on traditional polluting cookstoves and fuels, at the same time as undertaking energy transitions towards a net-neutral energy system by 2050. Achieving universal access to sustainable, reliable, affordable, and modern energy must also be an integral part of the just energy transition and be embedded in countries' climate commitments

and their strategies and actions for net-zero-energy systems. Countries should find ways of reorienting fossil fuel and other inefficient subsidies that encourage wasteful consumption of energy into smart subsidies for clean energy access, in particular towards poor and vulnerable households and community health and education facilities.

## RECOMMENDATION 2

**Prioritize and coordinate political commitments and financing to accelerate access to clean cooking, building synergies with electrification efforts.** National governments should integrate cooking energy demand into energy planning and strategy development. A transition to universal access to clean cooking will not be a quick fix, but will build on least-cost, best-fit approaches that reflect local people's needs, health risks, abilities to pay for services, and local market conditions; this transition should also take into account food security, gender, climate, and safety considerations. Unprecedented financial and analytical resources must be mobilized to build the enabling ecosystem. In the same vein, decentralized energy solutions and access to life-changing appliances should be included in energy planning and strategy development. There is an urgent need for end-user subsidies to bridge the affordability gap. Both the clean cooking and electricity sectors need to continue to improve their enabling ecosystems, including their policy and regulatory frameworks.<sup>1</sup> Clean cooking, in particular, will require more in terms of targeted efforts and financial support and innovation.

## RECOMMENDATION 3

**Position universal access to energy as a key enabler and driver of inclusive, sustainable, and resilient economic recovery and growth and as an integral part of the transition to a just net-zero-emissions energy system.** Energy-access planning must be fully integrated with broader development priorities to achieve unprecedented synergies and opportunities with respect to all the other Sustainable Development Goals (SDGs as noted below) as part of a broad-based political commitment and shift in fundamental assumptions related to energy access. The impacts of the lack of clean cooking and electricity access are often the greatest in countries experiencing fragility, conflict, and violence. Development partners should prioritize support for the least-developed countries (LDCs) and countries suffering fragility, conflict, and violence (FCV).

## RECOMMENDATION 4

**Put people at the centre of efforts to deliver universal energy.** Both clean cooking and electricity access initiatives must be designed based on (a variety of) human needs, user practices and preferences, and consumer affordability levels, taking into account diverse cultural (national and local), and socio-economic contexts. Communities should be seen not only as beneficiaries but also as co-creators of future energy systems. People-centred energy access approaches will need to include a social safety net to deliver modern energy services to people who cannot afford the full cost of access to clean cooking and electricity.

## RECOMMENDATION 5

**The 'last mile' of energy access must become the 'first mile' to be tackled.** Half of the population without access to electricity live in countries experiencing fragility and conflict, where lack of access to clean cooking and electricity disproportionately affects low-income and vulnerable populations and women and girls. Further progress in accelerating energy access cannot be achieved without significantly increasing rates of access to electricity and clean cooking among the remote, poorest, and most vulnerable population segments, including displacement-affected communities. Creative, context-sensitive solutions are needed to unleash sustainable energy access expansion efforts that

are truly inclusive and that not only meet the specific needs and situations of vulnerable populations, but also support their capacity to overcome energy poverty and their prospects of making progress in doing so. As the gap in finance needed to provide energy access in the LDCs is vast, there is an urgent need for increasing funding for energy access, and delivering on climate finance pledges, allocated to LDCs which can have a direct impact on accelerating poverty eradication and as a key enabler for sustainable development.

## RECOMMENDATION 6

**Support enterprises with innovative, cost-effective, and scalable energy- access business models so that delivery of clean cooking and electricity solutions can be accelerated to households, businesses, and community facilities.** Unlocking the potential of enterprises with innovative and pioneering mechanisms and supporting them to reach homes and businesses on the 'last mile' will enable scaling up. The private sector, thanks to its ability to innovate, can play a key role in driving energy access, and this is particularly so for poor and rural communities. The private sector can help with the creation of new public–private partnerships to address affordability constraints and the high costs of reaching rural customers in the most efficient ways possible.

## RECOMMENDATION 7

**Accelerate the advancement of knowledge exchange, capacity-building, partnership-building, and innovation.** Human capital will be essential to drive universal access to energy. Governments, development partners, and service providers should support local academic and training institutions by investing in capacity- and skills-building for all levels of participants in sustainable energy access–expansion efforts. These will include policymakers and technicians, the promotion of local entrepreneurship, and the particular targeting of women and youth. Such investments in human development should, in turn, drive further innovation in technology, business models, financing, policy, and market enablers to accelerate the pace of energy-access expansion.

## RECOMMENDATION 8

**Improve the availability and quality of open-source, verifiable energy information and data pertinent to national, subnational, and local contexts.** Both end-user and supply-side data are necessary for understanding consumers' needs—namely, what interventions will likely be effective in accelerating access—and also for tracking progress correspondingly. Household surveys should be improved to provide more-nuanced data on energy access that will also enable more accurate insights into the most critical aspects of energy access, such as reliability, quality, affordability, and convenience, as well as greater insights into electricity use and cooking practices, including fuel/stove stacking for clean cooking. For example, a recommended survey question module on energy could be inserted into regular household surveys, following the Multi-Tier Framework (MTF) approach, to complement the existing binary data.

This **paradigm shift** should be supported by the following **key building blocks** (as summarized in the Results and Action Matrix below):

1. reinforced **enabling policy and regulatory frameworks to attract investment**
2. enhanced **socio-economic inclusiveness of energy access**
3. aligned **costs, reliability, quality, and affordability of energy services**
4. catalysed, harnessed, and redirected **energy-access financing**

# 2 RESULTS AND ACTIONS MATRIX

PRIORITY RESULTS	PRIORITY ACTION AREAS	STAKEHOLDER ACTIONS				MILESTONES		
		Public	Private	Civil Society	International organisations	2025	2030	Towards 2050
<b>Reinforced enabling policy and regulatory frameworks to attract investment:</b>	<ol style="list-style-type: none"> <li>1. Position universal and gender-responsive access to energy as a key enabler and driver of inclusive, sustainable, and resilient economic recovery and growth and as an integral part of the transition to a just net-zero-emissions energy system; elevate clean cooking in both international and national priority settings.</li> <li>2. Adopt national clean cooking and electrification strategies, charting comprehensive, realistic, integrated, inclusive, and resilient pathways towards achieving SDG 7 universal-access targets for households, public institutions, and productive uses. Strategies to be backed up by least-cost, best-fit plans relying on mix of technologies and user-centred implementation and business models that leverage grid, mini-grid and off-grid, and varied clean cooking technologies and fuels; specification of tiers of service to be delivered, ensuring that all population gets access to at least basic energy services in the shortest time-frame possible, while addressing affordability constraints.</li> <li>3. Enact, implement, and enforce comprehensive enabling policy and regulatory frameworks for both clean cooking and electricity access,</li> </ol>	<ul style="list-style-type: none"> <li>• Elevate gender-responsive energy access among key priorities in national development strategies and assign champions for inter-sectoral coordination, especially for clean cooking.</li> <li>• Adopt clean cooking and electrification strategies and plans, charting comprehensive, realistic, integrated, inclusive, and resilient pathways towards achieving SDG7 universal access targets.</li> </ul>	<ul style="list-style-type: none"> <li>• Industry associations and private sector to participate in consultations and dialogue with the government on electrification and clean-cooking strategies, plans, policies, and regulations.</li> <li>• Private sector to form and support well-functioning renewable energy associations in energy access-deficit countries.</li> <li>• Enact policy and regulatory frameworks that empower and incentivize (i) private-sector investments and innovations in energy</li> </ul>	<ul style="list-style-type: none"> <li>• Build national and international coalitions and leverage multi stakeholder partnerships and platforms.</li> <li>• channel information on the needs and aspirations of communities in the process of formulating strategies, plans, policies, and regulations.</li> <li>• Participate in the design and implementation of action plans.</li> <li>• Monitor government compliance with energy -access strategies and plans, and engage in</li> </ul>	<ul style="list-style-type: none"> <li>• Elevate the priority of clean cooking, including building national and international coalitions and leveraging multi-stakeholder partnerships and platforms.</li> <li>• Increase technical assistance to governments for best practices for gender-responsive clean cooking and electrification planning, policies, regulations, and reporting systems, including trade rules and fiscal exemptions for clean cooking and distributed renewable energy products and components.</li> </ul>	<ol style="list-style-type: none"> <li>1. 100% of access-deficit countries have an advanced framework for clean-cooking strategies.</li> <li>2. 100% of access-deficit countries have an advanced framework for electrification strategies.</li> <li>3. 100% of access-deficit countries have an advanced framework for mini-grid and stand-alone systems.</li> <li>4. 100% of utilities in energy access-deficit countries are considered moderately creditworthy.</li> </ol>	<p>Universal access to sustainable, affordable, reliable, and modern energy services.</p>	<p>Universal access to sustainable, affordable, reliable, and modern energy services, consistent with and contributing to net-zero-emissions target.</p>



PRIORITY RESULTS	PRIORITY ACTION AREAS	STAKEHOLDER ACTIONS				MILESTONES		
		Public	Private	Civil Society	International organisations	2025	2030	Towards 2050
	<p>including incentivizing and empowering private sector to continue to innovate in the energy-access delivery and to reach scale, in particular, in the clean cooking and distributed renewable-energy (DRE) sectors.</p> <p>4. Incentivize sustainable grid expansion and reliable and affordable grid electricity services by empowering and incentivizing the national electricity utilities to improve their technical and financial performance through cost-effective tariffs, reducing losses, digitizing their networks, supporting investments in lower-cost, climate-friendly generation, and promoting innovative financing models and partnerships.</p> <p>5. Integrate inputs and promote dialogue with civil society organizations and industry associations to reflect views from communities/vulnerable groups and private sector, respectively, in the national strategy formulation and planning, and in policy and regulatory setting.</p>		<p>access, and (ii) the national electricity utilities to improve their technical and financial performance to enable sustainable energy access expansion.</p>	<p>the planning, collection, and monitoring of verified data on energy access.</p>	<ul style="list-style-type: none"> <li>Provide geospatial modelling tools and data, and support access to innovative platforms to promote evidence-based, data-driven decision-making, and to support efficiency and transparency of public-funding programs.</li> </ul>		<p>5. Energy access countries achieve on average RISE score above 67 for both electricity and clean cooking, reflecting advanced status of the policy and regulatory framework.</p>	
Enhanced socio-economic inclusiveness of energy access	<p>1. Increase inclusiveness of national clean-cooking and electrification strategies and programs by integrating support for poor, remote, and vulnerable households (including displaced persons and host communities) through (i) promoting and prioritizing support for business models focused on the last-mile service delivery, and (ii) closing the affordability gap, through provision of user financing and through design, demonstration, and scale up of sustainable, efficient, and targeted end-user subsidies, particularly for off-grid solar and clean cooking sectors.</p>	<ul style="list-style-type: none"> <li>Make national clean cooking and electrification strategies more inclusive, by specifically integrating: (i) affordability support for poor and vulnerable households, (ii) targeted support for displaced persons and host communities,</li> </ul>	<ul style="list-style-type: none"> <li>Both service providers and private financiers) to unleash its potential for innovation to devise cost-effective and user-centric approaches for servicing the remote, poor, and vulnerable populations with both clean cooking and electricity, including appliances, such as for electric cooking, cooling and productive uses.</li> </ul>	<ul style="list-style-type: none"> <li>Advocate for the needs of the poor and vulnerable populations so that these are well understood by governments and financiers.</li> <li>Engage with communities to increase awareness, education, and trust in information sources on clean cooking and electricity benefits to allow people to make informed choices.</li> </ul>	<ul style="list-style-type: none"> <li>Strengthen the focus on least-developed and FCV countries, including support to host governments to address energy poverty in displacement settings -Develop, demonstrate, and provide financing for scaling up sustainable, efficient and targeted end user subsidies, and integrate specific</li> </ul>	<p>1. 100% of access-deficit countries have an advanced framework for integrated national plans/programs, including productive uses, public institutions, and support for poor and vulnerable households.</p> <p>2. 25 off-grid solar markets and 25 access-deficit countries with</p>	<p>Universal access to sustainable, affordable, reliable, and modern energy services.</p>	<p>Universal access to sustainable, affordable, reliable and modern energy services, consistent with and contributing to net-zero-emissions target.</p>



PRIORITY RESULTS	PRIORITY ACTION AREAS	STAKEHOLDER ACTIONS				MILESTONES		
		Public	Private	Civil Society	International organisations	2025	2030	Towards 2050
	<p>2. Enhance gender equality in energy- access interventions, adopting gender-transformative strategies, disseminating and applying emerging good practices and instruments to enhance the role of women in the energy sector as beneficiaries, employees, and entrepreneurs, and increasing women's voices in decision-making.</p> <p>3. Address energy poverty of populations living in conditions of fragility, conflict, and violence, with particular reference to displaced persons and host communities, by, among other things, (i) improving enabling environment and scaling up both public and private financing in FCV and LDC countries, (ii) establishing and implementing dedicated energy-access programmes for displaced persons and their host communities; (iii) including displaced persons in national energy-access plans of host countries and supporting them in achieving the goals of these programmes; and (iv) supporting innovations and providing knowledge exchange on successful business models.</p> <p>4. Increase access to appliances, in particular, energy-efficient cooling to enhance climate resilience and to launch and enhance systematic efforts to stimulate the productive use of electricity to improve livelihoods: to achieve this, include design and implementation of marketing interventions, technical assistance for business development, market linkages, provision of user financing for appliances, e.g., through microfinance, PAYG models, and on-bill financing, as well as performance monitoring mechanisms and cross-sectoral coordination (in particular with agriculture).</p>	<p>(iii) gender-transformative strategies, (iv) productive uses and energy-efficient cooling, (v) electrification of healthcare, schools, and other key community services, and (vi) strengthening involvement of communities.</p> <p>• Reorient fossil fuel and inefficient and/or mistargeted subsidies to enable both supply and end-user subsidies for poor, remote, and vulnerable households and for electrification of healthcare facilities and schools with respect to both clean cooking and electricity.</p> <p>• Keep improving policy and regulatory frameworks, in particular for countries in FCV contexts, to enable innovations and partnerships in the</p>	<p>• (Both service providers and private financiers) to participate in and co-create new implementation approaches for electrification of public institutions, focusing on sustainable, long-term service delivery.</p> <p>• Service providers to enhance their gender strategies to increase female employment in energy-access industries, support female entrepreneurs, and invest in training and skills development, particularly for women and youth.</p>	<p>• Assist women, youth, slum dwellers, rural inhabitants, migrants, and displaced people in claiming and carrying out their rightful roles in the planning, decision-making, investment, entrepreneurial, and operational tasks needed to deliver access to modern energy services in their communities and beyond.</p>	<p>financing and TA windows for local businesses, last mile distributor, non-profits, community organizations serving remote, poor and vulnerable.</p> <p>• Enhance the impacts of energy-access programs and projects by integrating support for productive uses, sustainable business models for healthcare, schools, and other public institutions and community services, promoting energy-efficient appliances, especially for cooling and electric cooking, supporting synergies between electrification and clean cooking, and deploying gender-transformative strategies.</p>	<p>end-user subsidy programs for off-grid solar and other last mile delivery, including clean cooking.</p> <p>3. 50% of women among entrepreneurs and employed in the energy access sector, and 50% increased productivity of women farmers and business owners, as a result of productive uses of electricity.</p> <p>4. 100% of countries in conditions of fragility, conflict and violence enact enabling policy and regulatory frameworks to reach an advanced status in RISE (67 or above on average).</p> <p>5. 76% of schools and 69% healthcare facilities with sustainable and reliable electricity.</p>		

PRIORITY RESULTS	PRIORITY ACTION AREAS	STAKEHOLDER ACTIONS				MILESTONES		
		Public	Private	Civil Society	International organisations	2025	2030	Towards 2050
	5. Accelerate investments in electrification of healthcare facilities and schools and other essential public and community services, such as clean water supply, by integrating them into national electrification planning, and engaging with financiers and service providers to develop and demonstrate sustainable and scalable service-oriented models, including ones for replacing diesel back-up systems for grid-connected facilities, electrifying facilities with stand-alone off-grid solutions and integrating these with mini-grids.	last mile service delivery and attract both public and private investments; and to invest in skill development, particularly for women and youth.						
<b>Aligned costs, reliability, quality, and affordability of energy services</b>	<p>1. Drive innovations both in technologies and business models (including through innovation accelerators, R&amp;D, technology transfer, seed funding for piloting and commercialization, geospatial analysis for electrification planning, clustering of distributed renewable-energy sites into viable portfolios, distribution network design, and demand-stimulation and productive-use promotion) in order to reduce costs of clean-cooking technologies and fuels, distributed renewable-energy technologies, and grid expansion.</p> <p>2. Advance user-centred and gender-transformative approaches in clean cooking and DRE business models, including for access to energy- efficient cooking, cooling, productive and other appliances, in order to improve service delivery and thereby achieve long-term business sustainability and scalability. Incentivize national utilities to adopt more customer-centric approaches, including through innovative partnerships, demand-stimulation, support for appliances and productive uses, so as to improve service delivery and increase revenue generation.</p>	<ul style="list-style-type: none"> <li>• Prioritize national grid reliability and sustainability as a pre-condition for, or parallel track to, grid densification and expansion, and create incentives for more user-centric service delivery.</li> <li>• Create incentives for continued innovations in technologies and business models and improve intersectoral coordination with digital and financial sectors, in order to improve ecosystem for expanding digital-enabled business models, such as PAYG, in the off-grid solar sector and beyond, including for clean cooking</li> </ul>	<ul style="list-style-type: none"> <li>• Drive innovations in technologies and business models for DRE and clean cooking, with the aim of further reducing costs, increasing affordability and support last mile delivery, and drive impacts, such as through promotion of productive uses.</li> <li>• Invest in R&amp;D, supporting technology transfer for clean cooking solutions</li> <li>• Support collaboration and innovative partnerships, e.g. between electricity and clean cooking sector, between international and local service providers,</li> </ul>	<ul style="list-style-type: none"> <li>• Community engagement to ascertain local users' needs, health risks, abilities to pay for services, and local market conditions.</li> <li>• Advocate for greater adoption for user-centred approaches by all service providers, including national utilities, DRE and clean-cooking companies.</li> <li>• Assist in the process of knowledge exchange, skills building, and technology transfer to ensure inclusion of communities and small-scale service- providers.</li> </ul>	<ul style="list-style-type: none"> <li>• Assist in promoting user-centred innovation to drive down costs and improve performance and local maintainability of clean cooking solutions, including e.g. through setting up a technological innovation accelerator (for R&amp;D and technology transfer) and user insight lab (to capture user data and insights).</li> <li>• Help governments to identify and deploy sustainable-electri-fication business models, for a variety of institutional arrangements and contexts (e.g., from fully private sector–</li> </ul>	<p>1. Average unit tariff from grid supply is USD 0.08 per kilowatt-hour and the consumer price of 40 kWh of mini-grid is 10 USD.</p> <p>2. The average MTF tier of grid electricity is tier 4, and mini-grid service uptime is 97.</p> <p>3. 20 access-deficit countries use PAYG or other digitally enabled user finance, and 6.7 million new customers purchasing off-grid solar through PAYG or other digitally-enabled user finance per year.</p> <p>4. 50% of access-deficit countries has quality verified off-grid</p>	Universal access to sustainable, affordable, reliable, and modern energy services.	Universal access to sustainable, affordable, reliable and modern energy services, consistent with and contributing to net-zero-emissions target.

