POLICY BRIEFS IN SUPPORT OF THE HIGH-LEVEL POLITICAL FORUM 2022

ADDRESSING ENERGY'S INTERLINKAGES WITH OTHER SDGs

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PREFACE

Strong action towards achieving SDG 7 is needed today more than ever. The COVID-19 pandemic threw the world into socioeconomic turmoil worsening inequalities and driving millions into poverty. The conflict in Ukraine has made matters worse, sparking interlinked food, finance and energy crises, driving up energy prices and placing energy security at the heart of policy making in many countries, potentially undermining already deficient attention to climate action.

We must urgently counteract the recent slow-down in progress on SDG 7 with swift implementation of the outcomes of the High-level Dialogue on Energy, including the Global Roadmap for Accelerated SDG 7 Action. Sustainable energy is key to the attainment of the 2030 Agenda for Sustainable Development and the objectives of the Paris Agreement on Climate Change.

For energy action to deliver its much-needed co-benefits, we must gain a better understanding of the interlinkages among energy, climate action and sustainability. This 5th edition of the Policy Briefs, coordinated by the SDG7 Technical Advisory Group (SDG7 TAG), is an important step in shaping our understanding. This edition takes a closer look at interlinkages between energy and SDG 4 (education), SDG 5 (gender), and SDG 15 (life on land), identifying potential indicators that could help in tracking global progress in these interlinkages.

The insights from these Policy Briefs will prove valuable in informing the discussions at the High-Level Political Forum (HLPF), in 2022 and beyond. SDG 7 will be under in-depth review when the HLPF meets within ECOSOC in 2023, turning the spotlight onto the work of the SDG7 TAG. Moreover, the HLPF will also convene at summit level in 2023, when the United Nations General Assembly meets for the SDG Summit in New York. The 2023 summit provides an opportunity for a midpoint review of implementation of the 2030 Agenda at which point it will be important to have a complete assessment of energy's interlinkages with all other SDGs. I count on the SDG7 TAG to continue its outstanding work towards this end.

As the convener of the SDG7 TAG, UN DESA will continue to provide full support to the important work of this Group which contributes significantly to effective energy action world-wide. I would like to commend the leadership and commitment of the co-facilitators of the SDG7 TAG, Ms. Sheila Oparaocha and Mr. Hans Olav Ibrekk, and thank them for their continued strong engagement.

LIU Zhenmin
Under-Secretary-General for Economic and Social Affairs
United Nations

FOREWORD

It is our great pleasure to present the fifth compilation of the SDG 7 Policy Briefs, titled Addressing Energy's Interlinkages to Other SDGs, compiled by the SDG 7 Technical Advisory Group (SDG7 TAG).

Dimming prospects in the global fight to mitigate and adapt to climate change, and the devastating social and economic impacts of the lingering COVID-19 pandemic make for a grim picture of the state of the world. While energy action is needed more than ever in this situation, we are actually losing pace towards the achievement of SDG 7. The Global Roadmap for SDG 7 Action resulting from the High-level Dialogue on Energy held under the auspices of UN General Assembly in September 2021 provides clear guidance on what must be done to get on track to reach our goal. We must urgently step-up action to ensure that energy fulfils its key role in the attainment of the entire 2030 Agenda for Sustainable Development and the Paris Agreement on climate change.

To do this, we need a better understanding of energy's interlinkages with other SDGs. This publication is a first step towards creating a global framework for tracking progress on them. Addressing SDG 4 (education), SDG 5 (gender equality), and SDG 15 (life on land), it identifies potential indicators, assesses data availability, and provides clarity on additional requirements. Next year's edition of the Policy Briefs will build on this initial set of energy interlinkages and address the remaining SDGs.

We would like to thank all of the members of the SDG7 TAG for their unwavering commitment and strong engagement to advancing the joint work of the Group. Moreover, we would like to express our gratitude for the support provided by the members of the expert group on energy's interlinkages to other SDGs who provided very valuable inputs for the Policy Briefs.

We believe that this publication will be of great value in informing Member States and other Stakeholders in support of their deliberations at the High-level Political Forum (HLPF) 2022 and also in their preparations for the 27th UN Climate Change Conference of the Parties (COP27) in Egypt in November 2022. Meanwhile, the SDG7 TAG will continue its work to ensure that next year, it will be able to present a full set of proposed indicators on energy's interlinkages in support of the HLPF 2023 towards the SDG Summit at the United Nations General Assembly.

Co-facilitators of the SDG 7 Technical Advisory Group

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This document, including the Policy Briefs and the Summary for Policymakers, was developed under the auspices of the multi-stakeholder SDG 7 Technical Advisory Group, convened by UN DESA. Under the leadership and able facilitation of two co-facilitators of the group, Sheila Oparaocha and Hans Olav Ibrekk, the members of the group have demonstrated exemplary commitment and a true spirit of multi-stakeholder collaboration. The group consists of:

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KEY **NUMBERS**

We must drastically step up our efforts or the achievement of SDG7 will slip out of reach

733 MILLION people still did not have access to electricity in 2020

2.4 BILLION ppeople—one third of the world population—lacked access to clean cooking solutions in 2020

In 2019, the global share of renewable energy sources in total final energy consumption, including traditional uses of biomass, was **17.7%**, while the share of modern renewables was **11.5%**

The rate of energy efficiency improvement was **1.5%** in 2019 which was the second-lowest rate of improvement since the global financial crisis

International financial flows to developing countries in support of clean energy decreased for the second year in a row, amounting to only **USD 10.9 BILLION** in 2019

A holistic framework is required to address the interlinkages of energy with other SDGs, including a set of indicators and reliable data

1 in **4** primary schoolchildren attend schools without any form of electricity

Women are **9** to **23 PERCENTAGE** points more likely to gain employment outside the home following electrification