PRIORITY RESULTS	PRIORITY ACTION AREAS	STAKEHOLDER ACTIONS				MILESTONES		
		Public	Private	Civil Society	International organisations	2025	2030	Towards 2050
	<p><b>3.</b> Prioritize reliability of grid services by investing in strengthening transmission and distribution systems, sustainable generation, loss reduction, digitization of networks, and improving overall utilities’ technical, commercial, and financial performance, including through innovative partnerships and private sector engagement. Invest in continued innovations in technologies and operations of mini-grids, to demonstrate mini-grid ability to deliver highly reliable services at affordable costs at scale.</p> <p><b>4.</b> Improve ecosystem for expanding digital-enabled business models, such as PAYG (allowing households to access off-grid solar and clean cooking technologies, fuels and appliances through user financing) including through improving intersectoral coordination with the digital and financial sectors, and expanding digital enablement.</p> <p><b>5.</b> Increase quality of clean-cooking and off-grid solar products available in local markets, by supporting quality- assurance activities, including adopting and implementing national standards for cooking fuels and stoves (such as localization of international standards and labelling), and international quality standards for off-grid solar products, and also by supporting quality assurance for energy-efficient appliances, including those used for cooling and electric cooking.</p>	<ul style="list-style-type: none"> <li>Adopt, implement and enforce standards for clean cooking stoves and fuels and for off-grid solar products, following international best practices.</li> </ul>	with other sectors, such as agriculture, in between national utilities and DRE companies etc.		<p>led, market-based approaches to public–private partnerships to programs led by the national utility), and help bring down costs by supporting innovations in geospatial planning, clustering of DRE sites to build viable portfolios, and distribution network designs.</p> <ul style="list-style-type: none"> <li>Support development and implementation of robust international quality assurance system (e.g. Verasol for off-grid solar and its expansion to appliances), and development and adoption of international standards (and their localization for clean cooking).</li> </ul>	<p>systems on the market (in Tier 1 product category).</p> <p><b>5.</b> At least 30 access-deficit countries have adopted standards and labelling for clean cooking technologies and fuels, and at least 45 access-deficit countries have adopted off-grid solar international standards.</p>		

PRIORITY RESULTS	PRIORITY ACTION AREAS	STAKEHOLDER ACTIONS				MILESTONES		
		Public	Private	Civil Society	International organisations	2025	2030	Towards 2050
Catalysed, harnessed, and redirected energy access financing	<p>1. Scale up availability, diversity, and volume of public and private financing for clean-cooking projects and technical assistance, developing product and business-model innovations, increasing RBF/performance-based payments, enhancing risk-sharing mechanisms to attract more investors, and integrating clean cooking with electrification goals.</p> <p>2. Increase the annual financing flow to electricity access, while significantly increasing the share of public and private financing for the DRE technologies (mini-grid and off-grid solar) in line with their share in least-cost geospatial modelling, including for pre-electrification.</p> <p>3. Construct and scale up comprehensive, innovative, and gender-responsive financial packages that consist of equity, debt, and grants; including scaling up proven instruments, such as results-based financing (RBF), and supporting further financial innovation, such as new guarantees, and securitization credit-management instruments focused on risk mitigation to leverage private-sector investments, including leveraging lending from local commercial banks.</p> <p>4. Scale up digitally enabled and gender-responsive consumer financing schemes, such as PAYG, on-bill financing, and other innovations to make electricity connections/systems and appliances more affordable, and mobilize public funding to reach the poorest consumers who are unable to afford clean cooking and electricity services, such as through social safety nets for energy access and creating an impact bond market for energy access, including clean cooking.</p> <p>5. Prioritize public and private investments in energy access in LDC and FCV countries.</p>	<ul style="list-style-type: none"><li>• Reorient fossil fuel and other inefficient subsidies that encourage wasteful consumption of energy in favour of both demand- and supply-side support for sustainable energy access expansion, especially regarding access to clean cooking, electrification of poor, remote, and vulnerable households, and providing reliable electricity to healthcare facilities and schools.</li><li>• Integrate financial support – accessible to all, including women and youth—for energy access in the COVID-19 recovery packages.</li><li>• Increase public finance flows – accessible to all, including women and youth – for catalysing energy access investments and create gender-responsive social safety nets for energy access.</li></ul>	<ul style="list-style-type: none"><li>• Private-sector financiers to work closely with development partners and service providers to develop comprehensive financing packages that leverage public and private financing (e.g. through innovative risk mitigation instruments) in order to scale up private sector investments in energy access – attract more investments in early stage equity, including for local companies, and engage local commercial banks to provide local currency debt.</li><li>• Clean cooking and energy access companies must accelerate their path to profitability to attract private sector investments.</li></ul>	<ul style="list-style-type: none"><li>• Make knowledge on available financing available in a gender-responsive manners.</li><li>• Raise awareness of public and private stakeholder s on the importance of gender-responsive financing.</li><li>• Support awareness and monitor transparency in implementation of pro-poor schemes such as social safety nets for energy access.</li></ul>	<ul style="list-style-type: none"><li>• Dramatically increase financing of energy access, especially for clean cooking and DRE solutions, including scaling up of proven instruments, in particular, RBF, and stepping up financial innovations to leverage commercial financing, including local commercial banks, while reducing risk aversion for financing innovative DRE and clean cooking start-ups and create targeted financing schemes for local entrepreneurs (including women and youth).</li><li>• Reassess electricity funding priorities to ensure that they are consistent with country energy-access strategies and plans, net-zero-emissions targets and market reforms that reduce burdens on struggling utilities, while prioritizing funding for LCD and FCV countries.</li></ul>	<p>1. <b>USD 25 billion</b> annual financing flow to clean cooking (public/private.)</p> <p>2. <b>USD 35 billion</b> annual financing flow to electricity of which <b>USD 10 billion</b> for mini-grids.</p> <p>3. <b>Mobilize annual USD 1.1 billion</b> investments in equity and to off-grid solar companies and <b>USD 0.34 billion</b> to bridge affordability gap for at least Tier 1 off-grid system.</p> <p>4. Impact bond market created for energy access, including clean cooking.</p> <p>5. <b>50%</b> of the annual financing flows to clean cooking and electricity access should be directed <b>to the Least Developed Countries (LDCs)</b>.</p>	Universal access to sustainable, affordable, reliable, and modern energy services.	Universal access to sustainable, affordable, reliable and modern energy services, consistent with and contributing to net-zero-emissions target.

# 3 GOAL

## The Role of SDG 7.1

**Universal access to affordable, reliable, and modern energy services by 2030 (SDG 7.1) is a prerequisite and catalyst for improving the living and working conditions of all the world's people. The lack of access to modern energy is a barrier to achieving several other SDGs, especially for the poorest and most vulnerable populations.** Receiving access to modern energy helps people lift themselves out of poverty and enhances their prosperity, health, safety, well-being, educational, and entrepreneurial opportunities; it also advances gender equality and social, economic, and political equality goals. **Universal use of modern energy** also helps diminish environmental degradation and **is critical to abating climatic pressures and achieving net-zero emissions in a just and inclusive way by 2050.**

**'Affordable', 'reliable', 'modern', and 'universal': all these qualities** are the pillars of an **equitable and inclusive energy system and a society that leaves no one behind.** This includes people living in the least-developed countries (LDCs), the marginalized segments of the population, including the poor, indigenous populations, and the disabled; it includes, too, the women, men, youth, and children living in urban slums, remote rural areas, indefinite-term refugee and internal- displacement areas, and in fragile, conflict- and violence-afflicted areas (FCV zones). Conversely, a sustainable energy system is central to affordable, reliable, modern, and universal energy services. **Universal access is integral to the transition to an inclusive, just, sustainable, secure, and net-zero-emissions energy system.**

Concretely, SDG 7.1 states that all people should have **access to electricity** (SDG 7.1.1) and should rely primarily on **clean fuels and technologies for their cooking needs** (SDG 7.1.2) by the end of the 2020s.

**Access to affordable, reliable electricity** enables people to use convenient, life-enhancing amenities and strengthens their economic opportunities. It empowers the use of lighting, communications, cooling, educational, medical, and other electrical devices in households, workplaces, and community facilities, such as schools and medical clinics. It is crucial to efficient agriculture, which strengthens food security. It also permits the use of productive equipment, which, like efficient agriculture, enhances people's income-generating possibilities, especially those of women. The extra income, in turn, makes the energy services more affordable. Productive use of electricity lies at the interface of energy and socio-economic development. In short, access to electricity improves people's basic living standards and enhances economic growth, job creation, shared prosperity, gender equality, and the quality of health and education services.



**Access to affordable, reliable, modern, clean cooking fuels and technologies** aims to protect people, especially women and children, from the adverse health impacts of traditional cooking and fuel gathering systems and to free them from the excessive time burdens and the gender-based violence risks that these involve. It raises living standards by improving health and safety conditions in households and food preparation institutions and by reducing time poverty and drudgery, and it also diminishes climate and environmental degradation. Universal access to clean cooking solutions is particularly urgent because the household air pollution (HAP) caused by continued cooking with traditional fuels and stoves has been linked to close to 4 million premature deaths per year from heart disease, stroke, cancer, and other noncommunicable diseases, as well as childhood pneumonia. HAP is one of the largest single causes of premature mortality and morbidity worldwide, with women and children bearing the heaviest burden due to their high exposure to the pollution (WHO and World Bank, 2014). In addition, traditional cooking fuels and stoves lead to numerous disabilities from burns, scalds, and poisoning. They lead to deeply diminished income generation and educational- and personal enrichment opportunities due to the time spent/wasted on gathering fuel and using time-inefficient cooking practices and also the amount of time needed to care for family members with HAP-related poor health.

The two tracking indicators of SDG 7.1 follow only electricity connections and the use of clean cooking fuels and technologies. However, the overall goal of SDG 7.1 of universal access to affordable, reliable, and modern energy services also demands attention to multiple dimensions —**affordability, reliability, quality, sustainability, and local suitability**—in the cooking, lighting, heating/cooling, and other productive uses **equipment and the performance/supply/maintenance/financing chains of appliances**. Attention to the 'services' aspect of energy access is critical to building user confidence. Accordingly, this will also impact implementation of the energy sources/services on offer. Thus, for example, this report examines, as part of the electricity-access goal, the status of cooling solutions for ensuring liveable indoor temperatures and refrigeration in the storing and transporting of perishable goods, medicines, and vaccines—thereby recognizing that cooling is part of the broader issue of climate resilience.

Moreover, while **receiving access** to affordable, reliable, and modern energy services is clearly essential to sustainable development, **providing access** to these energy services—if done in an inclusive, equitable, transparent, participatory, and sustainable manner—also advances prosperity, gender equality, innovation, and social, economic, and political equality goals. It gives women, youth, slum dwellers, rural inhabitants, and displaced people roles in the planning, decision-making, investment, entrepreneurial, and operational tasks needed to deliver access to modern energy services in their communities and beyond. Further, the enabling role that energy access has for meeting many of the SDGs should be a source of collaborative and synergistic interventions, as discussed in the Impacts section below.

## System-level Paradigm Shift for Increasing the Pace of Progress towards Universal Access

In the last decade, about 1.1 billion people received their first access to electricity and 0.2 billion obtained clean cooking solutions. But there is still a long way to go in providing access for an additional 759 million people to electricity and 2.6 billion people to clean cooking in a relatively short period of time—10 years— to achieve universal access. As of 2019, only 90% of the world's population, it is 82% of people in all access-deficit countries<sup>2</sup>—mainly in sub-Saharan Africa and the least-developed countries (LDCs)—have access to electricity and only 66% of people have access to clean cooking fuels and technologies (Tracking SDG7, 2021).

Despite the gains in the past decade, the rate of advancement on both fronts, but especially on clean cooking, has been well below the levels required to meet the 2030 targets (Tracking SDG7, 2021) and has since been slowed by the physical, business, and economic constraints of the COVID-19 pandemic. It is estimated that if the slow pace of electrification and clean cooking deployments are not accelerated (i.e., if they remain at pre-pandemic levels), only 92% of the population worldwide will have electricity in 2030, leaving 660 million people unconnected. Likewise, only 72% of people will have clean cooking fuels and technologies in 2030, leaving 2.4 billion people without access (IEA 2019).

**To achieve universal energy access by 2030, the pace of deployment must be stepped up considerably.** Implementation rates need to increase to levels consistent with the following milestones:

- **Electricity access rate, in access-deficit countries, increases from 82% in 2019 to 94% by 2025 and 100% by 2030, meaning a yearly gain of 2.0 percentage points<sup>3</sup> or about 150 million people.** This represents a 33% increase—an extra 0.5 of a percentage point or an additional 40 million people per year—over the current rate of progress.
- **The clean cooking access rate, in access-deficit countries, increases from 66% in 2019 to 82% by 2025 and 100% by 2030, meaning a yearly gain of 3.0 percentage points or about 230 million people.** This represents a 66% increase—an extra 1.2 percentage points or additional 90 million people per year—over the current rate of progress.

Achieving this acceleration will require a **system-level paradigm shift**, challenging the habitual ways in which energy policy and investments are directed to realize an integrated approach that delivers on universal access to electricity and clean cooking while undertaking the transition towards net-zero energy systems by mid-century. The paradigm shift must be guided by eight **strategic recommendations**, implemented through actions within four **building blocks** (described fully in the Recommendations section of this report).



# 4 CONTEXT

Energy access means providing sustainable and modern energy services to meet end-users' energy needs. Taking a human-centred approach, from the perspectives of households and businesses, the most common energy needs are cooking, lighting, heating/cooling (where applicable), and other productive energy uses. While, in theory, electricity can meet all end users' energy needs, it is not yet realistic to expect all cooking energy demands to be served by electricity by 2030. Currently, the use of electricity for cooking accounts for only 7% of the population in low- and middle-income countries (Tracking SDG7, 2021). In sub-Saharan Africa where electrification is low, 80% of primary energy use is from biomass, largely fuelwood and charcoal for cooking (IEA, 2019). It is thus important to take a two-pronged yet interlinked approach to reaching universal access: **scaling up access to electricity services and scaling up access to clean cooking services**, with the interlinkage being to integrate cooking demand into electrification planning and expand electricity for cooking services, wherever economically cost-effective.

## Access to Electricity Services

The access rate for electricity services was 90% of the global population in 2019 (Tracking SDG7, 2021).<sup>4,5</sup> In the 95 access-deficit countries, mostly clustered in sub-Saharan Africa, only 82% of people have access to electricity. The rate of electricity access is 53% in least-developed countries (LDCs), 58% in landlocked developing countries (LLDCs), 83% in small island developing states (SIDS) (OHRLLS *et al.*, 2021), and less than 10% in displaced populations (NORCAP and BCG, 2020).

The 759 million people without access to electricity live throughout the world, but most (85% of those lacking access) reside in rural areas and in sub-Saharan Africa (75%) and to a lesser extent in Central Asia and Southern Asia (14%). Some 48% live in FCV settings. More than half of sub-Saharan Africa's population—83% of its rural people; 17% of its urban dwellers—lack electricity (Tracking SDG7, 2021). In this region, a quarter of health facilities have no access to electricity at all, and another half have only unreliable electricity (WHO and World Bank, 2014). As two thirds of schools lack reliable electricity, distance learning remains a distant aspiration (World Bank and SEforALL, 2020)

The number of people with no access to electricity fell by 36% from 1.2 billion to 759 million— from 2010 to 2019. Some 80% of these gains occurred in Central Asia and Southern Asia— where 103 million fewer people are now without access.

These gains were the result of accelerated electrification options, including the **densification and expansion of grids and the deployment of mini-grids and off-grid solar solutions**. Increased availability of data is extremely relevant as it allows governments to develop dynamic integrated electrification plans that appropriately combine these three approaches—grid densification and expansion, mini-grids, and off-grid solar technologies—into least-cost electrification pathways to universal access.

**Grid densification and expansion**—including reinforcement and upgrading of ageing infrastructure to minimize transmission and distribution losses—has been the traditional approach to electrification. Some countries, such as Afghanistan, Cambodia, Kenya, and Timor-Leste—electrified at rates exceeding 6 percentage points annually between 2010 and 2019 (Tracking SDG7, 2021) by pursuing electrification strategies adapted to each country's circumstances (i.e., fragility, population density); however, efforts in other countries have stalled.

The grid connection route is estimated to be the least-cost option for serving 42–57% of the unelectrified population by 2030 (World Bank, 2021a), but does not necessarily guarantee reliable electricity (especially where distribution utilities are weak) or sustainable electricity (especially if power is fossil fuel-based). Nor does it guarantee power system resilience. For instance, Ethiopia, Lesotho, Malawi, and Zambia have energy mixes that are reliant on hydro and are already affected by signs of climate change (i.e., lower levels of water). The overreliance on a sole power source lowers the national power system's resilience and sustainability. Approaches that incorporate a diverse energy mix, centralized renewable generation, and distributed energy resources, can augment resilience and sustainability.

**Mini-grids and off-grid solar technologies** have demonstrated that they can provide reliable and high-quality electricity for households, community facilities, and productive uses. These decentralized renewable energy-based systems have become the backbone of accelerated electrification strategies. Their growth is driven by innovation, entrepreneurship, enabling policy, and attracting finance.<sup>6</sup> Mini-grid investments have recently started to scale up. Off-grid solar technologies provide the fastest and lowest-cost path for closing the 'last mile' gap to reach the most remote populations. In 2019, 420 million people used off-grid solar products. Most products sold are entry level and unlock the very first step on the access staircase. In 2020, off-grid solar capacity expanded by 250 MW to reach 4.3 GW (IRENA, 2021).

Mini-grids and off-grid solar technologies are estimated to offer the least-cost option for serving an additional 425–581 million people lacking access to electricity by 2030 (World Bank, 2021a). Mini-grids present a more competitive solution when higher tiers of service are required, particularly in settlements with concentrated populations and productive use demand. Off-grid solar provides the more economical option when lower tiers of service are to be delivered as an entry-level energy access; this is particularly so for poorer and dispersed populations, although specialized off-grid systems can increasingly satisfy productive uses as well, such as for irrigation and cold storage.

**The level and pace of uptake of productive uses—a key enabler of socio-economic development—often lags far behind expectations, especially in rural areas.** It has been demonstrated that access to energy services is essential to support economic development (as referenced in the Impacts section below). However, due to constraints related to affordability, appliance availability, access to finance and awareness, many electrified households and businesses do not utilize electricity beyond basic services such as lighting and phone charging; this leads to unviable electrification interventions and, in socio-economic terms, electricity access having only a limited transformational impact.

**Among the service enabled by electricity access—lighting, communications, cooling, educational, medical, and income-generating productive uses—the demand for cooling is growing especially fast in this age of climate change and pandemics.** Space cooling is required for personal thermal comfort and safety; refrigeration and cold chains are essential for maintaining the quality and safety of perishable products in households and businesses; and vaccine cold chains are necessary for keeping vaccines safe and effective 'from factory to syringe' (i.e., manufacture to injection). Over 1 billion people lacking access to cooling in developing countries are already facing immediate risk. Nearly 700 million people live in hotter-climate slums where affordable, reliable electricity services do not exist. Almost 320 million people live in poor rural areas without access to cold chains for storage and preservation of food and medicine (SEforALL, 2020). The demand for cooling resulting from global temperature rises is part of a vicious cycle—where hotter temperatures drive increased cooling demand, which leads to greenhouse gas (GHG) emissions and hotter temperatures where fossil fuel-based electricity is powering the cooling devices. Cooling appliances will need to become more climate-friendly to mitigate this increase in energy consumption and associated GHGs.

## Access to Clean Cooking Services

The access rate for clean cooking services was 66% of the global population in 2019 (Tracking SDG7, 2021). The rate of clean cooking access is 17% in LDCs, 28% in LLDCs, and 40% in SIDS (OHRLLS *et al.*, 2021).

Of the 2.6 billion people without access to clean cooking solutions, most live in rural areas (58% of those lacking access), but are more evenly distributed across the three largest access-deficit regions—Central Asia and Southern Asia (31%); sub-Saharan Africa (35%) and eastern Asia and south-eastern Asia (29%)—than is the case for electricity access. Sub-Saharan Africa is by far the least-served region, with about 85% of its people—more than 95% of its rural residents and about 70% of its urban inhabitants—lacking clean cooking solutions (Tracking SDG7, 2021).

The number of people with no access to clean cooking solution declined by only 9% —from 3 billion to 2.6 billion—from 2010 to 2019. This number has largely remained the same over the past two decades owing to population growth outpacing the number of people gaining access to clean cooking solutions. Most of the gains occurred in eastern Asia and south-eastern Asia— 232 million fewer people are now without access. In sub-Saharan Africa, the number of people without clean cooking solutions has not declined, but has risen by more than 50% since 2000.