2 potential **INDICATORS** have been identified on the interlinkages between energy and education

3 potential **INDICATORS** have been identified on the interlinkages between energy and gender equality

4 potential **INDICATORS** have been identified on the interlinkages between energy and life on land

Address regional priorities to accelerate just, inclusive and equitable energy transitions

Close to **80%** of the global population without access to electricity live in Africa

In the Asia-Pacific regions, an estimated **1.3 BILLION** people continued to rely on dirty and polluting fuels and cookstoves

Only **4.6%** of the Arab region's total final energy consumption is covered by renewables

The energy mix in the ECE region still contains **82%** fossil fuel

0 reduction in the Latin America and the Caribbean's energy intensity level since 2014

Least Developed Countries received **25%** of the international financial flows to developing countries in support of clean energy in 2019

SECTION 1

KEY MESSAGES FOR POLICY MAKERS

Decisive action is required to accelerate progress towards SDG 7 now more than ever. The Intergovernmental Panel on Climate Change this year unequivocally warned that the world is on track to climate disaster, unless we immediately change course. On top of the continued COVID-19 pandemic, the world now faces interlinked triple crises of energy, food and finance arising from the Ukraine crisis which have the most devastating effect on the most vulnerable populations, with many developing countries particularly at risk. The importance of SDG 7 cannot be overemphasised in times of the triple crises, since achieving SDG 7 will enable action to combat climate change and attain many other SDGs.

WE MUST DRASTICALLY STEP UP OUR EFFORTS OR THE ACHIEVEMENT OF SDG7 WILL SLIP OUT OF REACH

Efforts towards universal energy access should be dramatically scaled up. Globally, 91% of the population had access to electricity in 2020, leaving 733 million people unserved. The pace of progress has slowed in recent years because of the disruptions by the COVID-19 crisis as well as the growing complexity of connecting remote and poorer people increasing, the challenge to ensure that no one is left behind. Notably, close to 80% of the global population without access to electricity live in Africa. If the current pace persists, only 92% of the world's population will be electrified in 2030. In 2020, 69% of the global population had access to clean cooking fuels and technologies, leaving some 2.4 billion people—one third of the world population—without access. If the current trend continues, 76% of the global population will have access to clean cooking by 2030, leaving a quarter of the global population unserved.

Modern renewable energy developments have advanced throughout the pandemic, especially in the electricity sector, despite the continued disruptions caused by COVID-19. In 2019, the global share of renewable energy in total final energy consumption, including traditional uses of biomass, was 17.7%, while the share of modern renewables was 11.5%. However, progress in the heat and transport sectors continues to be slow.

The annual rate of improvement in energy efficiency would now need to be 3.2% through 2030 to reach the SDG 7.3 target. The year 2019 recorded a 1.5% global improvement rate in energy efficiency, which is the second-lowest rate since the global financial crisis.

Clean energy investments for developing countries must be urgently scaled up. For the second year in a row, investments into clean energy in developing countries have been declining, amounting to only $10.9 billion in 2019. The financing level was especially lower in the Least Developed Countries, Landlocked Developing Countries, and Small Island Developing States.

Global CO_2 emissions reached an all-time high in 2021. At the same time, investment in clean energy technologies has remained far below the levels that are needed to bring emissions down to net zero by mid-century. There are many ways to respond to the immediate energy crisis that can pave the way to a cleaner and more secure future. The world does not need to choose between solving the energy crisis and the climate crisis – and it cannot afford to ignore either of them.

The UN High-Level Dialogue on Energy in 2021 has delivered the roadmap on which the world needs to take action. The dialogue created significant momentum to spur much needed energy action, which we need to build upon. The Global Roadmap for Accelerated SDG 7 Action, an official outcome of the Dialogue, provides a clear way forward with two sets of milestones to be achieved by 2025 and 2030 respectively. The Dialogue also triggered the registration of over 200 Energy Compacts including pledges of over US$600 billion of investments in clean energy from Governments and businesses alone. We must translate this momentum into action swiftly.

A HOLISTIC FRAMEWORK IS REQUIRED TO ADDRESS THE INTERLINKAGES OF ENERGY WITH OTHER SDGS, INCLUDING A SET OF INDICATORS AND RELIABLE DATA

Investing in SDG 7 action can yield multiple benefits, boosting progress on other SDGs. Decisive action on sustainable energy will catalyse progress towards all the other SDGs, as well as global climate targets, including both mitigation and adaptation. To achieve these co-benefits and minimise trade-offs, SDG 7 action by all stakeholders needs to be mindful of these opportunities and implications, integrating the consideration of energy's interlinkages in policy, regulation, planning, implementation and management at all levels.

Energy's interlinkages with other SDGs need to be quantified and tracked to strengthen the foundation for evidence-based decision-making. To understand better the impact of these interlinkages and to trigger increased action on them requires identifying potential indicators which can adequately capture progress on energy's interlinkage with other SDGs. Moreover, the dearth of data and lack of consistency in data collection on energy's interlinkages with other SDGs must be addressed.

The exploration into potential indicators for energy's interlinkages with SDG 4 (education), SDG 5 (gender equality), and SDG 15 (life on land) demonstrates the potential added value of a holistic framework for tracking interlinkages:

- **Access to affordable, reliable, and modern energy in schools critically improves the quality of, and accessibility to, education.** Two indicators that are currently ready to be applied are i). Proportion of schools (primary/secondary) with access to electricity, and ii) Access to electricity in educational facilities. However, additional data would be required to more accurately reflect the complexity of interlinkages with SDG 4. Governments, development partners, civil society, and the private sector are called upon to not only foster cooperation in collecting and collating data and to invest in robust data collection mechanisms at the national, subnational, and local levels, but to also engage young people in these efforts.