**The global access rate for clean cooking (66%) is well behind that for electricity (90%).** The slow progress mostly reflects the energy sector's low priority for clean cooking in comparison with electrification and is exacerbated by additional issues discussed in the Challenges section. However, there is growing consensus on the importance of the cooking sector and increasing policy prioritization of it at global and country levels, particularly due to the adoption of the SDGs. In addition, there are new technologies, business models, and financing mechanisms—including some inspired by and leveraging off-grid electricity access efforts—that enhance the affordability of solutions, using high-efficiency cooking appliances and digital and pay-as-you-go (PAYG) technologies. Thanks to new data and research, there is a better understanding of household cooking energy needs and sector dynamics, and also of the need to integrate clean cooking with electrification planning.

While the number of households with access to low HAP cooking solutions, such as liquefied petroleum gas (LPG), advanced gasifier stoves using wood pellets and electricity,<sup>7</sup> has grown over the past decade, the absolute number of people cooking with wood fuels, charcoal, and coal has also increased. Access interventions have not kept pace with population growth in communities using biomass in traditional stoves. The use of wood as a primary fuel has declined significantly, but it remains a major source of household energy across the world. Most clean-fuel gains can be attributed to large, government-driven fuel transition programs which have been able to tackle the key barriers of awareness, availability, and affordability.

## COVID-19 Pandemic Impact on Energy Access.

The COVID-19 pandemic has magnified the health and economic challenges of energy access, as well as its inherent opportunities and inequalities.

Underlying chronic diseases that are predictive of the severity and outcome for COVID-19 patients are exacerbated by exposure to air pollution. This linkage suggests a heightened risk for women across all age groups who lack clean cooking solutions and continue to endure the HAP from having to cook with traditional fuels and technologies.

In the poorest and most vulnerable countries, such as in LDCs, LLDCs, and SIDS, resources for COVID responses and immediate health priorities are likely to further constrain the already limited fiscal capacity and increase the risk of energy insecurity.

The economic downturn and supply chain disruptions, due to restrictive measures, have curtailed the ability of utilities, mini-grid operators, and off-grid companies, as well as the suppliers of clean cooking fuels and stoves to operate, maintain, and expand their services. There has been a sudden drop in energy sales from the utilities' most profitable industrial and commercial consumers, which accounts for over 70% of the power sector's revenues. Sector-specific policies introduced by some countries (e.g., bill reductions, cancellations, and deferrals) will also have a large short-term, negative impacts on utility finances. The impact on smaller mini-grid and off-grid solar service providers is even more devastating. These companies are reporting severe financial distress, as their revenues have plummeted, and they are unable to raise new funds. In 2020, the drop in market growth due to the impacts of COVID-19 resulted in an estimated 10–15 million people and 300,000–450,000 enterprises missing out on improved energy access (GOGLA, 2021b).

Household income has dropped significantly, and the pandemic is pushing an estimated 150 million additional people into extreme poverty, exacerbating energy affordability constraints. This means that, without external support, more poor households have no access to clean energy and are left to rely on traditional fuels for lighting and biomass for cooking, with their adverse effects on health, gender equity, and the environment (Shupler *et al.*, 2020).

On the other hand, in their 'building back better' plans, some countries have prioritized energy access, having realized the importance of reliable energy access for resilience (e.g., in healthcare facilities). For middle-income households with less severe affordability constraints, COVID-19 magnified the preference for convenience and energy-independence and nudged them to switch to clean cooking fuels and technologies, especially biogas and electricity, which have been less disrupted by COVID-19 restrictions (Zhang and Li, 2021). As societies recover from the pandemic and rebuild, governments can turn challenges into opportunities by including access to clean energy, especially clean cooking, as an essential service for all and a critical part of the pandemic response.

# 5 CHALLENGES

The pathways of receiving and providing universal access of modern energy services—the fuels and technologies adopted, the financing mechanisms used, and the inclusiveness of the planning, decision-making, investment, entrepreneurial, and operational tasks involved—are critical to maximizing the role of SDG 7.1 in meeting associated sustainable development goals and to achieving net-zero emissions in a just and inclusive way by 2050.

While the immediate effort is to ensure the world is back on track to meet SDG 7.1 by 2030 by meeting the critical 2025 targets, the medium- to long-term strategy will have to be to dramatically reduce unmitigated fossil-fuel combustion in order to achieve net-zero emissions by 2050. This can be particularly challenging for access to clean cooking, as LPG and natural gas are scalable clean cooking solutions but could make the net-zero-emissions goal more difficult to achieve. As countries need to balance the strategy of achieving short-, medium-, and long-term goals, the international community needs to commit scaled-up international climate and development finance to help countries to eventually phase out fossil fuels and align with the net-zero-emissions target by 2050.

Despite the increasing political commitment to the goal of universal energy access by 2030, the current rate of expansion of electricity and clean cooking technologies and fuels, which is highly uneven across regions, is insufficient to achieve SDG 7 by 2030. The pace is constrained by (i) inadequate development and/or suboptimal implementation of **enabling policy and regulatory frameworks**; (ii) incomplete **social-economic inclusiveness of energy access**, (iii) misaligned **costs, reliability, quality, and affordability of energy services**; and (iv) insufficient and misdirected **energy-access financing**.

## Inadequate and Suboptimal Enabling Policy and Regulatory Frameworks

According to the Regulatory Indicators for Sustainable Energy Report (RISE),<sup>8</sup> there have been improvements in policy and regulatory frameworks in recent years, but only a quarter of RISE energy-access-deficit countries<sup>9</sup> have enacted advanced enabling frameworks for electricity access, and fewer have done so for clean cooking (ESMAP, 2020a). In both cases, these figures need to increase to 100% by 2025, given that such strategies and plans are the essential first step in driving ambitious nation-wide energy access–expansion programmes.

**The lack of coordination within and between institutions in country contexts has stymied cooking interventions from becoming high-impact policy priorities.** Multiple countries in sub-Saharan Africa—where financing could potentially have the greatest impact—have seen financing commitments more than halve in the past decade. This challenge is exacerbated by the cross-cutting nature of cooking policy and interventions. Truly holistic solutions require the participation of stakeholders across multiple sectors, ranging from energy, health, climate, industry, and finance to rural and urban development, gender, and social protection, among others. **The absence of 'champions' and intergovernmental coordination** has therefore hindered progress in the **clean cooking** sector.

**Policies frameworks supporting access to clean cooking** are at an advanced level (RISE green zone) in only 15% of the countries with access deficits in clean cooking solutions.<sup>10</sup> In addition, many countries are still without clear access targets for cooking. While governments may include accelerating access to modern cooking energy in their policy agendas, they often lack the required institutional leadership and incentives for making major progress. Furthermore, a lack of integrated energy planning often isolates electrification programs from cooking policies and interventions.

**High taxes and misaligned tariff codes, in particular, are hindering industry growth and dampening product adoption.** In the early stages of market development, when local supply is inadequate, poorly calibrated tax and tariff regimes make it especially difficult to import fuel-production equipment, quality stoves and components, and clean fuels.

**In the last decade, the least policy progress has been on standards and labelling.** Standards facilitate coordination in a sector with a broad range of stakeholders, each with differing priorities, approaches, and goals. In addition to harmonizing how performance is measured and reported, standards also formalize a sector and drive product innovation. Thus, it is particularly important to include lenses related to 'leaving no one behind' indicators and gender inclusion aspects to ensure cooking products will fit the end user's needs. Additionally, standards are the basis of governmental and organizational policies and programs, as well as a means of tracking progress towards policy objectives and outcomes. Less than a third of the countries with significant access deficits have set standards for efficiency, emissions, and safety related to cooking solutions.

**Policies and regulations supporting electricity access** have registered progress since 2010, but most countries with access deficits still have room for improvement in terms of building robust policies. Frameworks to support mini-grid and standalone systems have seen faster development since 2010 compared to on-grid electrification.<sup>11</sup>

An increasing number of countries have adopted integrated national electrification strategies and plans. However, only 11 out of 54 electricity access-deficit countries are in the RISE green zone, having advanced electrification plans that capture all the best-practice attributes, including service level targets, inclusion of both grid and off-grid technologies, community and productive services, inclusion and gender-sensitivity and use of geospatial data and tools (ESMAP, 2020a). Moving forward, the plans also need to pay more attention to access to electrical appliances, including energy-efficient cooling appliances. In addition, without simultaneous improvements in grid, mini-grid, and off-grid frameworks, the ambition in these strategies and plans will remain unrealized.

**Without improvement in the financial performance of the national grid utilities, the grid investments prioritized in the electrification plans cannot be sustainably realized.** In that case, the pace of mini-grid and off-grid solar electrification would need to increase even further to fill the unrealized grid expansion.



For grid electrification, which is still the predominant electrification technology in most of the 95 energy-access-deficit countries, the poor creditworthiness of utilities has been the largest constraint slowing electrification efforts. Addressing utility performance has registered the least progress in the past decade and is likely to worsen as a result of COVID-19 impacts. It is particularly concerning that the utilities in low-access countries have lower cost-recovery compared to the utilities in higher-access countries, meaning the former have meagre financial resources for grid expansion. For example, utilities in 75% of countries with an electrification rate below 33% do not recover their operating costs before subsidies are considered (World Bank, 2021b).<sup>12</sup> Utilities should improve their commercial performance by leveraging the data they have to follow a more customer-centric approach and by improving customer engagement/communications.

While the frameworks for mini grids and off-grid solutions are more advanced than grid frameworks, their implementation has been a challenge: for example, many countries have enacted light-handed regulation for mini-grids, but the regulatory approval processes have often been lengthy and lack in transparency. Similarly, while many countries have adopted customs duty exemptions for off-grid solar products, these have not always been applied by customs agents; quality standards are often adopted but not enforced.<sup>13</sup>

## Incomplete Social-Economic Inclusiveness of Energy Access

Providing electricity and clean cooking access to all segments of society—**ensuring that no one is left behind**—is a core challenge. People lacking energy access are often poor and the most vulnerable in society. Aligning consumer affordability with supplier financial viability with respect to energy access in these situations is complex.

**Poor, vulnerable (including disabled, displaced persons, or other vulnerable groups) or female-headed households/female beneficiaries are at risk of being left behind if targeted support is not provided to them to deliver electrification solutions targeted to their needs at prices they can afford.** These population segments require special consideration when business and financing models are being prepared that are likely to include end-user subsidies; consumer awareness-raising efforts targeting their conditions is also required.

Access to electricity and clean cooking have both been historically unevenly distributed across income groups. Off-grid solar companies targeting primarily rural and primarily lower-income customers have started to close this income divide, but affordability gaps persist. Recent estimates show that at least 112 million people, including vulnerable and female-headed households, are unable to afford the most basic electricity service (Tier 1 system), even if this is offered with a consumer financing option (World Bank, 2020). This number is likely to have increased as a result of the COVID-19 economic crisis. Many last-mile households live on under USD 4 a day and are not being served by current commercial off-grid energy services.

In access-deficit countries and in particular in sub-Saharan Africa, a quarter of health facilities have no access to electricity at all, and another half have only unreliable electricity (WHO and World Bank, 2014). As two thirds of schools lack reliable electricity, distance learning as a response to the COVID-19 crisis remains a far-off aspiration (World Bank and SEforALL, 2020).



Female headed households (FHHs) and women in the energy business, in particular, face additional inequalities and challenges, because (i) there is a lack of data and market information about women customers, their needs, and the characteristics of their energy demand; (ii) unequal access to assets and land ownership, and limited control over them, directly affects women's ability to purchase energy products and prevents them from having collateral for loans from formal finance institutions; (iii) as discriminatory gender norms and decision-making power resides with men, women's influence over a decision on whether or not to purchase energy products is weak; (iv) seasonal and informal jobs, and income fluctuation throughout the year, make it difficult for women to make regular payments on an energy product; and (v) systemic barriers to education and lack of training opportunities for advancement may dictate women's ability to enter the workforce and to become leaders in energy companies or enterprises.

The new mini-grid and off-grid solar supply chains being built present socio-economic opportunities for new employment and entrepreneurial activities for women, but the available evidence shows that these opportunities are not yet being fully realized. A recent study of three countries found that women's participation in the Decentralised Renewable Energy (DRE) sector still has room for improvement: women made up less than 30% of the workforce: 23% in India and Kenya and 27% in Nigeria (Power for All, 2019).

As of 2017, there are 68.5 million forcibly displaced persons (FDPs) in the world, of which 40 million are internally displaced people, 25.4 million are refugees, and 3.1 million are asylum-seekers (UNHCR, 2017). Their host communities' energy infrastructure is often unable to deal with the additional demand and stress posed by these extra populations. Consequently, FDPs and their host communities frequently lack access to legal, safe, reliable, and affordable electricity, which is vital to: (i) preventing gender-based violence, (ii) supplying clean water and adequate hygienic conditions, (iii) powering cold chains for food security, (iv) improving the quality of education for children and youth, and (v) ensuring reliability of healthcare services. According to estimates by the UN High Commissioner for Refugees (UNHCR), more than 90% of refugees in camps have limited access to electricity.

**In Fragility, Conflict, and Violence (FCV) settings**, where 48% of today's population without access to electricity is concentrated, security constraints and other forms of fragility make energy service provision even more difficult and costly and consumers' ability to afford services even lower (Tracking SDG7, 2021). Furthermore, these countries often face institutional and capacity issues in delivering energy that make it more difficult to enact the necessary enabling policy and regulatory frameworks. These frameworks need to be adapted to the complex fragility situations in each country and take into account additional fragility challenges. Only limited FCV countries have enacted advanced electrification frameworks, although there are some signs of success, with half of FCV countries having improved the mini-grid and off-grid frameworks since 2010. For clean cooking, the RISE scores of countries marked by fragility are less than half those of non-fragile countries (ESMAP, 2020a).

The lack of inclusion of civil society and socio-economic groups in tariff approval and other access planning processes in LDCs remains a challenge. Their involvement into tariff approval processes in LDCs remains a blind spot.

# Misaligned Costs, Reliability, Quality, and Affordability of Energy Services

The pace of both electrification and clean cooking expansion is limited by the gap between the costs of reliable, quality service delivery, and affordability levels. To close this gap, costs need to decline and consumer willingness to pay (closely linked to affordability) needs to increase.

The World Bank's Multi-Tier Framework (MTF) for both electricity and cooking offers a formal tool to integrate holistic criteria on users' needs and preferences (Bhatia and Angelou, 2015). The MTF captures detailed indicator level data (using 6 attributes: quality/exposure, efficiency, convenience, safety, affordability, and availability) for tracking progress across tiers of access (from Tier 0 to Tier 5). In-depth data from MTF makes it possible to understand the behaviour and consumption pattern of end-users (i.e., use of backup solutions, consumption, appliance ownership, and energy expenditure) and thus allows insights to be provided into the types of policy reforms and project interventions that would drive higher levels of access to electricity and clean cooking. The richness of MTF data can provide valuable intelligence for the private sector to identify the market potential. In several countries, results from the MTF survey are helping to deepen sector dialogue and inform policies.

**Income remains a fundamental driver of cooking fuel and stove demand**, with the poorest people most dependent on the historically most affordable fuels: primarily wood and charcoal. When looking primarily at the relative share of income spent on fuel, higher-income households are more likely than lower-income ones to afford access to clean cooking fuels. This trend even occurs in countries with subsidy and direct provision programs. Compared to urban users, rural users tend to spend less on fuel, owing, in large part, to the prevalence of wood that can be freely collected. Roughly half of sub-Saharan Africa's population depends on free fuelwood for cooking (Hosier *et al.*, 2017) which make it difficult to switch. In urban settings, where households are less likely to have access to free fuel sources, a larger proportion of their income must be allocated to cooking energy.

In addition to fuel costs, the high up-front costs of cooking appliances also severely limit the affordability for the poorer half of consumers. The costs range from USD 50–100 for LPG and electric stove kits, to USD 75–100 for biomass fan gasifier stoves, to USD 500–1500 for biogas. Consumers are typically willing to spend the equivalent of 1–2 months of fuel expenditures on an improved appliance, meaning that stoves in the USD 30–100 price range are not affordable to about 66% of the global population.

On the supply side, for the clean cooking sector, the upfront costs to consumers remain high, as the stove and fuel markets are complex, fragmented, and highly contextual (i.e., lacking a highly scalable one-size-fits-all solution). Economies of scale are poor, and transaction costs are high. There are 400–500 active manufacturers and distributors in the cooking-operations chain across the world. Few, if any, of the businesses have reached volumes that enable economies of scale. Most cooking-sector actors are unprofitable which make it even harder to attract commercial financing.

The supply and demand imbalance is also a result of insufficient attention to user needs and behaviour patterns. Clean cooking interventions have traditionally been framed by the narrow technical attributes of 'clean' and 'efficient' and have paid too little attention to the contextual attributes of convenience, safety, affordability, and availability which are critical in household decision-making around cooking solutions. Consequently, they have often fallen short in terms of meeting the real needs of households,

especially lower-income rural and increasingly urban ones. This narrow framing leads to the promotion of solutions that are less likely to be adopted and used by the consumers they seek to help, which in turn makes the supply sector unattractive for investors and policymakers.

A more complete and rigorous perspective on cooking would reflect local users' concerns for exposure, efficiency, convenience, safety, affordability, and availability in the context of local fuel and stove market conditions.

In-depth data from MTF makes it possible to understand stacking behaviour (i.e., use of multiple stoves and fuels in the same household) and thus be able to distinguish between the negative trend of “dirty” stacking with polluting, traditional stoves and fuels and the high potential of “clean” stacking. Even in countries where clean-fuel penetration is relatively strong, affordability, convenience, and availability factors may drive users, particularly in rural areas, towards less clean, secondary solutions. Therefore, understanding the “hows” and “whys” of end users' preference will be essential for providing reliable and sustainable cooking energy service solutions. Using the market-based approach such as using results-based financing (RBF) mechanism to incentivise the private sector to deliver outcome and impact level results will also nudge them to focus on end users' preference to design and deliver clean cooking solutions.

**For electricity, costs also remain a barrier in all electrification options—grid, mini-grid, and off-grid.**

For grid electricity, the costs of supply in most energy access-deficit countries remain comparatively high, especially in smaller FCV countries. These high costs of generation are related to small size of electricity systems in many energy access-deficit countries that do not allow economies of scale, but also suboptimal decisions on generation mix and Independent Power Producer (IPP) contracting deficiencies (Foster and Witte, 2020), and sub-optimal operational efficiency of national utilities. There is an opportunity to reduce these costs, while also pursuing the low-carbon development path by investing in lower-cost locally available renewable energy generation and by supporting regional interconnections to build larger systems that allow economies of scale to be harnessed and can unlock viable investment opportunities in on-grid renewable energy, while loss-reduction strategies and innovative partnerships can improve the performance of national utilities. Reducing costs of generation, transmission, and distribution would allow utilities to increase their cost recovery, as well as to pass on benefits to consumers through improved reliability and potentially lower tariff.

**The expansion of mini-grid and off-grid solar systems has been driven by the falling costs of the key components of these systems**, but the costs still need to fall further to drive the required expansion and increase affordability for the poor. For example, for mini-grids, the current cost for an unsubsidized, well-designed mini-grid is still in the range of USD 0.40–0.50/kWh, while with continued technology improvements, as well as through economies of scale, it is estimated that this cost could fall to under USD 0.20/kWh by 2030. The retail tariff can be lower if subsidies are available (ESMAP, 2019). Equally, as mentioned above, even the Tier 1 off-grid solar system is not yet affordable for all households without subsidies (World Bank, 2020).

While reducing the costs of supply is essential, electricity demand-side constraints should not be underestimated. These include: (i) high upfront costs required to obtain an electricity connection, off-grid solar system, or a cookstove (and associated appliances); (ii) lack of consumer financing options; and (iii) lack of awareness/behavior aspects.

Considerable progress has, however, been achieved in reducing connection fees for grid electrification in recent years. Some 52 out of 54 low access countries are now considered to have affordable connection fees (ESMAP, 2020a).<sup>14</sup> However, the poorest and more vulnerable households may still find affordability barriers, particularly where connection fees have to be paid upfront and where additional expenses, such as for internal wiring, are needed. For example, as evidenced by the Multi-Tier Framework (MTF) surveys,<sup>15</sup> high connection fees and associated expenses to get a connection continue to be the primary reasons why 'under the grid' households are not connected. Affordability of off-grid solar systems also significantly improves when consumer financing options are offered (World Bank, 2020. [MTF surveys]). However, consumer financing options, including digital and pay-as-you-go (PAYG) technologies, are not yet widely available in the majority of low-access countries, in particular for rural consumers.

Utilities should operate under a customer-centric approach rather than a utility-centric solution, using real-time data to systematically refine their business model and tailoring services to specific consumer segments and needs. They can be helped by technologies to achieve this. Conversely, to acquire and customize the right set of technologies, a utility providing end-consumer services must have good information on the changing needs of its customers and a deep understanding of the existing customer classes (residential, public institutions, small and medium commercial, industrial, agricultural), as well as emerging (e-mobility).

Furthermore, data from MTF surveys and impact evaluations show that electrified households, particularly in rural areas, have very low ownership of appliances and are thus not reaping all the benefits of electrification. Energy-efficient appliances would make services more affordable, but there are often issues of appliance availability (they may not be available for purchase in rural areas), affordability (especially high upfront payment and lack of consumer financing options), as well as limited awareness (Waldron and Hacker, 2020). These issues also apply to appliances for cooking (e.g., pressure cookers), for cooling, and for productive uses—where they are particularly detrimental because they inhibit the virtuous cycle of higher household income, greater electricity consumption, increased revenues for service providers, improved viability and sustainability of electrification efforts, and improved affordability for consumers.

**Furthermore, poor reliability and service quality are undermining electrification efforts** in three ways. First, they deter households and businesses from connecting to the services. Second, they limit the usefulness of electricity, thereby constraining demand and potential for productive uses, which in turn threatens the revenue flows and sustainability of service provision. Third, they miss the opportunity to deliver the human and social benefits that prompted the public investment decisions in the first place.

**Productive uses of electricity and electrification of public institutions, such as healthcare facilities and schools, key enablers of social-economic and human capital development, in particular, are hindered by reliability and quality issues.** It is often perceived too risky for businesses to invest in new machinery and appliances if they do not know whether they will be able to run them when they are needed or whether they could be damaged, for example, due to voltage fluctuations, or they need to invest in back-up solutions, which are costly (Blimpo and Cosgrove-Davies, 2019). Furthermore, many healthcare and education facilities receive insufficient and unreliable grid service, and need to compensate with supplementary back-up solutions, which are typically costly and polluting diesel-fuelled systems. On the other hand, facilities that have been electrified with off-grid solar systems in the past tend to lack sustainability, given that the focus at the time was typically on procuring and installing systems and not on setting up sustainable service arrangements. The mindset of implementing agencies and

the international community needs to be changed from procurement of assets to delivery of service. Long-term service provision business models are required to harness the human development benefits of decentralized electrification (Elahi *et al.*, 2020).

**Availability, reliability and quality are the main attributes preventing grid users in low access countries to reach Tier 4 and 5 levels of electricity access.** (World Bank 2020. [MTF surveys]) Most of the national grid utilities (particularly at the distribution level) in the 95 energy access-deficit countries are struggling to provide reliable services, as they are tackling financial and operational challenges that limit their ability to invest in reliability improvements and balance the economics of serving low-income and rural customers, where the access-deficit is the most significant. These include: (i) lack of cost-recovery, (ii) large technical and commercial losses, (iii) institutional and operational capacity constraints, and (iv) pressure to expand electricity to new connections even when this is not technically and/or financially sustainable. In many countries, also, generation capacity is not sufficient to cover demand, especially at peak times. Utilities in many energy access-deficit countries are caught in a vicious cycle of poor financial and operational performance resulting in, and resulting from, underinvestment in grid expansion and sustainable reliable access.<sup>16</sup>

**The new generation of solar hybrid mini-grids have demonstrated that mini-grids can deliver reliable and quality access to their customers (at Tier4+), but sustained quality service provision needs to be still demonstrated at scale.** Off-grid solar markets, on the other hand, have demonstrated the ability to serve a large number of unelectrified households: they are the primary electricity source for 420 million people, but quality and sustainability of the overall market can still improve, as quality-verified systems<sup>17</sup> account only for 32% of the overall market (World Bank, 2020). For the off-grid solar sector to deliver on its promise to be the key delivery for people in the last mile that cannot be reached by grid or mini-grids, the share of quality-verified systems needs to increase, in particular in the Tier1+ segment.

**The technology and innovation of the cooling sector need to be improved dramatically to identify solutions** not dependent on electricity (such as passive cooling) and for use by poor and vulnerable populations in off- or weak-grid environments. The challenges, opportunities, and financial needs vary across cooling sectors, applications, and jurisdictions. Key barriers to broader access to efficient, sustainable cooling include: (i) weak policy environments; (ii) first cost and lack of access to affordable financing; (iii) lack of data and awareness; (iv) lack of fit-for-purpose business and implementation models; (v) competing priorities; (vi) lack of skills; (vii) lack of investment in research and development; and (viii) lack of affordable reliable and clean power. In addition, only 0.0 % of total Overseas Development Assistance is directed to cooling solutions, based on initial ESMAP estimations.

## Insufficient and Misdirected Energy Access Financing

In the decade 2020–2030, the annual investment required to achieve universal energy access totals around USD 35 billion for electricity (IEA, 2020) and USD 25 billion for clean cooking.<sup>18</sup>

Public and private finance commitments in 20 of the highest-deficit developing countries, which together are home to nearly 80% of the people living without access to sustainable energy, reached an all-time high of USD 36 billion in 2017 (SEforALL and CPI, 2020). This finance was driven primarily by

increased international public finance. However, only one third of this finance (USD 12.6 billion) benefited residential consumers. Further, LDCs attracted only 20% of international commitments supporting clean energy to developing countries in 2018, even though 15 LDCs are in the top 20 access-deficit countries in the world (OHRLLS *et al.*, 2021).

**Finance for clean cooking remains far below the investment needed to achieve SDG 7.12 by 2030.** For example, the current traceable investment in clean cooking was only USD 131 million in 2018 (SEforALL, 2020), far less than USD 6 billion estimated by IEA, 2021 for access to clean cookstoves only and less than 0.1% of the investment required to achieve modern energy cooking services, the highest tiers of cooking solutions.<sup>18</sup> Furthermore, resources are not reaching the countries that need them the most. A total of 18 countries that are home to 2.2 billion people without access to clean cooking attracted only 25% of the investment (SEforALL, 2020).

**The low level of available financing to the cooking sector is due to the high risks and low profitability perceived by the private sector and the low level of support from the public sector.** The complexity and fragmentation of the cooking ecosystem has also hindered advancement. An analysis of the current industrial stove market, limited to those supplying clean stove-and-fuel combinations, reveals that the cooking market currently features only about 50 consistently profitable and stable, cooking-focused businesses or approximately 10% of the total formalized industry. Investors and funders have been unwilling to provide a critical mass of capital to the clean cooking sector owing, at least in part, to the perceived riskiness of these enterprises. Grant volumes are small, and a critical share of the non-grant financing in the cooking space is poorly adapted to the volumes or financial structures needed by businesses in the sector. Moreover, innovative financing instruments (e.g., carbon finance) fail to reach their beneficiaries at the right time. Without major reorientation of priorities by the energy access funders, including those from both public and private sectors, universal access to clean cooking is unlikely to be achieved.

**For financing electricity access,** it is estimated that between USD 35 billion (IEA, 2020) and 40 billion (IEA, 2020b) are needed to reach universal electricity access between 2021 and 2030. Mobilizing sufficient financing to support mini-grid and off-grid electrification is a particular challenge. Grid extension and densification is the least-cost option for providing electricity to 42-57% of the population needing to gain access by 2030. However, the least-cost option is not necessarily the quickest or the most feasible approach, leaving a much larger role for decentralized renewable energy technologies to close the access gap. IEA (2017) and Bloomberg New Energy Finance (BNEF) (2020) estimate that to achieve universal access, about two thirds of electrification financing should flow to mini-grid and off-grid technologies. Yet, in 2017 investments to mini-grid and off-grid technologies accounted for only for 1.2% of total electricity finance flows in the 20 high impact energy-access countries (SEforALL, 2019). Support is needed to graduate households further into higher levels of access (i.e., Tier 1 and above) and quality standards are needed to protect consumers in the fast-growing markets (World Bank Group and GOGLA, 2020).

**For on-grid generation,** the weak creditworthiness of utilities as the main off-takers (i.e., signed Power Purchase Agreements [PPAs]) is the main barrier to gaining larger private financing flows. It thus needs to be addressed as a priority, for example, by seeking innovative private-sector engagements and partnerships.



**For mini-grids and off-grid solutions**, the principal barriers are the relative novelty of the technologies and new business models (including uncertainty about the demand profiles of mini-grid users) and the sector's preponderance of start-up companies, which are also perceived to be risky, many of which are yet to achieve the path to profitability. Additional barriers arise from the general country risks of the low-access areas where these companies operate. Financing flows, especially to smaller companies, have normally been constrained, but are worsening under COVID conditions. For mini-grids especially, private-sector debt financing has remained the main bottleneck. Access to local currency debt, in particular, is difficult to obtain for both mini-grid and off-grid solar companies.

**The challenge of mobilizing private financing** is twofold: (i) insufficient financial flows for access; and (ii) unbridged gaps between the needs, constraints and incentives of consumers on one hand, and energy suppliers, equipment distributors, private investors and lenders, and public funders, on the other. End users require credit or flexible payment methods to be able to afford the connection costs and the upfront investments in systems and appliances. Service providers require access to low-cost working capital to finance the systems over long repayment periods. The capital also needs to be made available in both local and foreign currency to efficiently manage currency fluctuation risks, as is evident from the COVID-19 crisis and other past external shocks. However, without more targeted demand-side interventions, the existing market incentives are often insufficient for the private sector to extend their solutions to these zones or segments. Households belonging to this group are considered high-risk customers and will not be a priority especially for companies that are already in financially precarious positions; the gap may need to be bridged through a careful consideration of both supply- and demand-side subsidies.



# 6

# RECOMMENDATIONS

Achieving SDG 7 will require a **system-level paradigm shift, challenging the habitual ways in which energy policy and investments are directed**. SDG 7 calls for an integrated approach that delivers on universal access to electricity and clean cooking while undertaking the transition towards net-zero energy systems by mid-century.

Universal energy access must become a political, economic, and environmental priority, supported by policies, investments, data, innovations, and multi-sector partnerships. It must be supported by all energy access stakeholders—starting with local communities, who need to be active participants in planning and implementing their access to energy—and encompassing governments, the international community, national utilities, the private sector, financiers, civil society, and academic institutions.

The energy-access challenge is multi-dimensional and multi-sectoral, and deeply affects the lives of billions of people. It cannot be resolved by fragmented and piecemeal efforts but requires a bold, system-level approach. The time to deliver this paradigm shift is now.

## Strategic Recommendations for a Paradigm Shift

Significant acceleration of the current energy-access expansion efforts is needed in order to achieve the SDG 7 universal access targets by 2030. Table 1 below provides critical reference points that need to be reached by 2025 in order to achieve the 2030 targets. The pace of clean cooking expansion needs to increase from the current growth rate of 1.2 percentage points to 3 percentage points per year, so that by 2025, 82% of the population can benefit from access to clean cooking technologies and fuels (Tracking SDG7, 2021). Even this progress, however, is not sufficient, as it will not be able to address the common practice of fuel/stove stacking. Country-specific pathways and roadmaps are needed to guide the countries' transitions to modern energy cooking services (which are clean, efficient, convenient, safe, reliable, and affordable, as measured by MTF to achieve tiers 4 and 5) by 2050 and use energy resources aligned with the net-zero target. Globally, the most polluting cooking practices (MTF tiers 0 and 1) need to be eliminated by 2030, while access to modern energy cooking services needs to increase from 48% to 57% by 2025 and to 65% by 2030,<sup>20</sup> so that it can reach 100% by 2050. (ESMAP, 2020b).

The pace of electrification needs to increase from the current 1.5 percentage points to at least 2 percentage points per year, which will raise global electrification rate by 2025 to 94%. (ESMAP calculations based on Tracking SDG7, 2021).<sup>21</sup> This will require, among others, building 14,200 mini-grids per year by 2025, from the less than 1,000 today<sup>22</sup> (ESMAP, 2019), while the global sales of the off-grid solar systems (Tier 1 and larger) need to increase from 15 million in 2019 to 30 million by 2025.<sup>23</sup> Country-specific pathways and roadmaps are needed to guide the countries' transitions up to MTF Tier 5 levels of capacity, availability, reliability, quality, affordability, formality, and safety of electricity access by 2050.

**TABLE 1. CRITICAL REFERENCE OUTPUTS NEEDED TO BE ACHIEVED BY 2025**

Critical reference outputs	2020	2025
Share of population with access to clean cooking fuel and technologies in access-deficit countries	66% <sup>24</sup>	82%
Pace of expansion of clean cooking fuel and technologies in access-deficit countries (annual average)	1.8 <sup>25</sup> percentage points	3.0 percentage points
Share of global population with access to MECS	48% <sup>26</sup>	57% <sup>27</sup>
Share of global population with access to improved cooking services	16% <sup>28</sup>	25% <sup>29</sup>
Share of population with access to electricity services in access-deficit countries	82% <sup>30</sup>	94%
Pace of expansion of electricity in access-deficit countries (annual average)	1.5 <sup>31</sup> percentage points	2.0 percentage points
Number of mini-grids to be built in electricity access -deficit countries per year	200-1000 <sup>32</sup>	14,200 <sup>33</sup>
Number of Tier1 off-grid systems sold annually	15 million <sup>34</sup>	30 million

The paradigm shift should be guided by the following **strategic recommendations**.

## RECOMMENDATION 1

**Align energy policy and investment with transition pathways that accomplish universal access to electricity and clean cooking by 2030.** This means that, in a joint global effort, we must provide access to electricity to 759 million people who currently have no electricity, and provide access to clean cooking solutions to 2.6 billion people who currently depend on traditional polluting cookstoves and fuels, while at the same time undertaking energy transitions towards a net-neutral energy system by 2050. Achieving universal access to sustainable, reliable, affordable, and modern energy must also be an integral part of the just energy transition—embedded in countries' climate commitments and their strategies and actions for net-zero energy systems. The just energy transition must not ignore the needs of the low-income population who lack energy access, and it acknowledges the essential role of energy access for climate change adaptation, while ensuring that energy-access expansion efforts avoid carbon lock-in.

To achieve these objectives, countries should find ways to reorient fossil fuel and other inefficient subsidies that encourage wasteful consumption of energy into smart subsidies for clean energy access, targeting poor and vulnerable households and community health and education facilities.

## RECOMMENDATION 2

**Prioritize and coordinate political commitments and financing into accelerating access to clean cooking.**

Clean cooking cannot be an electrification planning afterthought. Cooking energy demand should be fully and formally integrated into energy planning and strategy development. Driving progress forward also requires the mobilization of unprecedented financial and analytical resources to improve the overall cooking ecosystem, as well as innovative technologies and partnerships. A transition to universal access to clean cooking will not be a quick-fix, but will require a determined least-cost, best-fit transition approach that not only reflects local users' needs and local market conditions, but takes into account the socio-economic, health, food-security, gender, climate, and safety dimensions. Policy priority for clean cooking should reflect the major multi-sectorial benefits of universal access to clean cooking. This means building on granular understanding of household cooking energy use, including fuel stacking practices, as an input to broader national-level energy decision-making—a process that capitalizes upon energy system investments, incentives for clean energy consumption, and trade and energy investment policies that best leverage national comparative advantages and endogenous innovation. In the same vein, decentralized energy solutions and access to life-changing appliances, should be included in energy planning and strategy development alongside access to the national grid. Both public and private financing for clean cooking and decentralized energy solutions needs to increase drastically, and should additionally include end-user subsidies to bridge the affordability gap.

## RECOMMENDATION 3

**Universal access to energy must be positioned as a key enabler and driver of inclusive, sustainable, and resilient economic recovery and growth and as an integral part of just energy transitions.** Energy access planning must be fully integrated with other sector-development priorities and exploit synergies with other SDGs (as referenced in the Impacts section below). This integration will drive a broad-based political commitment to energy access by national governments, as well as greater impacts in areas such as improved livelihoods, health outcomes, human capital, food security, climate, jobs, and gender equality. COVID-19 economic recovery plans to 'build back better' present a unique opportunity to put this broader vision of energy access into action. Given how dire the impacts of the lack of clean cooking and electricity access are on countries experiencing fragility, conflict, and violence, development partners should prioritize support for LDC and FCV countries; further, they should work in partnership with humanitarian and peacebuilding organizations to help governments improve their strategic, policy, and regulatory frameworks, explore innovations and adaptations of successful approaches to fit the complex situations of fragility, conflict, and violence, and ensure the mobilization of both public and private investments for a rapid scale up of access intervention.

## RECOMMENDATION 4

**Efforts to deliver universal access to energy access need to have people at their centre.** Both clean-cooking and electricity-access initiatives must be designed based on (a variety of) human needs, household practices, user preferences, and consumer-affordability levels. The complexity of energy systems requires the ability to perceive challenges and solutions across multiple perspectives, contexts,

and interdependencies, acknowledging the multi-dimensional character of cooking practices and electricity uses, and addressing underlying inequalities. Furthermore, communities and users should be seen not only as beneficiaries, but also as co-creators of future energy systems. People-centred energy-access approaches will also need to include a social safety net to deliver modern energy services to those people who cannot afford the full cost of access to electricity and clean cooking. Clean cooking interventions will be successful only if they address cooking preferences and behaviours. The user-centric approach is at the heart of the Modern Energy Cooking Concept (MECS). This approach acknowledges the multi-dimensional character of cooking practices and the need to consider variations in cooking practices, preferences, and behaviours, including fuel and stove stacking, in designing and implementing clean cooking policies and interventions. Similarly, electrification efforts need to transition from counting connections to delivering energy services (which include cooking services) that enable users to enjoy the full benefits of reliable and affordable electricity access, including the ability to deploy appliances and equipment for both domestic and income-generating/productive uses. This should be supported as part of energy-access expansion efforts. Research and entrepreneurship, in which a critical role will be played by women and youth, will be important for driving innovations in clean cooking and electrification technologies, and business models, supported by enabling policies and regulations, to drive down the costs of energy services, make them affordable, and ensure that they are aligned with user needs and preferences. These innovations need strong support from governments, development partners, and financiers. The reliability and quality of energy services, essential for human and economic development, need to be emphasized for all technologies and business models. For the clean cooking and decentralized renewable energy (DRE) sectors, quality standards in line with international best practices are needed, and governments should continue to play a key role in adopting, implementing, and enforcing them. Development partners should work with governments and service providers to increase access to high-quality, energy-efficient appliances and productive use equipment, including through the provision of affordable end-user financing.

## RECOMMENDATION 5

**The last mile of energy access must become the first mile.** Lack of access to clean cooking and electricity is disproportionately affecting the low-income and vulnerable segments of the population, including displaced people and host communities, which face affordability constraints for clean cooking stoves, fuels, electricity services, and appliances alike. Women and girls are also disproportionately affected. Evidence from various countries shows that, compared with men, women are exposed to significantly higher levels of particulate matter (PM) emissions and that risks of physical injury and violence associated with the involvement of women and girls in fuel collection are endemic. The situation is especially dire in refugee camps and similar environments. In addition, time spent on fuelwood collection can contribute significantly to women's time-poverty (ESMAP, 2020b). Women and girls are also disproportionately represented in the remaining unelectrified population, which is predominantly rural and poor. Creative, context-sensitive solutions are needed to unleash sustainable energy-access expansion efforts that are truly inclusive and meet the specific needs and situations of vulnerable populations and support their capacity and prospects to change and overcome energy poverty. This is not only a matter of equity, justice, and dignity, but a necessity for all of us. Half of the population without access to electricity lives in countries that are experiencing fragility and conflict. Further progress cannot be achieved without significantly increasing rates of access to electricity and clean cooking among the remote, poorest, and vulnerable population segments, including communities affected by displacement,

while ensuring that these efforts also leverage the opportunities to create jobs, improve livelihoods, build human capital, and engage youth and women. Gender gaps should be closed through the support of gender-transformative strategies, enhancing the role of women in the energy sector as beneficiaries, employees, and entrepreneurs, and raising their voice in decision-making. Affordability constraints need to be addressed through a careful design and implementation of sustainable, efficient, and targeted end-user subsidies, which should be prioritized by governments and the international community. Furthermore, public and community institutions providing essential services, such as health, education, and clean-water provision, require special attention as users to increase their resilience to future shocks and support human capital formation; they can also be leveraged as vectors for raising awareness for change. As the gap in finance needed to provide energy access in the LDCs is vast, there is an urgent need to increase funding for energy access, and to deliver on climate finance pledges allocated to LDCs. This can have a direct impact on accelerating poverty eradication and as a key enabler for sustainable development.