- **Access to affordable, sustainable, and clean energy is a precondition for the achievement of SDG 5 on gender equality and the empowerment of all women and girls.** Gender gaps in energy should be measured through appropriate indicators in four key areas: energy poverty, empowerment and leadership, entrepreneurship, and enabling environments. A platform and partnership should be established to strengthen data collection on energy and gender to address the dearth of gender data and lack of consistency in data collection. Making women visible in sustainable energy helps advance achieving gender equality in the energy sector.

- **Energy's interlinkages with sustainable land management should be underpinned by multiple indicators that reflect the complexity and multi-faceted nature of such relationships.** This also means that one indicator alone may not be sufficient to capture potential trade-offs. For example, an indicator on changes in biological diversity caused by renewable energy deployment could complement one on the change in lifecycle greenhouse gas emissions attributed to renewable energy deployment. It is imperative that sustainable energy systems appropriately consider and address potential conflicts with stakeholders, find the best fit for renewable energy systems to minimize negative effects, and optimize synergies with other land management goals, such as productivity and biodiversity conservation.

This publication is a first step towards informing a holistic framework for tracking progress on energy's interlinkages with other SDGs. The next edition of the SDG 7 Policy Briefs in 2023 is intended to explore more details towards developing such framework.

ADDRESS REGIONAL PRIORITIES TO ACCELERATE JUST, INCLUSIVE AND EQUITABLE ENERGY TRANSITIONS

Africa remains the least energized region, with close to 80% of the 760 million people globally without access to electricity and 36% of the 2.6 billion people without access to clean cooking. While significant efforts have increased electrification, the rate is not enough to close the continent's energy access deficit rapidly. Despite its abundant clean energy resources potential, with over 40% of global solar irradiation falling on Africa, deployment of renewables on the continent remains very small, with Africa's share of global electricity generation from hydropower, wind and solar power being only 3.3%, 1.2%, and 1.1%, respectively. Energy efficiency remains a challenge on the continent. With an increasing industrialization agenda, there are tremendous opportunities to drive energy efficiency efforts on the continent. In terms of investments, less than 2% of global clean energy investments flow to Africa, mainly in just a few countries. Notably, Africa's private sector must become more involved in the energy investment space.

In the Asia-Pacific region, the pace of energy intensity improvement is slowing, falling seriously short of the global target. While a few nations have successfully implemented energy efficiency measures across sectors, many have faced difficulties in achieving scale. On the other hand, progress toward achieving universal access to electricity is well on-track. The key challenge facing Asia-Pacific nations is supplying universal access to higher tiers of energy services. Asia-Pacific nations are making weak advancements in expanding access to clean cooking fuels and technologies. Recent years have seen a decline in the total number of people making the transition to clean cooking, reversing a previously improving trend. Growing pressures to take action on climate change, along with the increasing affordability of renewable energy, has led to energy development plans with an increasing focus on renewables. This has been coupled with a shift away from coal. Modern renewable energies, particularly wind and solar, are helping renewables make small gains as a share of final energy consumption. Greater efforts are needed to increase investment readiness, strengthen grids and connectivity, and expand renewables to transport and heat raising sectors.

In the Arab region, renewable energy penetration rates continue to lag other regions, with only 4.6% of the region's total final energy consumption covered by renewables, mainly from traditional biomass. Modern renewables, however, continue to grow as their falling costs have made them increasingly cost competitive with conventional sources, particularly in the Gulf Cooperation Council (GCC) countries. Given the geopolitical situation and rising energy prices, there is a strong incentive for governments to shift to renewable energy sources and invest in energy efficiency at the earliest. Access to electricity in the Arab region was around 90% in 2020 with about 42 million people not having electricity access. Although the number decreased by about 3 million between 2019 and 2020, there was a noticeable slowdown in the rate of access to electricity. Primary energy intensity in the Arab region (4.9 MJ/US$ 2017 PPP) was higher than the average global primary energy intensity (4.7 MJ/US$ 2017 PPP) in 2019. While there has been some progress over the past decade, more recently there was a slowdown in the improvement of energy intensity.

The most significant development for the ECE region has been the Ukraine crisis and its consequences for energy prices and energy security. Importers in the region will increasingly replace gas with other alternatives, which will entail faster growth of renewables but could also result in a reversion to existing infrastructure based on coal. Generally, the western reaches of the ECE region have seen a lot of investment in renewable energy technology, but in the eastern reaches there has been more limited activity. The main issues are related to end-use tariffs, market design, and investment policy. Although the ECE region has achieved 100% access with modern energy services and clean cooking fuels, there are remote communities whose access does not register in the reported statistics which require attention. Notably distributed renewable generation, small scale storage, and microgrids are opportunities for these communities. With respect to energy efficiency indicators, the region shows better results than the global indicators. Nevertheless, there remain significant opportunities for improvement.

While Latin America has historically had the lowest energy intensity in the world, there has been no reduction in the region's energy intensity level since 2014, and additional efforts will be required to reach the target set for 2030. The region continues to make progress in the implementation of SDG 7, but the negative impacts on the region's economy caused by the COVID-19 global pandemic have limited the progress made. This pandemic has heightened the urgency of solving the region's energy access gap, and the current situation strongly calls for a united effort between the public and private sectors. Overall, electricity access is 97.4%, but rural areas remained disadvantaged, with coverage of only around 95%. In many LAC countries, more than 10% of the population still does not have access to clean technologies for cooking. Due to the slow advancement, the region is unlikely to reach the 2030 target. The region has continued to make significant progress on incorporating renewable energy, increasing its share in the primary energy supply from 30% (2019) to 33% (2020). This exceeds the global average in primary supply, which is only 13%.