## RECOMMENDATION 6

**Enterprises with innovative, cost-effective, and scalable energy-access business models must be supported so that they can expand their operations and rapidly accelerate access.** The private sector plays a key role in driving access to electricity and clean cooking solutions, particularly for poor and rural communities. Several enterprises have a clear and demonstrated approach to reaching ‘last mile’ homes and businesses and a focus on building the innovative models needed to create sustainable energy access. Unlocking and supporting this innovation and working with the private sector to create the pioneering mechanisms that will enable scale can enhance the speed of energy access and provide an accelerated pathway for achieving the 2030 targets. This also includes working with the private sector to create new public–private partnerships to address affordability constraints and the high costs of reaching rural customers in the most efficient ways.

## RECOMMENDATION 7

**The pace of knowledge exchange, capacity-building, partnership-building, and innovation needs to accelerate in line with more expeditious energy-access efforts.** Human capital will be essential for driving universal access to energy. Governments, development partners, and service providers should support local academic and training institutions by investing in capacity-building and skills acquisition for all levels of participants in sustainable energy–access expansion efforts, from policymakers to technicians: they should also promote local entrepreneurship, particularly among women and youth. These investments in human development should, in turn, drive further innovation in technologies, business models, financing, policies, and market enablers to accelerate the overall pace of energy-access expansion. CSOs, NGOs, industry associations (and other sector-support organizations) should be supported to enable fair and transparent representation of industry and civil society in dialogue with governments and to share best practices among sector stakeholders; this will facilitate commercial matchmaking, partnership building, and community engagement. To achieve the required pace of clean cooking and sustainable electrification efforts, best practices and lessons need to flow rapidly across all stakeholders: governments, development partners, service providers, academic institutions, and the communities and users themselves. Development partners should invest in mechanisms to enable this rapid transfer of knowledge for the benefits of all electrification stakeholders.

## RECOMMENDATION 8

**Achieving and tracking results will require the availability and quality of energy information and data to be improved.** Timely, detailed, end-user and supply-side data are necessary to understand consumers' needs and what interventions will likely be effective in accelerating access. The recommended survey question module on energy, currently under development by the World Bank, that can be inserted into regular household surveys, follows the MTF. These data should be complemented with supply-side data, for example, from utilities, and leveraged by innovations in data collection, such as satellite imagery. Open access to data and development of open-source tools should be promoted by all stakeholders.

### BOX 1. SPECIFIC ACTIONS ON DATA AVAILABILITY AND QUALITY

- **End-user data**

- *Governments, with support of development partners, industry associations and civil society organizations*
- To collect more detailed and nuanced data on access to electricity and clean cooking at the end-user level by integrating the recommended energy module into the national household survey.
- To build the capacities of statistical agencies, for instance, national statistical offices (NSOs) and other key stakeholders involved in data collection and use.

- **End-user insights**

- *Governments, with support of development partners, industry associations and civil society organizations*
- To invest in generating stronger user insights by supporting enterprises and entrepreneurs in conducting deeper user research, and in generating coordinated research and analysis on user needs and behaviours related to cooking and productive use.

- **Supply-side data**

- *Governments and utilities, with the support of development partners, industry associations, and civil society organizations*
- To encourage utilities to make supply-side data more reliable and publicly available.
- To build capacities of statistical agencies and other key stakeholders involved in data collection and use.

- **Innovation, knowledge sharing, and learning.**

- *Governments, with the support of development partners, industry associations, and civil society organizations.*
- To invest in data, tools, open-source technologies, and platforms that can spur innovation, knowledge sharing, and learning.
- To publicize and promote better access to data for all energy-access stakeholders.



## Key Building Blocks

The 2025 outputs referenced above, and the associated paradigm shift, will require accelerated and sustained progress in: (i) reinforcing the **enabling policy and regulatory frameworks**, (ii) enhancing **social-economic inclusiveness of energy access**, (iii) aligning the **costs, reliability, quality, and affordability of energy services**, and (iv) catalyzing, harnessing, and redirecting **energy-access financing** to the degree needed to deliver universal energy access by 2030.

This section summarizes recommendations for each of these essential building blocks, sets milestones to be achieved by 2025, and prioritizes immediate actions to deliver on these milestones.

### BUILDING BLOCK 1: REINFORCING THE ENABLING POLICY AND REGULATORY FRAMEWORKS

**Comprehensive energy-access strategies.** All access-deficit countries should adopt comprehensive national electrification and clean-cooking strategies and integrate energy-access priorities into their broader economic development and climate strategies, including nationally determined contributions (NDCs). The national strategies and accompanying plans should have specific targets and milestones, be up-to-date, well-consulted and publicly available, and integrate best practices. The strategies and plans, including targets and milestones, must be country- and context-specific and, in particular, reflect the user-centric approach described in Recommendation #3, and provide context-appropriate solutions to electrify all segments of the population, productive use and public institution segments, based on the 'leave no one behind' approach, described in Recommendation #4. It is therefore recommended that the plans should provide targets for tiers of access, specifically targeting the highest-possible tiers that are technically, economically and financially feasible, while ensuring, however, that everyone gets access to at least basic energy-access service in the shortest possible time period, while specifically addressing affordability constraints.

**By 2025, the share of access-deficit countries with clean cooking strategies, action plans, and target countries with clean cooking RISE scores above 67 (advanced framework) must increase to 100% from the current 15%.** For clean cooking, all strategies need to particularly highlight (i) institutional strengthening, (ii) building of an enabling policy and regulatory environment, (iii) widespread awareness drives, (iv) last-mile distribution strategies for both modern and improved cooking solutions, and (v) stimulation of household demand through subsidies and financing mechanisms.

**By 2025, the share of access-deficit countries with national electrification strategies and integrated least-cost electrification plans with RISE scores above 67 (advanced framework) must increase to 100% from the current 26%.** For electrification, all strategies and plans should include an integrated approach, leveraging grid, mini-grid, and off-grid solar technologies, account for clean cooking demand, have explicit support for productive uses of electricity and electrification of public institutions, have established targeted measures to reach the poor and vulnerable households (including displaced people and host communities), and reflect resilience aspects. The new generation of integrated, geospatial electrification plans allow governments to chart pathways that are not only least-cost, but also dynamic, and take into account specific country opportunities, limitations, and policy objectives. The strategies and plans should therefore define long-term least-cost electrification pathways, while also developing interim strategies to bring the benefits of electricity to their populations faster, for example, by prioritizing pre-electrification with mini-grid and off-grid solar technologies.

**Enabling policy and regulatory environment.** Both the electricity and clean cooking sectors need to continue to improve their enabling ecosystems, including their policy and regulatory frameworks. The RISE score is used here as a proxy for progress, given that it encompasses a wide range of indicators summarizing key elements of the policy and regulatory frameworks in the grid, mini-grid, off-grid solar, and the clean cooking segments (ESMAP, 2020a) **By 2025, the average RISE scores for energy access–deficit countries must increase to 67 or above (advanced frameworks) from the current 37 for clean cooking and 53 for electricity (ESMAP, 2020a)**

For clean cooking, as noted above, this implies improving the content of the clean cooking strategies and plans and making sure that the plans get operationalized and implemented; it also involves ensuring that they are targeting all segments of the population appropriately. As a lack of champions and intergovernmental coordination is a key barrier, it is important to assign an institutional champion within the government to coordinate with key stakeholders and to be accountable for the clean cooking strategy implementation. 'Clean Cooking Delivery Units' may be further established to draw in expertise, mobilize funding, coordinate various models of public–private partnerships (PPP), and engage with the local communities and the international development community.

In addition, high taxes and misaligned tariff codes, in particular, have hindered adoption of products for clean cooking and overall sector growth. This challenge is shared with the off-grid solar sector. While a number of countries have issued customs duty/tax exemptions for off-grid solar products, the consistency in implementing such exemptions needs to improve and intensify, in particular, for the clean cooking sector. Governments need to reassess the macroeconomic impact of taxing clean fuels, stoves, and off-grid solar products and components and also of checking that tariff codes align with product categories to ensure a level playing field for meeting supply and demand more efficiently. This is particularly important so as not to exacerbate affordability barriers for the poor. Additionally, policy and regulatory frameworks on cooking fuel and stove standards and labelling, as well as quality standards for off-grid solar products, also need to improve (specific suggestions for improvements are included under Building Block 3).

More intensive and sustained efforts are needed to fully leverage the already demonstrated potential of renewable energy mini-grid and off-grid solar technologies, including in the LDCs and fragile countries. These technologies, due to their modular character, have the ability to leverage the positive cost trends of key components and also to leverage innovations in both the technologies and business models that hold the greatest promise for filling the current gap towards universal access by 2030. This is particularly so in remote settings and for poor and vulnerable populations, including displaced people.

The progress in improving enabling mini-grid and off-grid frameworks should thus be sustained and expanded. **By 2025, the share of access-deficit countries with framework for mini-grids and for stand-alone systems with RISE scores above 67 (advanced framework) must increase to 100% from the current 45%.**

At the same time, national grids are still the largest service providers in the majority of low-access countries. They need to be supported to improve their technical and financial performance, so that they can deliver reliable services to their existing customers, densify within their footprints, and continue to expand based on the least-cost electrification plans. There thus needs to be a comprehensive and system-level approach that will not only expand mini-grid and off-grid options but also centre on improving the financial performance of the utilities in low-access countries and greening their generation mix. The grid framework thus needs to improve drastically on the current RISE score. Utility creditworthiness, in

particular, requires the most immediate attention. Only 10 out of 54 utilities in the energy access–deficit countries (see footnote 2) were considered creditworthy in the 2020 RISE report, while 12 countries’ utilities were moderately creditworthy (ESMAP, 2020a). **By 2025, the share of access-deficit countries with utilities that are considered at least moderately creditworthy (medium and advanced framework) must increase to 100% from the current 41%.** Achieving the 2025 milestones would require all utilities to be raised to at least a moderate creditworthiness status. Strong, financially viable utilities are required in order to play their part in the delivery of the ambitious national electrification plans adopted by the governments. This will require specific policy and regulatory measures to support the financial viability of utilities and also innovative partnerships with the private sector.

**Effective and efficient implementation structures and capacities.** In addition, governments need to pay more attention to the actual implementation of enabling measures, for example, efficient and consistent implementation of mini-grid regulations, consistent application of customs duty waivers, enforcement of quality standards etc., in order to stimulate the regulatory stability needed for attracting private investment. This also requires governments to engage proactively in dialogue with industry associations, to ensure that measures are, and remain, targeted, effective, and efficient, given how, so often, ‘the devil is in the detail’. The efficiency of government processes needs to improve, particularly in terms of streamlining and reducing the time of regulatory approvals, and of improving the efficiency and transparency of subsidy allocation.

Achieving the targets stated below will therefore require development partners to step up their technical assistance to governments, ensuring that this assistance is prioritized in energy access–funding allocations. This is a necessary step. Without continued significant improvements in enacting, implementing, and enforcing enabling frameworks, it will be impossible to utilize financing for energy access investments in an efficient and sustainable manner, no matter how much the financing increases.

Private-sector and development partners should also support the creation of national renewable energy associations to facilitate dialogue between government and the private sector.

**TABLE 2. ENABLING POLICY AND REGULATORY FRAMEWORKS TO BE ACHIEVED BY 2025**

Enabling policy and regulatory frameworks	2020 <sup>35</sup>	2025 <sup>36</sup>
Share of access-deficit countries with clean cooking strategies, action plans, and target countries with clean cooking RISE scores above 67 (advanced framework)	15%	100%
Share of access-deficit countries with national electrification strategies and integrated least-cost electrification plans with RISE scores above 67 (advanced framework)	26%	100%
Share of access-deficit countries with frameworks mini-grids and for stand-alone systems with RISE scores above 67 (advanced framework)	45%	100%
Share of access-deficit countries with utilities that are considered at least moderately creditworthy (medium and advanced framework)	41%	100%
Average RISE score for clean cooking access	37	Above 67
Average RISE score for electricity access	53	Above 67

## **BOX 2. IMMEDIATE ACTIONS TO SUPPORT DELIVERY OF THE 2025 MILESTONES FOR REINFORCED ENABLING POLICY AND REGULATORY FRAMEWORKS**

- **End-user data**

- *Governments, with support of development partners, industry associations and civil society organizations*
- To collect more detailed and nuanced data on access to electricity and clean cooking at the end-user level by integrating the recommended energy module into the national household survey.
- To build the capacities of statistical agencies, for instance, national statistical offices (NSOs) and other key stakeholders involved in data collection and use.

- **Clean cooking**

- *International community to work with governments*
- To elevate the priority of clean cooking, including building national and international coalitions and leveraging multi-stakeholder partnerships and platforms, such as the health and energy platform of action (HEPA).

- **Priorities in national strategies and plans**

- *Governments (with inputs sought from civil society organizations and industry associations)*
- To elevate energy access—both clean cooking and electricity—among key priorities in national development strategies and plans, including COVID-19 recovery plans and NDCs.
- To adopt clean cooking and electrification strategies and plans, charting comprehensive, realistic, inclusive, and resilient pathways towards achieving the universal access targets of SDG 7.
- To include a clear role and integration/coordination for grid, mini-grid, and off-grid solutions within electrification plans, and specify what tiers of service are to be delivered, ensuring that all the population gains access to at least basic energy services in the shortest time-frame possible, while specifically addressing affordability constraints. To prioritize integration of electrification of public facilities, including healthcare (inclusive of cold chains for vaccination), schools, water provision, and productive uses in all electrification plans. To include cooking energy demand in electrification strategies and plans.
- To promote dialogue with civil society organizations and industry associations to reflect views from communities/vulnerable groups and the private sector, respectively.

- **Best practice sharing, champions, and innovation**

- *Governments and industry associations, with the support of development partners and civil society organizations*
- To increase technical assistance and share best practices for clean cooking and electrification planning, policies and workable regulations, including leveraging new geospatial modelling tools and data to promote evidence-based, data-driven decision-making.

- To assign champions to support intergovernmental coordination for clean cooking and consider establishing 'clean cooking delivery units' with the expertise required to drive multi-sectoral clean cooking interventions.
  - To design and implement innovations to improve business environments, such as e-government initiatives and online platforms to manage electrification and cooking programs both efficiently and transparently.
  - Civil society organizations to promote public access to energy-access strategies and plans and to monitor accountability of governments for their implementation.
- **Fiscal policies**
    - *Governments, with support of development partners*
    - To align their fiscal policies to ensure that these are not constraining the affordability of clean energy access for the poor
    - To assess the economic costs and benefits of fiscal exemptions for clean cooking and distributed renewable-energy products and components.
    - To reorient fossil fuel subsidies, where they exist, towards supporting renewable energy and clean cooking solutions.
  - **National electricity utilities**
    - *Governments*
    - To empower and incentivize the national electricity utilities to improve their technical and financial performance through cost-effective tariffs, reduction of losses, digitizing their networks, supporting investments in lower-cost, climate-friendly generation, and promoting innovative financing models and partnerships, including working with the private sector.

## BUILDING BLOCK 2: INCREASED SOCIAL-ECONOMIC INCLUSIVENESS OF ENERGY ACCESS

**Inclusive energy access—equitable and fair for everybody—is central to SDG 7.1** and needs to be mainstreamed throughout all energy-access interventions in order to leave no one behind, as is already being achieved by many organizations.

**Pro-poor and vulnerable approaches and subsidies.** Across the board, there is an urgent need to demonstrate and scale up approaches aimed at reaching poor and vulnerable communities and households (including female-headed households and women beneficiaries, as well as displaced persons and host communities). Governments, development partners, and financiers should adapt their approaches to prioritize support to local entrepreneurs, last-mile distributors, and non-profit and other organizations that are specifically targeting these population segments. Considering that off-grid solar solutions, due to their costs and modularity, tend to be the main technology reaching the poor, remote, and vulnerable consumer groups, **by 2025, the number of active off-grid solar markets in energy access—deficit countries must increase to at least 25 from the current 10.**

Income remains a fundamental driver of both fuel and stove demand, with the lowest quintiles most dependent on the historically most affordable fuels—primarily wood and charcoal. (ESMAP, 2020b). For

electricity, it has been estimated that at least 100 million households will not be able to afford even a Tier 1 off-grid solar system, the lowest-cost electrification option, even offered with a financing package, such as PAYG. (World Bank, 2020; DFID ACE 2020). Achieving universal access, will require end-user subsidies, including in sectors that have shied away from them in the past, such as off-grid solar. **By 2025, the number of energy access–deficit countries with end-user subsidy programs must increase to 25 from the current 2.** Subsidies can go directly to households through, for example, cash transfers, leveraging social safety net programmes or vouchers, or by being channelled on the supply side, such as through pro-poor, results-based financing or lifeline tariffs, through which companies pass on subsidies to final users. In all cases end-user subsidies must be designed to target specific groups, depending on their energy needs, including the different needs of women and men (SEforALL, ODI and CAOFD, 2020), for example, by following the Gender Equality and Social Inclusion (GESI) concepts. End-user subsidies need to be designed in close consultation with industry associations,<sup>37</sup> and be set in the broader context of electrification programmes so as to minimize economic distortions, in particular 'when market-based approaches have as a whole been followed. They should go hand in hand with other measures to enhance affordability, including reducing costs through supply-side interventions and continued innovations in technologies and business models (See Building Block 3). They also require sustainable financing mechanisms, such as impact bonds or cross-subsidization arrangements (See Building Block 4).

**Livelihoods and human capital.** While subsidies can enable first-time access for poor and vulnerable households, ensuring a sustainable service will require that the household capacity to pay actually grows over time, for example, if households can use energy services for income-generating activities. Evidence has shown that in the absence of targeted activities promoting productive use of electricity, the level and pace of uptake of such productive uses often lags far behind expectations, especially in rural and remote areas, leading to unviable electrification interventions and the transformational impact of electricity access being limited. Systematic efforts need to be pursued to stimulate productive use of electricity, including integration of energy into broader development strategies, public awareness, availability and affordability of energy-efficient appliances, and technical assistance for business development (Oxfam, 2019; RMI, 2018).

**By 2025, the share of energy access–deficit countries with integrated national plans/programs including productive uses, public institutions, and support for poor and vulnerable households, with RISE scores above 67 (advanced frameworks) must increase to 100% from the current 30%.** Using electricity and clean cooking (e.g., for food providers/street vendors) for income-generating activities is a win–win situation that will increase both the inclusiveness (including for women and youth) and sustainability of energy-access efforts.

To support human capital transformation, essential public services, such as health and education, require reliable electricity. Reliable access is essential to increase the resilience of healthcare and education facilities to future shocks and to deliver quality services to support human capital formation; however, the sustainability of electrification efforts needs to improve. Service-oriented models, leveraging the private sector in particular, appear to hold the promise of better sustainability, but they still need to be demonstrated at scale (SEforALL, 2019; Elahi *et al.*, 2020). For access to clean cooking, there are also particular opportunities to engage schools as centres for community change by modernizing the cooking practice of school feeding programs and also by raising awareness and instigating behaviour change with respect to clean cooking.



**Gender equity and jobs.** Energy access–expansion efforts open job opportunities in newly created supply chains and productive uses. Off-grid decentralized renewables already account for increasing numbers of direct jobs, especially in Africa, as well as boosting employment in agro-processing, health care, communications, local commerce, and productive uses. (IRENA, 2020). **By 2025, the productivity of female farmers and business owners, as a result of productive uses of electricity in energy access-deficit countries, must increase to 50%.**

This broader emphasis on improved livelihoods and jobs in energy access–expansion programs also provides an opportunity to further advance gender-equality goals. Compared to the average gender wage gap of 14.6% in low-income countries, the distributed renewable energy sector in particular already seems to have greater gender parity in its compensation policies, which these efforts can build on (Power for All, 2019). To leverage the new opportunities, however, countries will need to invest in more vocational training, stronger curricula, more teacher training, and expanded use of information and communications technology for remote learning (IRENA, 2020). Special efforts are needed to increase the share of women employed in energy-access companies and energy-related supply chains, as well as the share of those engaged in productive uses of energy. **By 2025, the share of women entrepreneurs and employees in the energy-access sector (energy-access companies and value chains) must increase to 50%.**

There should be support for gender-transformative strategies that leverage opportunities, instruments, and new business models and solutions to enhance the inclusion of women in the energy sector, with a focus on women as beneficiaries, employees, and entrepreneurs. This support could: (i) integrate gender criteria across funding windows, for example, by incentivizing private companies and MFIs to collaborate on the provision of energy services and financing options tailored to women’s productive activities and businesses; (ii) link gender quotas to program incentives (e.g., in results-based financing (RBF) schemes or credit guarantees); (iii) provide financial literacy, coaching, mentoring, networking, empowerment training, and business-skills development; (iv) develop gender-equity score cards, certification, or excellence awards; (v) design recruitment processes and job opportunities with requirements that fit into women’s lives in terms of time flexibility, mobility constraints, and childcare needs; and (vi) focus on technologies that create job opportunities for women or target productive uses of energy. These instruments and solutions should be fully integrated when energy access challenges are being tackled: they range from data collection and market assessments, gender-sensitive multi-stakeholder dialogues, and women’s voice being heard, to programme design and innovative financing mechanisms for monitoring and evaluation of results.

**Fragility, conflict, and situations of displacement.** Given that the lack of electricity and clean cooking access in countries experiencing fragility, conflict, and violence (FCV) is growing in intensity and having very dire impacts, development partners should prioritize support for LDC and FCV countries. Development partners should help governments improve their strategic, policy, and regulatory frameworks, explore innovations and adaptations of successful approaches to fit the complex situations of FCV situations, and mobilize both public and private investments for a rapid scale up of access interventions. Most LDC and FCV countries have no or inadequate frameworks for clean cooking, and inadequate or only moderately advanced frameworks for electricity access (ESMAP, 2020a). It is essential that these frameworks significantly improve (to reach the RISE advanced status) so that these countries can start attracting much needed (public and private) financing in access to both electricity and clean cooking. **By 2025, the average RISE scores for countries experiencing fragility and conflict must increase to 67 or greater (advanced frameworks) from the current 21 for clean cooking and 40 for electricity.**

In this context, displaced persons, including youth and host communities lacking basic energy access, require special attention. Accordingly, they should have priority energy-access support programmes that particularly ensure basic health, education, water pumping, cooking, and street lighting services. These can be achieved by (i) dedicated energy-access programs for displaced people and their host communities, for instance, as part of humanitarian processes and/or (ii) integrating energy-access provision for this target group into national energy-access plans. The goal of the humanitarian sector, namely, to decarbonize its own fossil fuel-powered infrastructure using a private-sector delivery model, also provides it with an opportunity to extend sustainable energy access to displaced persons and host communities that are supported by the humanitarian sector (UNHCR, 2021).

**TABLE 3. SOCIAL ECONOMIC INCLUSIVENESS OF ENERGY ACCESS TO BE ACHIEVED BY 2025**

Social-Economic Inclusiveness of Energy Access	2020	2025
Average RISE scores for countries experiencing fragility and conflict for clean cooking access	21 <sup>38</sup>	67 or greater
Average RISE scores for countries experiencing fragility and conflict for electricity access	40 <sup>39</sup>	67 or greater
Share of access-deficit countries with integrated national plans/programs including productive uses, public institutions, and support for poor and vulnerable households, with RISE scores above 67 (advanced frameworks)	30% <sup>40</sup>	100%
Number of active off-grid solar markets in energy access-deficit countries <sup>41</sup>	10 <sup>42</sup>	25
Number of access-deficit countries with end-user subsidy programs for off-grid solar and other last mile delivery	2 <sup>42</sup>	25
Increased share of women entrepreneurs and women employed in the energy-access sector (energy-access companies and value chains)	n/a <sup>44</sup>	50%
Increased productivity of female farmers and business owners as a result of productive uses of electricity	n/a <sup>45</sup>	50%
Share of health-care facilities with reliable electricity access in access-deficit countries	45% <sup>46</sup>	69%
Share of schools with reliable electricity access in access-deficit countries	57% <sup>47</sup>	76%

### **BOX 3. IMMEDIATE ACTIONS TO SUPPORT DELIVERY OF THE 2025 MILESTONES FOR INCREASING SOCIAL-ECONOMIC INCLUSIVENESS OF ENERGY ACCESS**

- **End-user subsidies**

- *Governments, development partners and service providers in consultation with industry associations, and with support from civil society organizations*
- To design, demonstrate, and scale up sustainable, efficient, and targeted end-user subsidies, in particular for the off-grid solar and clean-cooking sectors to bridge the affordability constraints related to poor, remote, and vulnerable households, including displaced persons.
- Provide data and facilitate and encourage knowledge exchange on emerging best practices and lessons from **subsidy designs and implementation**.

- **Support business models delivering services to poor, remote, and vulnerable households**

- *Development partners and financiers*
- To adapt their approaches to integrate specific financing and technical assistance (TA) windows and/or other targeted support for local businesses, last mile distributors, non-profits, community, and other organizations specifically serving remote, poor, and vulnerable population segments at risk of being left behind.

- **Gender equity**

- *All stakeholders*
- To enhance gender equality in energy-access interventions, with a focus on gender-transformative strategies, with women as beneficiaries, employees, and entrepreneurs, disseminating and applying emerging good practices and instruments to enhance the role of women in the energy sector, including their voice in decision-making.

- **Focus on least-developed and FCV countries and situations of displacement**

- *Development partners and civil society organizations, helping governments*
- To improve strategic, policy, and regulatory frameworks, supporting innovations and adapting successful approaches to local contexts, and mobilizing public and private investments for a rapid scale up of access interventions.
- To address energy poverty in displacement settings, for example: (i) establishing and implementing dedicated energy-access programmes for displaced persons and their host communities; (ii) including displaced people in national energy-access plans of host countries and supporting them in achieving the goals of these programmes; and (iii) providing knowledge exchange on successful business models.
- To address clean cooking challenges among fragile and displaced populations.

- **Productive use of electricity and energy-efficient cooling**

- *Governments, development partners, financiers, and service providers, with support from civil society organizations*
- To launch and enhance systematic efforts to stimulate productive use of electricity, including through design and implementation of marketing interventions, technical assistance for business development, market linkages, measures to improve access to energy-efficient cooling and other appliances, for example, through microfinance, PAYG models and on-bill financing, and performance-monitoring mechanisms.
- To integrate access to energy-efficient cooling in order to enhance the climate resilience of the currently unserved and underserved populations in energy access-deficit countries.

- **Electrification of healthcare facilities and schools**

- *Governments and development partners, financiers, and service providers, with support from civil society organizations*
- To prioritize investments in the electrification of healthcare facilities and schools, by engaging with financiers and service providers to develop and demonstrate sustainable and scalable service-oriented models: these would include replacement diesel back-up systems for grid-connected facilities, electrification facilities with stand-alone off-grid solutions, and their integration with mini-grids.

- **Training, skills, and awareness building**

- *Governments, development partners, industry associations, civil society organizations, and education organizations*
- To support training and skills-building for STEM professions (i.e., related to science, technology, engineering, and mathematics), such as engineers and technicians, and other energy professionals, including government officials, bankers, and managers; targeting an increased share of women among energy professionals; and creating employment and skills-enhancement, plus opportunities for youth.
- To engage and train local entrepreneurs, especially female and youth entrepreneurs, to be part of the innovation-development process and solution providers.
- To engage with communities and both female and male household members to increase awareness, education, and trust in information sources regarding electricity and clean cooking benefits. This will allow them to make informed fuel, technology, and behaviour choices as a result of access to high-quality electricity and cooking services.

### BUILDING BLOCK 3: ALIGNING THE COSTS, RELIABILITY, QUALITY, AND AFFORDABILITY OF ENERGY SERVICES

Reliability and affordability are essential elements of the SDG 7 goal, but partly because they are more difficult to track, they often receive less attention than the binary indicator of the number of people without access. The SDG 7 goal cannot be achieved, however, if reliability and affordability of energy services are not adequately prioritized.

**Affordability of clean cooking technologies and fuels** is the most important barrier to sustainable adoption. Innovations in both technologies and business models need to continue to drive down the costs of clean cooking technologies and fuels, and to align them with user needs and preferences. There are some positive pointers of progress in this area. Clean fuels, such as electricity, LPG, ethanol, and biomass pellets are increasingly affordable, particularly in urban and peri-urban settings, compared to traditional alternatives, such as charcoal and kerosene. Gasifier stoves that use pellets instead of raw biomass can lower emissions and allow for more efficient combustion, and the economics of pellet production are encouraging. The affordability argument for eCooking appliances, such as electric pressure cookers (EPC), is promising, and grid-powered EPCs have already taken root in many markets of Asia. Bottling of ethanol using an itemized approach can reduce company costs and user prices, achieve scale, and realize safety and environmental benefits (ESMAP, 2020b). These innovations are promising, but nascent, and require strong support from governments, development partners, and financiers for them to be consolidated and expanded.

**Affordability in the electricity sector.** The reductions in the costs of key components, including battery storage, as well as the economies of scale, will continue driving down the costs of renewable energy mini-grids and off-grid solar products, but continued innovations in business models, service provision, and energy-efficient appliances are still needed in order to increase the affordability of services. **By 2025, the consumer price of 40 kWh of mini-grid consumption at an unsubsidized levelized cost of energy (LCOE) must decline to USD 10 from the current USD 16–20.** The same trends will also allow enhancements in reliability and quality of services. The new generation of solar PV hybrid mini-grids already typically deliver at least Tier 4 service (ESMAP, 2019). **By 2025, mini-grid service uptime must improve on average to 97% from the current 90%.**

The affordability of off-grid solar products will also benefit from reduced costs of technologies and innovations in business models. Affordability is particularly expected to continue improving through the expansion of the digitally enabled service models, such as PAYG, which have already had a revolutionary impact on the sector,<sup>48</sup> despite its limited geographic footprint (World Bank, 2020). **By 2025, the number of access-deficit countries, where PAYG is operating at scale must increase to 20 from the current 8.** In addition, **by 2025, the number of new customers purchasing off-grid solar through PAYG per year must increase to 6.7 million<sup>49</sup> from the current 2.2 million** (GOGLA, 2021b). The expansion of the PAYG business model is also noted as a promising development for making clean cooking services more affordable and for driving integration in service provision between clean cooking and off-grid solar sectors.<sup>50</sup>

**Quality standards.** The pace of adoption and affordability of both off-grid solar and clean cooking products is also closely related to their quality. Low-quality products may have lower upfront costs for consumers, but they tend to break down faster and generally do not allow the same benefits to be realized to the consumers as higher-quality products. This can lead to consumer distrust of the technologies. In the clean cooking sector, the frameworks on cooking fuel and stove standards and labelling are among the policy and regulatory frameworks requiring the most urgent improvements (ESMAP, 2020a). This

will boost the development, selection, and promotion of quality clean-cooking products to meet end users' cooking needs. Governments should play a key role in localizing international clean cooking standards through close coordination with international standard-setters, strong domestic monitoring and enforcement, and it should engage critical players, where needed, to strengthen capabilities. **By 2025, the number of countries that have adopted standards and labelling for clean cooking technologies and fuels with RISE scores above 67 (advanced frameworks) must increase to 30 from the current 6.** In the off-grid solar sector, governments should continue the adoption (and the implementation and enforcement) of international quality standards. **By 2025, the number of countries that have adopted off-grid solar international standards must increase to 45 from the current 26.** In addition, continued support to quality assurance by both the off-grid solar industry and development partners is required. **By 2025, the share of quality verified off-grid systems on the market (in the Tier 1 product category) must improve to 50% from the current 32%.<sup>51</sup>**

**The reliability and quality of grid electricity** need to improve as a matter of urgency. Based on the available MTF surveys from electricity access–deficit countries, grid users are typically concentrated in Tiers 3 and 4 (and even lower tiers in some countries). This means that users suffer frequent interruptions and voltage fluctuations, which can damage appliances. This situation does not allow users to fully benefit from their electricity service; it constrains their ability to run appliances and use electricity for productive uses; and it even deters people from getting connected to electricity. (Blimpo and Cosgrove-Davies, 2019). **By 2025, therefore, the average MTF tier of grid electricity in energy access–deficit countries must improve to Tiers 4–5 from the current Tiers 3–4.** This will require the prioritization of investments in the reliability, quality, and sustainability of grid electricity as a pre-condition or an integral part of any grid densification or expansion investments. Costs also need to decrease in order to ensure that grid electricity is affordable. **By 2025, the average unit tariff from grid supply in the top 20 impact countries must decline to USD 0.08/kWh from the current USD 0.10/kWh** (Foster & Witte, 2020) through least-cost generation planning, in particular, leveraging lower cost renewable energy technologies, improved efficiency and loss reduction, and the benefits of regional integration/power pools. Furthermore, all energy access–deficit countries need to put in place connection policies and financing mechanisms to ensure that grid connection fees are affordable.

**The role of innovation.** These improvements will require continued R&D and innovations in all aspects of service delivery (technologies, costs, enabling ecosystem, business models, financing) (IRENA, 2019). This is especially important for the clean cooking sector, where successful technologies and business models are still only emerging. Innovative partnerships also need to be built, for example: between electricity and clean cooking service providers, to leverage synergies in service provisions between utilities, mini-grid, and off-grid companies and thereby achieve better integration of least-cost solutions; between the public and private sector; between international and local service providers to leverage international and local knowledge and to build more resilient supply chains; and across sectors (e.g., synergies in delivery of electricity and agriculture extension services or banking services, etc.). Finally, continued innovations will be needed to ensure that the technologies and business models respond to the wide variety of consumer needs. For the private sector as clean energy service providers, as well as for the national utilities, this will mean advancing user-centred innovation to drive down costs and improve performance and also to improve service delivery to achieve long-term business sustainability and scalability. This also implies that more efforts are needed to collect more-nuanced data to measure reliability and affordability so that progress can be tracked and better insights gained about consumer needs and preferences, and, in so doing, enhancing the user-centric approach.



**TABLE 4. COSTS, RELIABILITY, QUALITY AND AFFORDABILITY OF ENERGY SERVICES TO BE ACHIEVED BY 2025**

Costs, Reliability, Quality and Affordability of Energy Services	2020	2025
Average MTF tier of grid electricity in energy access-deficit countries	3-4 <sup>52</sup>	4 or greater
Mini-grid service uptime on average	90 <sup>53</sup>	97 <sup>54</sup>
Share of quality verified off-grid systems on the market (in Tier 1 product category)	32% <sup>55</sup>	50%
Number of countries that have adopted international quality standards for stand-alone systems with RISE scores above 67 (advanced frameworks)	26 <sup>56</sup>	45
Number of countries that have adopted standards and labelling for clean cooking technologies and fuels with RISE scores above 67 (advanced frameworks)	6 <sup>57</sup>	30
Average unit tariff from grid supply in the top 20 impact countries.	USD 0.10/ kWh <sup>58</sup>	USD 0.08/ kWh
Consumer price of 40 kWh of mini-grid consumption at unsubsidized LCOE	USD 16-20 <sup>59</sup>	USD 10 <sup>60</sup>
Number of new customers purchasing off-grid solar through PAYG per year	2.2 million <sup>61</sup>	6.7 million
Number of access-deficit countries, where PAYG is operating at scale <sup>62</sup>	8 <sup>63</sup>	20

**BOX 4. IMMEDIATE ACTIONS TO SUPPORT DELIVERY OF THE 2025 MILESTONES FOR ALIGNING THE COSTS, RELIABILITY, QUALITY AND AFFORDABILITY OF ENERGY SERVICES**

- **Innovation**

- *Service providers, development partners, and academic/training institutions*
- To continue to drive innovations (including through innovation accelerators, R&D, technology transfer, seed funding for piloting and commercialization, geospatial analysis for electrification planning, clustering of distributed renewable energy sites into viable portfolios, and distribution network design) in both technologies and business models to reduce costs of clean cooking technologies, fuels, and distributed renewable energy technologies (mini-grids, off-grid, other solutions), and to align them with user needs and preferences.
- Invest in user-centred data and technological and business innovations to drive down costs and improve service delivery.

- **Clean cooking solutions that reflect the needs of diverse users**
  - *Governments, with support from development partners, service providers, and civil society organizations*
  - To lead clean cooking transitions that reflect diverse user needs, local market conditions, and national comparative advantages on energy resources, while addressing inequalities.
  - To advance user-centred innovation to drive down costs, improve performance, and improve service delivery to achieve long-term business sustainability and scalability. For example, development partners could consider setting up a user insight lab, a focused initiative to invest in generating stronger user insights by supporting enterprises and entrepreneurs in conducting deeper user research, as well as more coordinated research and analysis on user needs and behaviours, in particular related to cooking and fuel/solutions stacking.
- **Digital business and payment solutions**
  - *Governments and service providers, with support from development partners*
  - To continue improving the ecosystem for expanding digitally enabled business models, such as PAYG, allowing off-grid households to access off-grid solar systems and appliances with user financing: this includes improving intersectoral coordination with the digital and financial sectors.
- **National standards for cooking fuels and stoves and off-grid solar products**
  - *Governments, with support from development partners*
  - To adopt national standards for cooking fuels and stoves (including localization of international standards and labelling), and international quality standards for off-grid solar products, and continue supporting independent quality assurance framework through VeraSol. Expand quality assurance and standards to energy-efficient appliances, including ones for cooling.
- **Grid reliability and sustainability**
  - *Governments and national utilities, with support from development partners*
  - To prioritize national grid reliability and sustainability as an enabler of grid expansion. Focus on on-grid financing in investments and actions to support improved technical and financial performance of national utilities to enable sustainable grid expansion.
  - To reduce costs and carbon footprint of on-grid generation, including through regional interconnections and power pools.
  - To develop national decarbonization strategies, climate-friendly, least-cost generation and electrification plans, and digitalization of power grids to integrate distributed renewable resources and for improved metering and revenue recovery.
  - To explore innovative models for private-sector engagement and partnerships in generation, transmission, and distribution, including digitization, customer interface, and demand-stimulation.

- **Clean cooking solutions that reflect the needs of diverse users**
  - *Governments, with support from development partners, service providers, and civil society organizations*
  - To lead clean cooking transitions that reflect diverse user needs, local market conditions, and national comparative advantages on energy resources, while addressing inequalities.
  - To advance user-centred innovation to drive down costs, improve performance, and improve service delivery to achieve long-term business sustainability and scalability. For example, development partners could consider setting up a user insight lab, a focused initiative to invest in generating stronger user insights by supporting enterprises and entrepreneurs in conducting deeper user research, as well as more coordinated research and analysis on user needs and behaviours, in particular related to cooking and fuel/solutions stacking.
- **Sustainable business models**
  - *All stakeholders*
  - To identify and deploy appropriate sustainable business models for a variety of institutional arrangements and contexts (e.g., from fully private sector-led, market-based approaches to public–private partnerships, to programs led by the national utility).
  - To support a path to profitability for the private-sector service providers to ensure that they are bankable.
- **Support collaboration and innovative partnerships**
  - *All stakeholders*
  - To increase involvement of local companies, foster partnerships between local and international companies, support collaboration and innovative partnerships between national utilities, mini-grid, and off-grid service providers across electricity and clean-cooking business models, as well as multi-sectoral partnership (e.g., energy and agriculture).

## BUILDING BLOCK 4: CATALYSING, HARNESSING, AND REDIRECTING ENERGY ACCESS FINANCING

Public and private financing needs to increase in all energy access segments, and drastically so in the clean cooking segment. **By 2025, annual financing (public/private) flows to clean cooking access must scale up to USD 25 billion<sup>64</sup> from the current USD tens of millions** (SEforALL, 2019). Such investments include not only the initial capital costs of stoves and deposit/connection fees, but also the energy infrastructure costs and additional subsidies required to make the clean-fuel costs affordable to the poorest consumers (ESMAP, 2020b).