In the Least Developed Countries (LDCs), access to energy is moving at a slower pace and falling behind actual needs to achieve structural transformation — a central pillar of the Doha Programme of Action for the Least Developed Countries for the Decade 2022-2031 (DPoA), and critical to achieving all other SDGs. Electricity access improved steadily between 2010 and 2020, from 33 percent to 55 percent. As of 2020, 478 million people in LDCs still had no access to electricity, and over 860 million people rely on harmful fuels for cooking. Excluding traditional uses of biomass, the share of renewables in total final energy consumption reached 10.3 % in 2019, down slightly from 10.7 % in 2010. Non-renewable capacity continues to expand faster than renewables to meet growing energy demands in LDCs. Energy intensity needs are falling in LDCs from 5.59 MJ/US$ to 4.84 MJ/US$ between 2010 to 2019, using 2017 PPP. This is compared with a global average of 4.69 MJ/US$. LDCs received 25% of the international financial flows to developing countries in support of clean energy in 2019, an increase from the 21% in 2018 but hiding a 9% decrease from USD 3.0 billion to USD 2.7 billion.

SECTION 2

ADVANCING SDG 7 IMPLEMENTATION **IN SUPPORT OF THE 2030 AGENDA**

CONTRIBUTING ORGANIZATIONS:
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THE WORLD BANK,
THE WORLD HEALTH ORGANIZATION (WHO)

Key Messages/Summary

The 2022 edition of *Tracking SDG 7: The Energy Progress Report* reviews the outcomes of key energy targets and serves to guide policymaking to achieve universal access to affordable, reliable, sustainable, and modern energy by 2030. Although innovative policies and technologies continue to develop and provide benefits in the energy sector, recent data and scenarios show that the world still falls short of achieving the goals of Sustainable Development Goal (SDG) 7 on affordable and clean energy. While faster and stronger action is needed, the impact of the COVID-19 crisis in early 2020 has undermined efforts to meet the goals, especially in the most vulnerable countries and those that already lag far behind. As the world follows up on the September 2021 United Nations High-Level Dialogue (HLDE), with the launch of a global roadmap to accelerate SDG 7 actions, it is critical to enhance international collaboration to achieve the energy targets.

ACCESS TO ELECTRICITY

Globally, 91% of the population had access to electricity in 2020, leaving 733 million people unserved. Despite the continuous advances since 2010, the pace of progress has slowed in recent years because of the disruptions caused by the COVID-19 crisis as well as the growing complexity of connecting remote and poorer people. Sub-Saharan Africa, where most least developed countries (LDCs) are located, remained the largest access-deficit region. If the current pace persists, only 92% of the world's population will be electrified in 2030. Reaching universal access by 2030 thus requires the electrification rate to increase by 0.9 percentage points annually.

ACCESS TO CLEAN COOKING TECHNOLOGIES

In 2020, 69% of the global population had access to clean cooking fuels and technologies, an increase of about 70 million people over the previous year. Nevertheless, some 2.4 billion people – one-third of the world population – still lacked access in 2020. If the current trend continues, 76% of the global population will have access to clean cooking by 2030, leaving a quarter of the population unserved, mostly in low- and middle-income countries. To reach universal access, major progress should be made in sub-Saharan Africa, where population growth outpaced the progress in access.

RENEWABLE ENERGY

In 2019, the global share of renewable energy sources in total final energy consumption (TFEC), including traditional uses of biomass, was 17.7%, while the share of modern renewables was 11.5%. Despite continued disruptions by the COVID-19 impact, renewable energy developments continued throughout the pandemic, especially in the electricity sector. Addition of new renewable electricity-generating capacities slowed down in 2021, however, and heat and transport are continuing to see limited progress. The current trend is not on track to achieve the target, which requires a much faster uptake of renewables.

INSTALLED RENEWABLE ELECTRICITY-GENERATING CAPACITY IN DEVELOPING COUNTRIES

Developing countries had 246 watts (W) of installed renewable capacity per capita in 2020, with a year-on-year growth rate of 11.6%. While renewable capacity per capita advanced at a compound annual growth rate of 9.5% over 2015–2020 for the developing world, the pace of growth was slow in Small Island Developing States (8.3%), the Least Developed Countries (5.2%), and Landlocked Developing Countries (2.4%).

ENERGY EFFICIENCY

The primary energy intensity was 4.69 megajoules (MJ) per United States dollar ($US) in 2019. Although the recent figure indicates a 1.5% improvement over 2018, this was the second-lowest rate of improvement since the global financial crisis. Annual improvement through 2030 should be now 3.2% to reach the SDG 7.3 target. Eastern and South-eastern Asia is the only region overachieving the target, with an annual average growth of 2.7% in 2010–2019. Meanwhile, the lowest rates of improvement were found in Latin America and the Caribbean (0.6%), followed by Western Asia and Northern Africa (1.2%), and sub-Saharan Africa (1.3%).

INTERNATIONAL PUBLIC FINANCIAL FLOWS TO DEVELOPING COUNTRIES IN SUPPORT OF RENEWABLE ENERGY

The international financial flows to developing countries in support of clean energy amounted to $10.9 billion in 2019. This was a decrease for the second year in a row. In terms of the five-year moving average, the average annual commitments declined by 5.5% from $17.5 billion in 2014–2018 to $16.6 billion in 2015–2019 for the first time since 2008. The financing level was especially lower in the Least Developed Countries, Landlocked Developing Countries, and Small Island Developing Countries.