**By 2025, annual financing flows to electricity access must increase by at least USD 35 billion from the current USD 20 billion** (SEforALL, 2019). Mini-grid and off-grid investments, in particular, need to be increased in line with their projected share, based on geospatial electrification modelling. **By 2025, the portion of annual electricity access financing going to mini-grids must increase to USD 10 billion from the current USD 1 billion** (ESMAP, 2019). At the same time, additional funding is needed to drive off-grid solar market expansion.

As LDCs account for the majority of the deficit, **50% of the financing needed for clean cooking and electricity access should be directed to LDCs.** The main obstacles regarding financing for sustainable energy in LDCs include the high costs inherent to the energy sector (starting from project preparation to high initial investment costs), limited access to funding due to poor or non-existent credit ratings, and a lack of understanding by domestic and foreign private-sector partners of the business case that exists in LDC energy sector.<sup>65</sup>

**By 2025, financing for equity, debt, and grants to off-grid solar companies must increase to annually USD 1.1 billion from the current USD 315 million. Also by 2025, annual public-sector financing for demand-side subsidies for off-grid solar to bridge the affordability gap must increase to USD 0.34 billion, up from the current less than USD 0.01 billion.** These funds should be allocated for end-user subsidies to close the affordability gap for the poorest population segments, as described in the Building Block 2 (World Bank, 2020).<sup>66</sup>

Closing the financing gap will require both public and private resources to be leveraged, including through increased and sustained commitments from DFIs and philanthropies. It will also require the private-sector arms of DFIs to be willing to take higher risks in order to channel larger financial resources to private-sector enterprises involved in energy access expansion, in the mini-grid, off-grid solar, and clean-cooking sectors. Philanthropies can play a critical role in de-risking the sector, while further enhancing the focus on impacts.

Closing the financial gap will also require scaling up instruments that are proven to work, such as results-based financing (RBF), tapping into new potential sources of funding, such as innovative forms of blended finance, unlocking local debt finance (which remains a major challenge for energy-access financing), developing more innovative instruments for risk mitigation (including first-loss portfolio guarantees, securitization, credit management), and attracting more early-stage equity into the sector.

Financing to achieve universal electricity access will be needed across the entire spectrum of the value chain. End users require credit or flexible payment methods to be able to afford the connection costs, as well as the upfront investments in systems and appliances. Service providers require access to low-cost working capital to finance the systems over long repayment periods. The capital also needs to be made available in both local and foreign currency to efficiently manage currency fluctuation risks, as is evident from the external shocks of the past.

Grant funding will be needed to support innovation and help scale up promising business models for both decentralized electrification and clean cooking. In particular, in the clean-cooking sector, grant funding will need to increase drastically to play the catalytic role of (i) correcting a temporary market failure by monetizing the full co-benefits of access to clean cooking fuels and stoves that are not currently priced in by the market, (ii) subsidize the costs of market actors to build customer awareness and market adoption, and (iii) improve the viability of clean cooking businesses to attract private-sector financing. In mini-grids, grant funding will be required to continue closing the viability gap for the mini-grids, to align the need for profitability for service providers and investors, and to deliver affordability for the target population. As discussed in Building Block 4, however, the falling levelized costs of energy of mini-grids mean that the share of grant funding in investments is expected to decline over time. While off-grid solar is a more mature technology, grant funding is still required to support continued innovation in the sector (e.g., for productive use systems), drive the geographic expansion, especially to less attractive (poorer, more remote) markets, and to close the affordability gaps for poor and vulnerable households.

Results-Based Funding, in particular, has proved to be an effective instrument for scaling up mini-grid, off-grid solar, and clean-cooking access. It is versatile in the sense that it can be structured and targeted to fulfil specific program objectives for example, by accelerating market scale up, reaching underserved areas, addressing affordability for the poorest segments, and incentivizing gender, climate, health, and livelihood impacts. The RBF results chain can range from output level results to outcome and impact level results. **By 2025, an impact bond market must be established for energy access, including for clean cooking.** This would attract financiers for a broad range of public benefits from access to modern energy, for example, health, climate, and gender impacts.

Public-sector financing should be increasingly targeted towards the LDCs and FCV countries, and for poorer, more remote, and vulnerable consumer segments that are at risk of being left behind, as well as towards service providers that are addressing this market segment. This will also require adjustments in targeting towards local and smaller companies, simplification of the complex administrative process in grant allocations, and consideration of the limited capacity of local entities/institutions in the LDC and FCV contexts to navigate the international finance system. Furthermore, development-partner resources should be made available to develop high quality, eligible funding requests. Considering the dire impacts of COVID-19 on smaller and local companies, development partners should ensure that these companies have access to relief funding to help them survive the crisis and contribute to the economic recovery post COVID-19.

Considering the magnitude of the investment needed, however, public-sector financing and instruments must be designed to leverage private capital, where feasible. The development community needs to respond to the twofold need for (i) increasing financial flows for access and (ii) using the funds more innovatively. In particular, reaching the poor and vulnerable population segments, guiding capital towards LDC and FCV countries, and focusing on less attractive markets will require a more creative structuring of available tools and piloting of new ones. Innovations in digital development and financial inclusion, consumer credit intelligence, geospatial technology, etc., are essential to enable access to the more challenging market segments.

Mobilizing more commercial finance will also require continued improvements in the policy and regulatory ecosystem (as highlighted in Building Block 1), but the service providers themselves need to take measures to continue improving their financial performance. The nascent off-grid solar, mini-grid, and clean-cooking industry needs to demonstrate a path to profitability. For on-grid generation, the weak creditworthiness of utilities as the main off-takers is the main barrier preventing larger private financing flows, and thus needs to be addressed as a priority.

Furthermore, more consumer finance needs to become available and to spread beyond connections, targeting also access to high-quality and energy-efficient appliances. The new emerging consumer financing schemes, such as PAYG, and other digital payment-enabled solutions, as well as on-bill financing schemes for appliances have already demonstrated emerging successes and should be promoted and expanded across all technologies. These should be accompanied by parallel demand-side interventions, such as consumer awareness. As pointed out in Building Block 2, well designed and targeted end-user subsidies will be needed to bridge the affordability gap for poorer and more vulnerable households. The overall financing packages, particularly for these less commercially attractive consumer segments, need to address the requirement to offer proportionate returns to the service providers and address affordability constraints for the end users.

**TABLE 5. ENERGY ACCESS FINANCING TO BE ACHIEVED BY 2025**

Energy Access Financing	2020	2025
Annual financing (public/ private) flows to clean cooking access	Tens of millions <sup>67</sup>	USD 25 billion <sup>68</sup>
Share of annual financing flows to clean energy access going to Least-Developed Countries (LDCs)	n/a	50%
An impact bond market is established for energy access, including for clean cooking	No	Yes
Annual financing flows to electricity access	USD 20 billion <sup>69</sup>	USD 35 billion <sup>70</sup>
Share of annual financing flows to electricity access going to Least-Developed Countries (LDCs)	n/a	50%
Portion of annual electricity access financing going to mini-grids	USD 1 billion <sup>71</sup>	USD 10 billion <sup>72</sup>
Annual financing for equity, debt, and grants to off-grid solar companies	USD 315 million <sup>73</sup>	USD 1.1 billion
Annual public sector financing for off-grid solar to bridge affordability gap	USD 0.01 billion <sup>74</sup>	0.34 billion

### **BOX 5. IMMEDIATE ACTIONS TO SUPPORT DELIVERY OF THE 2025 MILESTONES FOR CATALYSING, HARNESSING AND REDIRECTING ENERGY ACCESS FINANCING**

- **Clean-cooking funding**

- *Development partners, philanthropic funders, and other financiers*
- To dramatically scale up availability, diversity, and volume of public and private financing for clean-cooking projects and technical assistance, with consideration being given to reorienting fossil fuel subsidies, developing product and business-model innovations, increasing RBF/performance-based payments, enhancing risk-sharing mechanisms to attract more investors, and integrating clean cooking planning, implementation and funding with that of electrification.

- **COVID-19 recovery packages**

- *Governments and development partners*
- To set up a global Energy Access Relief Fund, and to ensure that small and local mini-grid, off-grid solar, and clean-cooking companies have access to affordable financing, including relief funding.



- **Electricity funding priorities**
  - *Governments and development partners*
  - To reassess and ensure that the packages are consistent with country energy-access strategies and plans.
  - To significantly increase the volume and share of funding flowing to mini-grid and off-grid technologies.
- **Scale up proven and develop new innovative instruments for electricity and clean-cooking funding instruments**
  - *Governments and financiers, with help of development partners*
  - To construct and scale up comprehensive and innovative financial packages that consist of equity, debt (including impact bonds), and grants (including RBF/performance-based grants), scale up proven instruments, especially RBF.
  - Explore further financial innovation and put in place new guarantees, and securitization credit-management instruments focused on risk mitigation to leverage private-sector investments, including leveraging lending from local commercial banks.
  - Explore innovations for financing affordability gaps such as through social safety nets for energy access, supporting by sustainable sources of finance, such as impact bonds
  - Scale up digitally enabled consumer financing schemes, such as PAYG, on-bill financing, and other innovations to make electricity connections/systems and appliances more affordable.
- **Improve transparency on industry performance and profitability.**
  - *Industry associations, with inputs from financiers, development partners and service providers*
  - Help investors better assess and manage risks of investing in energy-access service providers
  - Help governments and development partners better understand the need for grants and subsidies to help scale up the market.

In implementing these building blocks, synergies with other SDGs must be supported through a set of interlinked actions, including (i) elevating the priority and drastically scaling up financial resources for clean-cooking access (SDGs 3, 5, 10, and 13); (ii) setting up policies, business models, and financing mechanisms targeting the poor and vulnerable populations, improving livelihoods, and building human capital (SDGs 1 and 10); (iii) integrating electrification of healthcare and education facilities in the national energy-access strategies and plans, including enhancing sustainability of these efforts (SDGs 3 and 4); (iv) enhancing gender equality in all energy-access interventions, with a focus on women as beneficiaries, employees, and entrepreneurs, disseminating and applying emerging good practices and instruments to enhance the role of women in the energy sector, including increasing their voice in decision-making (SDG 5); (v) building multi-sectoral partnerships, including at the energy–food–water nexus and supporting productive and community uses of electricity (SDGs 2 and 6); (v) generating employment opportunities, including for women and youth, in the newly created supply chains and through productive uses, and supporting capacity and skill-building activities, local entrepreneurship,

knowledge transfer, and innovation (SDG 8); as well as (vi) positioning energy access as a key element of just energy transition, with both mitigation and adaptation benefits, by emphasizing access to modern-energy cooking services, by scaling up energy access with distributed renewable energy technologies, by supporting the national utilities to green their generation mix, and by enabling affordable access to energy-efficient appliances, including energy-efficient cooling (SDG 13). The next section describes the interlinkages in more detail.

# 7

# IMPACTS

Affordable, reliable, and modern energy services are prerequisites and catalysts for many aspects of sustainable development. Their use conveys benefits for poverty reduction, economic growth, human development, and environmental protection.

The many synergies of SDG 7.1 and other SDGs highlight the crucial roles of energy access. They also reveal how beneficial and important collaboration among the stakeholders working in energy, health, climate, industry, and finance is to rural and urban development, gender, and social protection, among others.

Access to both electricity and clean cooking solutions are crucial to meeting the other SDGs. While contributing similarly to reducing poverty, each furthers different SDGs in different ways. **Access to electricity services access** works to provide convenient, affordable, life-enhancing amenities and to strengthen economic opportunities. Besides improving basic living standards, it mainly affects the economy, employment, and the quality of health and education services. **Access to clean cooking solutions** aims to avoid the adverse impacts—the human health and environmental costs—of traditional cooking and fuel-gathering systems. While it, too, raises living standards, it primarily affects health, climate, and environmental conditions, and the time-poverty of women and children.

## Impact on Poverty and Economic Growth

No poverty (SDG 1) and Reduced Inequalities (SDG 10)—Access to electricity and clean cooking solutions enhances basic living standards, as well as facilitating human development, gender equality, and security. Energy access begins to break the vicious cycle of energy poverty, where people are trapped in a self-reinforcing cycle of deprivation and lower income. Households lacking access to modern energy have fewer opportunities and less time for income generation, especially in agriculture. They earn less, spend more time collecting biomass and less time receiving education, and they pay more per unit for the limited amounts of modern energy that they can purchase, such as batteries for lighting and phone charging. Low earnings and malnourishment contribute to their remaining poor, perpetuating the lack of access to modern energy (Karekezi *et al.*, 2012).

Lack of access to energy services is a form, an outcome, and a cause of poverty (Practical Action, 2010, cited in UN DESA *et al.*, 2010).

It is a form of poverty because it restricts human beings' capabilities of meeting their needs and realizing their full potential. The capability-reinforcing abilities of energy relate to interlinkages between energy, health, and education. Hence, an improved quality of energy supply would have a direct bearing on human capability functions, resulting in reduced inequalities.

It is an outcome of poverty because low-income individuals are limited in their financial ability to afford goods and services that better-off fellow citizens enjoy, even if those goods and services are ultimately unsuitable or unsustainable.

Finally, it is a cause of poverty because it 'reinforces constraints in income generation potential, because many product- and service-based enterprises and public services either rely on energy or are substantially improved in their productivity, profitability, or efficiency by the introduction of improved forms of energy access' (Practical Action 2010, page 28) Lack of coverage of energy supply exacerbates the inequalities of opportunities in more remote areas. The lack of quality of supply also increases financial inequities, as stand-alone electricity supply and fall-back options have higher costs per unit of supply and require additional investments, which can be unobtainable for the lowest income groups. Low levels of electricity supply limit the ability of women to use time-saving appliances in the household, while inequalities in access further increase gender inequities. Lack of adequate fuel supply maintains inequities through the drudgery of fuel and water collection, poor health, and time-poverty, which influence many other aspects of life.

Reducing the global disparity in energy is key to reducing income inequalities, gender inequalities, and inequalities in other dimensions such as rural/urban income disparities. A lack of adequate, reliable, and affordable supplies of modern energy disproportionately impacts women and children. This is more severe in rural communities, and limits women's productive opportunities, enterprise growth, and employment, exacerbating income inequality and persistent poverty. Research in this domain also reveals that the productive uses of energy have gender implications and that women could significantly benefit from the productive application of electricity (Pueyo and Maestre, 2019, cited in UN DESA *et al.*, 2019), which could significantly reduce gender disparities (cited in UN DESA *et al.*, 2019).

**Decent Work and Economic Growth (SDG 8)**—Access to **electricity** plays a catalytic role in economic growth, job creation, gender equality, and shared prosperity. While electricity alone cannot drive economic growth, studies show a strong correlation, but inconclusive causality, between electricity *consumption* and GDP growth (World Bank, 2017). A study of rural electrification in Bangladesh showed it increased enterprise productivity in several ways, among them: (i) allowing businesses to operate well into the evening, giving them more hours per day to generate sales and profits; and (ii) allowing enterprises to use machinery and tools that are more efficient and productive than their nonelectrical counterparts (Samad and Portale, 2019a). A study of grid connectivity in rural Lao PDR showed it advanced human welfare and development, in terms of household income, spending, ownership of durable assets, and children's education (Samad and Portale, 2018).

Similarly, reviewed studies have shown a strong correlation between energy *consumption* and employment, principally through higher household employment following electrification. Notably, most of the studies show that household employment increases only for women (World Bank, 2017).

Studies investigating the effects of increased energy *infrastructure* on GDP show that the size of the power sector determines the growth and level of GDP, but that increases in the quantity and quality of transmission and distribution infrastructure were associated with reductions in inequality. There is consensus that *infrastructure* is a key contributor to economic growth (Alam, M.S., M.D. Miah, S. Hammoudeh, and A.K. Tiwari (2018)).

The energy sector creates job opportunities. Youth are well suited to benefit from the emerging opportunities in the renewable energy sector, especially upskilling and employment.

As business models for providing energy access spread and mature, the expansion of off-grid renewable energy solutions creates growing employment. Information remains relatively sparse, but a number of reports are shedding light on this fast-evolving situation. A 2017 study (Hystra, 2017, cited in UN DESA *et al.*, 2019) compiled information on direct employment provided by companies operating in the energy access field. A 2018 study by the organization GOGLA regarding direct employment in the off-grid solar sector (looking at sales data and information from close to 40 companies), estimated that direct employment in the off-grid solar sector in sub-Saharan Africa and South Asia runs to about 450,000 full-time equivalent jobs and could rise to 1.5 million by 2022. This estimate covers the sales and distribution, installation and maintenance, and customer-support segments of the value chain, but excludes manufacturing and assembly, which takes place primarily in countries like China (photovoltaic [PV] panels) and Germany (batteries). Depending on the business model, there are employment opportunities in sales and distribution (cash-based transactions) or in technical jobs such as software design, logistics, and customer service (pay-as-you-go model). Improved energy access enables productive uses of energy and catalyses local economic activity, creating income streams and additional employment (GOGLA, 2018, cited in UN DESA *et al.*, 2019).

The provision of **clean-cooking solutions** enhances employment opportunities and economic growth by freeing up time, primarily that of women and children, from cooking and related fuel-gathering. A number of studies have demonstrated measurable benefits for health from cleaner cooking solutions (Smith *et al.*, 2011); Alexander *et al.*, 2018). A study of improved cook stoves in Kenya showed their use not only led to reduced fuel consumption and symptoms associated with exposure to HAP, but also to more household time for income-generating activities, childcare, and leisure activities (Samad and Portale, 2019b).

## Impact on Human Capital

**Good Health and Well-Being (SDG 3)—Clean cooking solutions** are the key intervention needed to address the adverse health impacts from household air pollution. Cooking with clean fuels and technologies could help avert close to 4 million premature deaths a year from HAP-related pneumonia and noncommunicable diseases (including heart disease, stroke, and cancer), leading to a reduction in health costs of an estimated USD 1.4 trillion per year (ESMAP, 2020b). HAP is one of the largest single causes of premature mortality and morbidity worldwide, with women and children bearing the heaviest burden, due to their high exposure (WHO and World Bank, 2014). Clean cooking solutions also reduce the risk of burns, scalds, and poisonings.

**Electricity** can improve health conditions in homes through refrigeration for food preservation and nutrition, and via fans and air conditioners for personal comfort and safety. However, its greater contribution comes in medical facilities, through: (i) powering lighting, medical devices, and refrigeration for blood and vaccines; (ii) powering life-saving interventions and essential medical devices and appliances for prevention, diagnosis, and treatment; (iii) prolonging night-time service provision; and (iv) attracting and retaining skilled health workers (especially in rural areas) to provide faster emergency response, including for childbirth deliveries.

**Zero Hunger (SDG 2) and Clean Water and Sanitation (SDG 6)**—Electricity is key to efficient agriculture (e.g., irrigation, agro-processing, etc.) and food security. Irrigation pumps can double the yield of croplands, and refrigeration reduces spoilage. Modern energy for processing can vastly improve the efficiency of food production, increase the value of the products, and generate economic and employment gains, which in rural areas would potentially reduce the pressure towards urban migration. Moreover, installing and operating water extraction, transport, and treatment systems requires a considerable amount of energy (UN DESA *et al.*, 2018).

**Quality Education (SDG 4)**—Access to **electricity** in homes can improve education by providing quality lighting for longer and more comfortable night-time studying. As in the case of health, however, the greatest gains of electricity access are in educational facilities. Access to modern energy services can improve basic amenities, for example clean water, sanitation, lighting, space heating, and cooling in schools, which helps learning and teaching experiences, increases school attendance, and reduces dropout rates (Bacolod and Tobias 2006). Lighting allows schools to remain open in the evenings to accommodate more and better-sized classes and study sessions, and to facilitate lesson preparation and administrative tasks for teachers. Electricity also enables access to information and communication technologies (ICTs)—helping to bridge the digital divide—and facilitates distance learning, staff training, and administrative tasks.