CUSTODIAN TRACKING AND ANALYSIS ON THE ADVANCEMENT OF SDG 7

Energy is central to most major challenges that the world confronts these days, such as health, education, and job creation. During the pandemic especially, energy has been essential for life-saving medical care. For this important issue, the Tracking SDG 7: Energy Progress Report was jointly prepared by the SDG 7 Custodian agencies—International Energy Agency (IEA), International Renewable Energy Agency (IRENA), United Nations Statistics Division (UNSD), World Bank, and World Health Organization (WHO) – to annually monitor and assess global progress for the key targets. Moreover, the report serves to guide policymaking to ensure access to affordable, reliable, sustainable, and modern energy.

Goal 7 Targets	Indicators
SDG 7.1: Ensuring universal access to electricity and clean cooking solutions	**Indicator 7.1.1:** Proportion of population with access to electricity
	Indicator 7.1.2: Proportion of population with primary reliance on clean fuels and technology
SDG 7.2: Substantially increasing the share of renewable energy in the global energy mix	**Indicator 7.2.1:** Renewable energy share in the total final energy consumption
SDG 7.3: Doubling the global rate of improvement in energy efficiency	**IIndicator 7.3.1:** Energy intensity measured in terms of primary energy and GDP
SDG 7.A: Enhancing international cooperation to facilitate access to clean energy research and technology, and promote investment in energy infrastructure and technology	**Indicator 7.a.1:** International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems
SDG 7.B: Expanding infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries	**Indicator 7.b.1:** Installed renewable energy-generating capacity in developing countries (in watt per capita)

The world has been making constant progress toward SDG 7 targets. The recent data and selected energy scenarios indicate, however, that it is not on track to achieving the SDG 7 goal by 2030, with the COVID-19 pandemic and its impacts also weakening progress. As the world focuses on the outcome of 2021 United Nations High-Level Dialogue on Energy at this critical moment, the SDG 7 custodian agencies are encouraging the international community and policymakers to secure the gains, focusing on the vulnerable countries, which need the most support.

SDG 7.1.1. Access to Electricity

Recent Progress

Global electricity access has advanced from 83% in 2010 to 91% in 2020. Accordingly, the number of unserved people fell from 1.2 billion to 733 million during the same period. The number of people lacking access was predominant in sub-Saharan Africa where three-quarters of the unelectrified people live, while other regions witnessed decreases in their access deficits. The top three countries with the largest access deficits are all from sub-Saharan Africa, including Nigeria (92 million), Democratic Republic of the Congo (72 million), and Ethiopia (56 million). Compared with previous years, the growth in annual access declined to 0.5 percentage points in 2018–2020. Nonetheless, the increase in electrification outpaced population growth worldwide. The slowdown in improvement did, however, hamper the pace of progress in sub-Saharan Africa. Additionally, the COVID-19 impacts on household incomes made basic energy services unaffordable for about 90 million people in Asia and Africa, who had previously had access.

Are we on track to meet the target by 2030?

Reaching universal access has become challenging, as expansion of electricity to people living in isolated and low-income rural areas is difficult. The COVID-19 impact could also delay in progress towards the goal. For example, owing to pandemic-related disruptions, off-grid solar markets were under pressure in early 2020 and the industry has yet to return to pre-COVID-19 levels. To meet the 2030 target, the share of population with access to electricity should increase by 0.9 percentage points annually. In particular, the number of customers connected each year in the LDCs should triple from 23 million in 2000–2018 to 63 million in 2019–2030. According to the IEA's Stated Policies Scenario, if progress continues at the current pace, the world will only reach 92% in 2030, leaving 670 million people unserved, mostly in sub-Saharan Africa. An interplay of robust policies and financial support is thus needed to promote progress in electrification in order to leave no one behind.

SDG 7.1.2 Access to Clean Cooking Solutions

Recent Progress

As of 2020, 69% of the global population had access to clean cooking solutions. Over the past decade, access to clean cooking fuels and technologies has advanced by 12 percentage points, mainly led by the top five most populous countries, including China, India, Indonesia, Brazil, and Pakistan. More than 65 countries have included household energy– or clean cooking–related goals in their Nationally Determined Constitutions (NDCs) for the 2021 UN Climate Change Conference (COP 26). Compared with the previous year, the number of served people increased by 70 million in 2020. Nevertheless, some 2.4 billion people remained without access. The lack of access to clean cooking has been concentrated in sub-Saharan Africa, where 923 million people lived without access in 2020. Progress in Latin America and Caribbean stagnated with an average annual growth of 0.3 percentage points between 2010 and 2020. Meanwhile, during the same period, Central and Southern Asia and Eastern and South-eastern Asia made the largest access gains. Of the top 20 countries with the lowest access rates, 19 of the 20 were LDCs in Africa.

Are we on track to meet the target by 2030?

If the current trend continues, 76% of the global population is projected to gain access to clean cooking by 2030. Based on the IEA's Stated Policies Scenario, 2.1 billion people – mainly in low- and middle-income countries – are expected to live without access in 2030. By the target year, the access rates in Central and Southern Asia, and Eastern and South-eastern Asia are projected to approach 80 to 90%, whereas only one in five people will have access in sub-Saharan Africa and Oceania, excluding Australia and New Zealand. To reach the 2030 target, the access deficit in sub-Saharan Africa should be addressed, where the number of unserved people increases each year. As access growth continues to lag behind population growth, the number of people without access in the region is estimated to rise by around 20 million annually from 2020 onwards, resulting in 1.1 billion without access in 2030. Therefore, scaling up investment in clean cooking is urgently required for the region.

SDG 7.2 Renewable Energy

Recent Progress

The share of renewable energy sources in total final energy consumption (TFEC), inclusive of traditional uses of biomass, was 17.7% in 2019, only 0.4 percentage points higher than the year before. Excluding traditional uses of biomass, it amounted to just 11.5% of TFEC. Most end-use sectors made regular progress, but the trends differ across the sectors. The electricity sector has consistently accounted for the largest growth in the share of renewables, while the pace of progress in the transport and heat sectors has been much slower. Electricity, however, constituted only a fifth of global TFEC in 2019. In the heat sector, which represents half of global TFEC in 2019, the share of modern renewables in global heat consumption stayed at just 10.1% in 2019, a less than two-percentage-point advance in the last 10 years. Traditional uses of biomass remained stable, accounting for more than 13% (23.5 exajoules [EJ]) of global heat consumption. Among the different regions, the share of renewables in energy supply is the largest in sub-Saharan Africa because of widespread traditional uses of biomass for heating and cooking. Taking only modern renewables into account, Latin America and the Caribbean showed the highest share among all regions due to hydropower generation and consumption of bioenergy in industrial processes and biofuels for transport.

Are we on track to meet the target by 2030?

Target 7.2 aims to accelerate deployment of renewable energy sources in the different conventional categories, including electricity, heat, and transport. The share of renewable energy in TFEC is the main indicator for monitoring and assessing progress toward the target. In fact, there is no quantitative milestone set for the target, but custodian agencies have found the current trend not to be ambitious enough and that the use of renewable energy should be swiftly increased. Between 2010 and 2019, the share of renewables in TFEC grew by only 2.7 percentage points. This modest pace highlights how important it is to curb energy consumption through energy efficiency and energy conservation efforts if we are to achieve Target 7.2. To put renewable development on track for achieving SDG 7.2, more ambitious policy and more effective tools to mobilize private capital for developing countries should be implemented in all sectors. To make the energy transition from fossil fuels and traditional uses of biomass to modern renewables, significant improvements in the following areas are required: energy efficiency, energy conservation, and materials efficiency, with the fast deployment of renewable heat technologies.

SDG 7.B.1 Installed renewable energy-generating capacity in developing countries

Recent Progress

Renewable installed capacity per capita has continuously advanced over the past decade in developing countries. Growth in recent years has been mainly due to new capacity additions powered by solar and wind, which have become less expensive than the cheapest new fossil fuel. In 2020, there were 246 W per capita of installed renewable capacity in developing countries, representing an 11.6% year-on-year growth rate. Geographically, growth in renewables-fuelled capacity varied over the past decade. Western Asia and Northern America, and Central and Southern Asia almost doubled their per capita capacity in 2010–2020, owing to solar and wind power. In Eastern and South-eastern Asia, capacity increased from 134 W per capita in 2010 to 460 W per capita in 2020. In Latin America and the Caribbean, capacity grew by 49%, from 285 to 425 W per capita. Meanwhile, trends were lagging in Oceania and sub-Saharan Africa, growing by 25% and 56%, respectively. At the country level, four countries had more than 1,000 W per capita: Bhutan (3,026), Paraguay (1,238), Uruguay (1,075), and the Lao People's Democratic Republic (1,022). Despite the disruptions caused by COVID-19 to economic activity and supply changes, renewable energy developments have shown resilience. Yet, more recently, increasing commodity, energy, and shipping prices have been impacting renewable energy technology markets, heightening uncertainty about future renewable energy projects.

Are we on track to meet the target by 2030?

While there is no quantifiable target for 2030, developing countries are not on track to meet 2030 ambitions; nor is modelled growth on track to a 1.5 °C global warming scenario. The positive trajectory at global and regional levels hides that – even among the developing countries – some of the countries most in need are falling behind. While developing countries enhanced renewable capacity by 9.5% annually in the past five years, the pace of growth is slower in Small Island Developing States (8.3%), Least Developed countries (5.2%), and Landlocked Developing Countries (2.4%). To put renewable deployment on track to reach SDG 7.b.1, along with SDG 7.2 target, a great deal of attention and stronger policy support for renewables are required for those groups across all sectors. Moreover, greater mobilization of the private sector is needed for renewable energy projects.

SDG 7.3 Energy Efficiency

Recent Progress

In recent years, the progress in primary energy intensity – defined as the percentage decrease in the ratio of energy supply per unit of gross domestic product (GDP) – has been slow. Primary energy intensity was 4.69 megajoules (MJ) per US dollar (2017 purchasing power parity [PPP]) in 2019. Although the 2019 number increased by 1.5% from 2018, it was the second-lowest rate of improvement since the global financial crisis. In terms of region, only Eastern and South-eastern Asia showed significant progress with an annual average rate of 2.7% in 2010–2019, overachieving the target, driven by strong economic growth. On the other hand, Latin America and the Caribbean showed the lowest rate at 0.6%, followed by Western Asia and Northern Africa (1.2%), and sub-Saharan Africa (1.3%). Meanwhile, data on absolute energy intensity present wide regional disparities. For instance, energy intensity in sub-Saharan Africa is almost double the level in Latin America and the Caribbean. These variations reflect the differences in economic structure, energy supply, and electrification, rather than in energy efficiency.

Are we on track to meet the target by 2030?

Despite the gradual improvement since 1990, improvements in primary energy intensity have been below the SDG target 7.3 of 2.6% per year. In 2010–2019, the average annual rate of improvement in global primary energy intensity was 1.9%. Compared to the rate of 1.2% between 1990 and 2010, it is higher but still below the target. Given the slow progress, annual improvement should now average 3.2% to achieve the SDG target 7.3. Considering the impact of the COVID-19 crisis, early estimates for 2020 signalled a dramatic plunge in intensity improvement. The outlook for 2021 foresees a return to the average rate of progress in the last decade. Under the IEA's Net Zero Emissions by 2050 Scenario, the global economy grows more than 40% by 2030, but uses 7% less energy. However, without the contribution of energy efficiency, electrification, and behavioural change, total energy consumption is expected to be around 30% higher in 2030. According to the UN HLDE, global annual investment in energy efficiency needs to triple by 2030 to reach the target 7.3 and achieve net-zero emissions by 2050.