Energy access, energy-efficiency, and renewable energy for educational facilities also affect other SDGs besides SDG 4, including good health and well-being (SDG 3), clean water and sanitation (SDG 6), gender equality (SDG 5), and climate action (SDG 13), among others. Other than providing lighting, electricity in schools can have a multiplier effect on community services when it is used to access, deliver, and purify water for drinking and sanitation, circulate air to provide a comfortable indoor climate, heat the space during winter, and refrigerate food and medical supplies (UN DESA *et al.*, 2019).

**Gender Equality (SDG 5)**—Both **clean cooking solutions** and **electricity** empower women by reducing the time and drudgery of female- and child-dominated labour-intensive activities. This effect is greater for **clean cooking**, as it saves many hours a day in quicker food preparation and avoided fuel collection. The estimated costs of inaction on gender equality are estimated at USD 0.8 trillion per year, borne by women in the forms of lost productivity as well as poor health and safety (ESMAP, 2020b). **Electricity** adds potential value to the saved time through: (i) increased employment opportunities outside the home and (ii) enhanced education and study possibilities for children. In addition, the health and well-being, particularly of women, benefit when health clinics are electrified and maternal health services are expanded.



## Impact on Environment

**Climate Action (SDG 13)** Greenhouse gas emissions from the unsustainable collection of wood fuels for cooking amount to a gigaton of carbon dioxide (CO<sub>2</sub>) equivalent per year, equivalent to 1.9-2.3% of global emissions (Bailis et al. 2015), whilst household cooking and heating account for up to 51% of the world's black-carbon emissions (CCAC, 2021). Universal access to **electricity** is estimated to cause a negligible increase in greenhouse gas (GHG) emissions if the energy demand of the affected population remains low. According to the Energy Access Outlook 2017 of the International Energy Agency (IEA), providing energy for all generally does not have a significant impact on energy demand. The 'Energy for All' case accounts for an additional increase of just 0.23% in global energy demand in 2030. Accordingly, at first glance, achieving universal energy access is not in conflict with achieving climate objectives.

However, energy and cooking access in this sense refers principally to very basic energy services, such as the provision of lighting. At the same time, productive uses of electricity that go beyond the consumption required for private household applications, for example, in a small family-run workshop or larger commercial energy uses, are expected to catalyse an increase in economic development across all sectors. Systematic encouragement of productive uses, as well as their adequate monitoring, leads to exorbitantly higher energy demand and consequently to correspondingly higher GHG emissions, if not met exclusively by renewable energy (UN DESA *et al.*, (2019).

**Life on Land (SDG 15) Clean cooking solutions** would avoid the forest degradation and localized deforestation caused by biomass-fuelled cooking. However, the current consensus view is that the collection of firewood for energy is not a major contributor to deforestation in comparison with land clearing for agriculture, timber harvesting, road building, commercial and residential development, and other permanent land uses (EC 2010; Hiemstra-van der Horst 2008; UCS 2011; World Bank 2011, cited in ESMAP 2020b).

## 8

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## ENDNOTES

- <sup>1</sup> The RISE score is used here as a proxy of progress, given that it encompasses a wide range of indicators summarizing key elements of the policy and regulatory frameworks in grid, mini-grid, off-grid solar, as well as clean cooking segments. The average RISE score for energy access-deficit countries (see footnote x) will need to increase from the current 37 for clean cooking and 53 for electricity (moderately developed frameworks) to 67 or above (advanced frameworks). (ESMAP, 2020a)
- <sup>2</sup> 'Access-deficit countries' refers to the 95 countries with electricity and clean cooking fuel and technology access below 100 %. This definition is used throughout the report except when referring specifically to the top 20 access-deficit countries. The top 20 electricity access-deficit countries in 2019 (deficit in millions) were: Nigeria (90), Democratic Republic of the Congo (70), Ethiopia (58), Pakistan (56), United Republic of Tanzania (36), India (30), Uganda (26), Mozambique (21), Sudan (20), Madagascar (20), Niger (19), Angola (17), Myanmar (17), Burkina Faso (17), Malawi (17), Kenya (16), Chad (15), Democratic People's Republic of Korea (13), Bangladesh (13), South Sudan (10). Source: Tracking SDG7 (2021). These countries account for 95% of the total electricity access deficit.
- <sup>3</sup> With linear progress, the electrification growth rate would need to be 1.7 percentage points per year to achieve universal access in 2030 (Tracking SDG7, 2021). However, the challenges of the last mile electrification efforts will likely result in slower progress in the later years of electrification efforts, so planned progress should compensate with at least a 2.0 percentage points per year growth rate in the period up to 2025.
- <sup>4</sup> SDG 7.1 is formally articulated in terms of people with **access to energy services**, setting the goal of an **access rate** of **100%** of the population—universal energy access or energy for everyone. Organizations and individuals working to meet this goal, however, often focus their attention on people **without access to energy services**—the **access deficit**—seeking to reduce the access deficit to **0 people** or the **access deficit rate** to **0%** of the population.
- <sup>5</sup> Progress on SDG 7.1.1 and 7.1.2 is currently tracked through binary indicators (access or no access). Although convenient, these indicators do not measure the affordability and reliability aspects of their respective goals, leading to a discrepancy between the definitions of the goals and the indicators used to monitor progress towards them. In this report, the clean cooking access rate refers to the binary SDG 7.1.2 indicator, as access to clean fuels and technologies for cooking, which has been measured by using the proxy of the proportion of whether households are cooking primarily with clean fuels, defined as electricity, liquefied petroleum gas (LPG), natural gas, biogas, solar, and alcohol fuel stoves. The Energy Sector Management Assistance Program's (ESMAP) **Multi-Tier Framework (MTF)** approach complements the binary data with more nuanced measures of energy access, including the affordability and reliability aspects that governments and stakeholders can use to inform policy and investment decisions (Bhatia and Angelou, 2015).
- <sup>6</sup> In particular, (i) continued reductions in hardware costs—in solar photovoltaic (PV) modules, batteries, energy management systems, meters, etc.; (ii) a digital revolution facilitating geospatial planning, preparation for scaling, marketing, payments and monitoring, as well as new financial technology solutions (e.g., end-user credit assessments); (iii) innovation in business models, such as pay-as-you go (PAYG) for solar home systems, which offer energy-as-a-service without prohibitive up-front costs to consumers; (iv) development of solar-powered productive use applications; and (v) reduced costs of energy-efficient appliances, which give households affordable services beyond lighting and cell phone charging that were previously unaffordable for them.
- <sup>7</sup> While electric cooking is an option, it is not realistic to expect all cooking energy needs to be served by electricity by 2030. Currently, use of electricity for cooking only accounts for 7% of the population in low- and middle-income countries (Tracking SDG7, 2021). In sub-Saharan Africa where electrification is low, 80% of primary energy use is biomass, largely fuelwood and charcoal for cooking (IEA, 2019). Therefore, it is important to take a two-pronged yet interlinked approach to reach universal access: scaling up access to electricity services and scaling up access to clean cooking services with the interlinkage to expand electricity for cooking services wherever economically cost-effective.
- <sup>8</sup> **RISE** is Energy Sector Management Assistance Program's (ESMAP) **Regulatory Indicators for Sustainable Energy** tool, which assesses countries' policy and regulatory support for each of the four pillars of sustainable energy—access to electricity (54 access-deficit countries were surveyed in 2019), access to clean cooking (for



55 access-deficit countries), energy efficiency, and renewable energy. RISE provides a reference point to help policymakers benchmark their sector policy and regulatory framework against those of regional and global peers, and it is a powerful tool to help develop policies and regulations that advance sustainable energy goals. Electricity Access is assessed by performance on (i) electrification planning, (ii) scope of officially approved electrification plan, (iii) framework for grid electrification, (iv) framework for mini-grids, (v) framework for stand-alone systems, (vi) consumer affordability of electricity, (vii) utility transparency and monitoring, and (viii) utility creditworthiness. Clean Cooking is assessed by progress on (i) planning, (ii) scope of planning, (iii) standards and labelling, and (iv) incentives and attributes. RISE indicators are scored on a 0–100 scale and grouped into three categories based on a 'traffic light' system: green indicating a relatively mature policy environment though in some cases still with room for improvement (for the highest third of scores, 67–100, these are the 'advanced frameworks'); yellow indicating that the country has begun to make serious efforts to develop a policy framework but still has some room for improvement (for the middle range, 33–67); and red indicating that policy adoption remains at an early stage (for the lowest scores, 0–33).

- <sup>9</sup> RISE 2020 includes 54 access-deficit countries for access to electricity and 55 access-deficit countries for Clean cooking (Including China). (ESMAP, 2020a)
- <sup>10</sup> Countries with advanced frameworks for clean cooking include Ethiopia, India, Indonesia and Kenya, represent more than half of the unserved population globally. While the 2010–2017 period was notable for progress in upper- and lower-middle-income countries in Asia (Bangladesh, Cambodia, China, India, Indonesia, Mongolia, and Nepal) and Latin America (Guatemala), the 2017–2019 period also saw large improvements in low-income sub-Saharan Africa countries, notably Benin, Kenya, Nigeria, and Tanzania, which moved from insufficient policy framework to a more mature set of policies (ESMAP, 2020a).
- <sup>11</sup> Income levels have affected electrification policy efforts, with 67% in middle- and upper-income countries having adopted comprehensive access frameworks by 2019 (RISE green zone), compared with just 13% of low-income countries (ESMAP, 2020a).
- <sup>12</sup> Grid access expansion requires a CAPEX subsidy to make connection cost affordable. All too often utilities accumulate this subsidy on their books as a liability.
- <sup>13</sup> According to RISE, the frameworks for mini-grid and off-grid solutions have registered faster progress in the past decade, growing from 2 countries with advanced (RISE green zone) mini-grid and off-grid policy in 2010 to 22 countries (nearly 50% of surveyed countries) in 2019, but the progress has been inconsistent across countries (ESMAP, 2020a).
- <sup>14</sup> **RISE affordability definition:** 'Consumer affordability is evaluated based on a combination of three measures: (i) the affordability of subsistence consumption (meaning that the cost of a minimal consumption of 30 kilowatt-hours per month is less than 5 percent of the gross household monthly income of the poorest 40 percent of the population); (ii) the affordability of connection fees (meaning that the upfront cost of connection is below the gross average monthly household income of the bottom 40 percent of the population); and (iii) the existence of a lifeline tariff.' This information is from the RISE website: <https://rise.esmap.org/pillar/electricity-access/indicator/consumer-affordability-electricity>
- <sup>15</sup> The World Bank's Multi-Tier Framework (MTF) for electricity captures detailed indicator level data (using 7 attributes: Capacity, Availability, Reliability, Quality, Affordability, Formality, and Safety) for tracking progress across tiers of access (from Tier 0 to Tier 5). Tier 0 refers to households that receive electricity for less than 4 hours per day (or less than 1 hour per evening) or that have a primary energy source with capacity of less than 3 watts. A household is said to have access to electricity if it has met the standards of Tier 1 or higher across all 7 attributes, particularly for Capacity and Availability attributes. The MTF for cooking captures detailed indicator level data (using 6 attributes: Exposure, Efficiency, Convenience, Safety, Affordability, and Availability) for tracking progress across tiers of access (from Tier 0 to Tier 5). A household is said to have access to Modern Energy Cooking Services (MECS) if it has met the standards of Tier 4 or higher across all 6 attributes. Households which have met the standards of Tier 2 or Tier 3 are considered to be in 'Transition' or have access to Improved Cooking Services (ESMAP, 2020b).
- <sup>16</sup> The situation was exacerbated during the COVID-19 pandemic when many governments declared electricity free to mitigate the socio-economic cost of the crisis, often without compensating utilities for the loss of revenue.

- <sup>17</sup> Tier 1 and higher
- <sup>18</sup> ESMAP estimates of financing needs that include the cost of clean stove, subsidies needed to fill the affordability gap on fuel expenditures, and downstream infrastructure essential to the functioning of clean cooking market. The amount is higher than the USD 6 billion estimated by IEA (2021) which only considers stove costs, but lower than USD 150 billion needed to achieve universal access to MECS by 2030, as it does not include contributions from households for stoves and fuels and does not account for additional investments needed to fully eliminate stove/fuel stacking (ESMAP, 2020b).
- <sup>19</sup> The 6 billion USD only includes costs of clean cookstoves and does not factor in the additional costs for clean fuels and other necessary infrastructure arrangements
- <sup>20</sup> This scenario also assumes that access to improved cooking services (MTF tiers 2 and 3) need to increase from 16% to 25% by 2025 and to 35% by 2030.
- <sup>21</sup> Assuming linear progress, the annual rate of electricity access expansion would need to increase from 1.5 percentage point to 1.7 percentage points. Considering, however, that electrification efforts are likely to slow down in the last years to reach the most remote, poorest and inaccessible population, it is projected that the rate of electrification progress needs to increase to 2 percentage point between now and 2025.
- <sup>22</sup> Aiming to reach a total of 212,000 mini-grids, and 30,000 mini-grids to be built annually, by 2030 (ESMAP, 2019, Mini-grids for Half a Billion People)
- <sup>23</sup> Baseline and projection from World Bank Group (2020). This implies a compound annual growth rate (CAGR) of 13%, up from 10% registered in 2017–2019 (before the COVID-19 market collapse). This also implies that the 'active off-grid solar markets' need to grow from currently 10 to 25 countries by 2025.
- <sup>24</sup> Tracking SDG7 (2021)
- <sup>25</sup> Tracking SDG7 (2021)
- <sup>26</sup> ESMAP (2020), the State of Access to Modern Energy Cooking Services
- <sup>27</sup> ESMAP estimated target to align the goal of achieving access to MECS to 65% by 2030 and then to 100% by 2050.
- <sup>28</sup> ESMAP (2020), the State of Access to Modern Energy Cooking Services
- <sup>29</sup> ESMAP estimated target to align the goal of eliminating traditional polluting cooking practice by 2030.
- <sup>30</sup> Tracking SDG7 (2021). Target assumes the rate of expansion of 2 percentage points.
- <sup>31</sup> Tracking SDG7 (2021). Assuming linear progress, the annual rate of electricity access expansion would need to increase from 1.5 percentage points to 1.7 percentage points. Considering, however, that electrification efforts are likely to slow down in the last years to reach the most remote, poorest and inaccessible population, it is projected that the rate of electrification progress needs to increase to 2 percentage point between now and 2025.
- <sup>32</sup> ESMAP (2019), Mini Grids for Half A Billion People
- <sup>33</sup> ESMAP (2019), Mini Grids for Half a Billion People
- <sup>34</sup> World Bank Group (2020). The target assumes annual growth rate of 13%, which is required for the off-grid solar sector reach 617 million people with Tier 1+ systems to deliver its share of the SDG7 goal, as per methodology described in the report.
- <sup>35</sup> All baselines are from ESMAP (2020a).
- <sup>36</sup> Targets assume that all countries should (i) produce clean cooking and electrification strategies/plans; (ii) on average the regulatory framework for the group of energy access-deficit countries should reach advanced status, (iii) all utilities of energy access-deficit countries should achieve at least moderately creditworthy status, and (iv) RISE score for mini-grid and stand-alone systems should reach a highly advanced level, since this

sector needs to attract considerable financing in the coming years.

<sup>37</sup> ESMAP, GOGA, ACE and Shell Foundation, for example, are jointly working on establishing the End-User Subsidy Lab, as the key resource center for Governments, development partners and private sector, supporting design and implementation of end-user subsidies in the off-grid solar sector

<sup>38</sup> ESMAP (2020a). The target is the minimum score needed to achieve on average an advanced framework for the group of FCV countries. This score is considered indicative of developing framework required of attracting required public and private financing.

<sup>39</sup> ESMAP (2020a). The target is the minimum score needed to achieve on average an advanced framework for the group of FCV countries. This score is considered indicative of developing framework required of attracting required public and private financing.

<sup>40</sup> ESMAP (2020a). To drive the needed progress in pro-poor electrification (including displaced persons), productive use stimulation and electrification of public institutions, it is considered essential that these three aspects are included in the national electrification plans of all electricity access-deficit countries.

<sup>41</sup> Active market is defined as a minimum of three off-grid solar companies selling more than 100,000 products per year (GOGA 2019) and GOGA (2021).

<sup>42</sup> Baseline: GOGA (2021b). Target is based on ESMAP staff estimates of additional market expansion to deliver the target for the annual sales of Tier1+ off-grid system.

<sup>43</sup> Baseline: Rwanda and Togo. Target: ESMAP staff estimates.

<sup>44</sup> The baseline is calculated in each country of intervention.

<sup>45</sup> The baseline is calculated in each country of intervention.

<sup>46</sup> World Bank. Global Electrification Platform 2020 <https://electrifynow.energydata.info/>

<sup>47</sup> World Bank. Global Electrification Platform 2020 <https://electrifynow.energydata.info/>

<sup>48</sup> The PAYGo business model used to finance both SHS and pico solar products has rapidly its market share, reaching 24 % of unit sales in H1 2019 from 20 % in H1 2018. PAYGo boosts affordability, unlocking larger off-grid solar systems that provide higher levels of energy service in addition to a wide variety of high-value, non-energy services that can be offered over PAYGo platforms.

<sup>49</sup> Based on assumption of a year-on-year growth rate of 25%

<sup>50</sup> These trends are unlikely, however, to be sufficient to bridge the affordability gaps of the poorest and most vulnerable populations, which will require also end-user subsidies (which are covered in Building Block 2).

<sup>51</sup> The target is based on the assumption that in order to achieve universal access by 2030, the majority of off-grid solar systems on the market should be quality-verified. This requires that by 2025, at least 50% milestone is achieved. It should be noted that non quality-verified products on the market are not all of inferior quality, but are of unknown quality, of which a certain share are of inferior quality.

<sup>52</sup> As per available World Bank MTF surveys

<sup>53</sup> ESMAP (2019), Mini Grids for Half A Billion People

<sup>54</sup> ESMAP (2019), Mini Grids for Half A Billion People

<sup>55</sup> Baseline: World Bank Group, 2020. The target is based on the assumption that in order to achieve universal access by 2030, the majority of off-grid solar systems on the market should be quality-verified. This requires that by 2025, at least the 50% milestone is achieved.

<sup>56</sup> ESMAP (2020a). The target assumes that all countries with a significant off-grid market should adopt quality standards by 2025.

<sup>57</sup> ESMAP (2020a)

- <sup>58</sup> Both baseline and target: Foster and Witte (2020)
- <sup>59</sup> ESMAP (2019), Mini Grids for Half A Billion People
- <sup>60</sup> ESMAP (2019), Mini Grids for Half A Billion People
- <sup>61</sup> GOGLA (2021b). The target is based on assumption of a year-on-year growth rate of 25%
- <sup>62</sup> operating at scale is defined as min. Of 50,000 PAYG sales/ year
- <sup>63</sup> GOGLA (2021b)
- <sup>64</sup> See footnote 18.
- <sup>65</sup> [https://www.un.org/ohrrls/sites/www.un.org.ohrrls/files/promo\\_energy\\_10\\_10\\_2017\\_final\\_lowresf\\_0.pdf](https://www.un.org/ohrrls/sites/www.un.org.ohrrls/files/promo_energy_10_10_2017_final_lowresf_0.pdf)
- <sup>66</sup> This assumes bridging the affordability gap for a Tier 1 system. Targeting higher tiers will require substantially higher subsidies.
- <sup>67</sup> Baseline: ESMAP (2020b). Target: ESMAP staff calculation based on the MECS target in ESMAP (2020b) report
- <sup>68</sup> see footnote 18
- <sup>69</sup> Total electricity financing for residential sector in the 20 highest energy access-deficit countries as of 2017 was USD 12.7 billion (SEforALL, 2019)
- <sup>70</sup> Target based on Tracking SDG7 (2021)
- <sup>71</sup> ESMAP (2019), Mini Grids for Half a Billion People
- <sup>72</sup> ESMAP (2019), Mini Grids for Half a Billion People
- <sup>73</sup> Baseline: GOGLA (2021a), target: World Bank Group (2020)
- <sup>74</sup> Baseline: GOGLA (2021a), target: World Bank Group (2020)

**For further information, please contact:**

**Secretariat of the High-level Dialogue on Energy 2021**

**Division for Sustainable Development Goals**

**Department of Economic and Social Affairs**

**United Nations**

**<https://www.un.org/en/conferences/energy2021/about>**

**Email: [salame1@un.org](mailto:salame1@un.org)**



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