SDG 7.A.1 International Public Financial Flows to Developing Countries in Support of Renewable Energy

Recent Progress

In 2019, international public financial flows to developing countries in support of clean energy amounted to $10.9 billion. This was a decrease for the second year in a row across all renewable energy technologies, indicating a 25% decrease compared to $14 billion in 2018. This trend shows a contraction even before the COVID-19 crisis. Except for large fluctuations in 2016 for solar energy and in 2017 for hydropower commitments, the flows remained within the range of $10–16 billion per year since 2010. Based on a five-year moving average trend, average annual commitments decreased by 5.5% from $17.5 billion in 2014–2018 to $16.6 billion in 2015–2019 for the first time since 2008. In terms of technologies, the largest share of commitments was contributed by hydropower (26%), followed by solar (21%), wind (12%), and geothermal energy (3%) in 2019. The remaining commitments went to other renewables (37%). Regarding geographical regions, most regions observed a drop in international public flows in 2019, except Oceania, which showed an increase in the flows by 72%. The decrease was mainly focused on the following regions: Eastern and South-eastern Asia by 66.2%, Latin America and the Caribbean by 29.8%, and Central and Southern Asia by 24.5%.

Are we on track to meet the target by 2030?

A quantitative target was not specifically set for international public financial flows to developing countries. The world is not, however, on track to meet SDG 7A, if the current flows are compared with those required for an energy transition that is compliant with limiting the global temperature rise to 1.5°C. For example, according to the IEA's Net Zero Emissions by 2050 and IRENA's World Energy Transitions Outlook 2022, global investments in renewable power generation should reach $1 trillion and $1.7 trillion annually by 2030. In 2019, the financing level fell short of the SDG 7 goal, particularly for Least Developed Countries, Landlocked Developing Countries, and Small Island Developing States, although the commitments increased in each group. The current flows should thus mount up to reach the SDG 7 goal and enable other related SDGs, such as SDG 13 on climate. This international cooperative effort becomes more critical when one considers the shrunken fiscal space in many developing countries and the need for a sustainable recovery from the COVID-19 impact.

Recommendations on how to Accelerate SDG 7 Implementation

Summary

Innovative policies and technologies continue to benefit the energy sector. However, the COVID-19 pandemic and climate change have impeded progress on SDG 7 and are particularly affecting the most vulnerable countries. The pace of progress in electrification, clean cooking, and energy efficiency has been undermined; efforts in renewables have been consistent during the pandemic, although still below SDG 7 ambitions. Inequalities in access to reliable energy and health care for remote and poor areas have widened. For example, due to the COVID-19 impact on household incomes, about 90 million connected people in Asia and Africa could no longer afford basic electricity services. This situation emphasizes the significance of expanding clean energy access to help people cope with the health and environmental crises.

Under the IEA's Stated Policies Scenario, the perspective for renewables and efficiency was positive. Low oil and gas prices were usually challenging to clean energy technologies and energy efficiency. Recently, however, rising oil and gas prices in 2021 and recovery plans in key economies increased the focus on renewables and efficiency. Recent price spikes and the Ukraine crisis have also increased uncertainty in global oil and gas markets, putting pressure on net importers to reduce exposure.

In response to the pandemic, many governments have strengthened policies to support energy-related SDGs, especially in advanced economies. Additionally, the UN HLDE 2021 promoted international collaboration towards SDG 7. In this context, the SDG 7 custodian agencies encouraged the international community and policymakers to safeguard existing gains; to be aware of the need for continued action on universal access to affordable, reliable, sustainable, and modern energy; and to keep a strategic focus on the vulnerable countries. Moreover, to align with the Net Zero by 2050 and 1.5°C scenarios, more policy support for renewable integration, electrification, and decarbonization is needed. The following highlights provided further insights into measures to accelerate the implementation of SDG 7 targets.

Access to electricity

Since 2010, 1.3 billion people have been connected to power thanks to strong political commitments, better-targeted policies, disruptive technology, effective business models, and innovative financing tools. Recently, however, governments and the international community have had difficulty in accelerating the electrification progress in the context of transition to net-zero energy systems. According to the United Nations HLDE 2021, first of all, universal access to electricity should be an integral part of energy planning within governments and energy companies. Second, access should be considered as part of just energy transitions and thus be considered within the scope of socioeconomic development aid and climate commitments. Third, political commitments and financing support for access to electricity should be coordinated with those on access to clean cooking. Fourth, electrification efforts should focus on meeting the needs and aspirations of communities in terms of energy systems – aligning with their practices, affordability, and cultural contexts. Fifth, the most remote, vulnerable, and poorest populations should be given special support to ensure electricity affordability. Lastly, private-sector engagement will provide a sustainable approach to connecting the vulnerable. In addition to the strategic recommendations, the HLDE endorses actions in four building blocks: (i) reinforcing enabling policy and regulatory frameworks to attract investment; (ii) enhancing the socioeconomic inclusiveness of energy access; (iii) aligning the costs, reliability, quality, and affordability of energy services; and (iv) catalysing, harnessing, and redirecting financing for energy access.

Access to clean cooking technologies

To align with the 'leaving no one behind' paradigm, accelerating access to clean cooking is necessary to mitigate the poorest households' vulnerability to the pandemic and to enhance gender parity. National governments should speed up the recovery efforts to develop and implement regulatory and financial policies to improve the affordability and adoption of clean cooking for the most vulnerable people. This effort could be made through support from international organizations and civil society and the strong engagement of the private sector. Financial support, such as targeted affordability support, is essential to increase access to clean cooking, along with the efforts to make transitions to clean energy. Investment and decision-making for clean cooking could be achieved by acting upon reliable data on consumer preferences for, and use of, different clean cooking solutions. Policies and programmes should also address issues related to supply chains. Moreover, a multi-sectoral and coordinated effort across institutions and businesses is needed to build robust measures for the SDG 7.1 target.

Renewable energy

Accelerating the uptake of renewable energy in electricity, heat, and transport requires comprehensive, consistent, and stable policy frameworks. Such frameworks should demonstrate political commitment through clearly defined renewable energy targets and long-term strategies. Policy frameworks should also provide an effective institutional structure facilitating coordination between jurisdictions and sectors, and should ensure streamlined, clear and transparent permitting procedures. It is also essential to level the playing field for renewables, for instance by phasing out fossil fuel subsidies while ensuring adequate support to vulnerable communities. Policy strategies can rely on a mix of incentives such as subsidies or loans, which can help address the relatively high upfront costs of certain renewable technologies, regulations (e.g., bans or mandates), and information and awareness-raising campaigns. Improving data collection is also key to assessing renewable energy opportunities (e.g., heat mapping, mobility needs), improving investor visibility, and monitoring progress. Additionally, green hydrogen is emerging as a key solution for hard-to-abate sectors, and any strategy for SDG 7 should consider integrated approaches to deploying green hydrogen.

Installed renewable electricity-generating capacity in developing countries

Population growth, development patterns, and evolving lifestyles will continue to increase electricity demand in developing countries. Meeting this demand while phasing out fossil fuels will require a rapid increase in renewable power generation. Particular policy attention will need to be paid to Least Developed Countries, Landlocked Developing Countries, and Small Island Developing Countries, which are currently being left farthest behind, even within the group of developing countries. Comprehensive tailored policies and investments commensurate with the needs of developing countries, bolstered by strong international cooperation, will be essential.

Energy efficiency

Energy intensity improvements have been below the rates needed to reach the SDG 7.3 target, and the continued shortfalls bear witness to the need for advanced government policies on energy efficiency. In addition, well-designed and well-implemented energy efficiency policies can deliver a range of benefits beyond energy and emissions savings. For instance, these include improved health owing to better air quality, reduced energy bills for households and businesses, and new job creation in energy efficiency retrofits. A range of national and subnational governments have already established policies to meet their energy efficiency goals. To increase energy efficiency consistent with the IEA's Net Zero Emissions by 2050 Scenario, 20% of buildings worldwide must be retrofitted to be compatible with net-zero building codes by 2030, and all new buildings must be net-zero ready. Additionally, by 2035, all appliances and industrial electric motors sold must be best in class. To ensure this, governments have to implement a range of policies, including energy efficiency performance standards, financial incentives, market-based mechanisms, capacity-building initiatives, and regulatory measures. Digitalization can also reshape the energy landscape, improve progress in energy efficiency, and support deep decarbonization. To reach the SDG 7.3 target, energy efficiency must be prioritized in policy and investment, and existing policies need to be strengthened and expanded to other sectors.

International financial flows to developing countries in support of renewable energy

Public finance institutions and international donors play a critical role beyond direct investments in renewable assets, particularly in developing countries, where risks have led to a high cost of financing or limited project implementation. Many developing countries, especially Least Developed Countries, have struggled with mobilizing financing for energy projects. The COVID-19 crisis has only aggravated this trend. Hence, further action should be taken to ensure transformative investments for recovery in these countries, and the achievement of SDG 7 and other related climate goals. The policies and funds of public finance providers should also be aligned to create an enabling environment for private investments, establish necessary infrastructure, and mitigate perceived risks to private capital flows. In addition, funding should be used to implement policies that enable just and inclusive energy transitions, such as capacity building, retraining, or implementation of industrial policies. International collaboration should be strengthened to better channel funds to support the energy transition, as highlighted in the outcomes of the UN HLDE 2021.

SECTION 3

ADDRESSING **INTERLINKAGES**

4 QUALITY EDUCATION

5 GENDER EQUALITY

15 LIFE ON LAND

SECTION 3.1

TRACKING INTERLINKAGES BETWEEN **ENERGY AND EDUCATION (SDG 4)**

CONTRIBUTING ORGANIZATIONS:
UNICEF, SDG 7 YOUTH CONSTITUENCY

Key Messages/Summary

1. Access to affordable, reliable, and modern energy in schools critically improves the quality of, and accessibility to, education. Energy plays a key role in ensuring that school children have access to educational services such as information and communication technologies (ICTs), digital connectivity, and a comfortable learning environment with adequate heating, cooling, and lighting, and safe water. Access to quality education results in enhanced educational attainment and high completion rates, providing lifelong benefits to children.

2. There are, however, insufficient data to accurately reflect interlinkages between SDG 4 and SDG 7. Existing indicators fall short of reflecting the multidimensional nature of energy, with most data focusing solely on ***access*** to electricity in schools and failing to indicate, for example, the quality or duration of such access. This makes it difficult to confidently ascertain whether or not the presence of an electricity connection in a school is enough to provide access to effective learning and targeted educational outcomes.

3. To gain better insights into these interlinkages, increased efforts to analyse data are urgently required in order to strengthen progress tracking mechanisms.[1] For instance, for SDG 7 and SDG 4, existing data on access must be disaggregated by gender, age, usage, and also by rural or urban this will afford a more detailed and realistic reflection of the state of access to energy in schools and provide comprehensive insights into it. Where possible, the existing indicators and data sets such as UNESCO UIS, World Bank MTF, UNICEF MICS, etc. must be used and refined.

4. Moreover, an indicator that tracks the impact of incorporating sustainable energy education into school curricula is essential to provide a clear picture of children and young people being educated and skilled for the renewable energy sector.

5. Governments, development partners, civil society, and the private sector have an important role in strengthening the tracking of interlinkages. These actors must foster cooperation between ministries of education and energy in collecting and collating data and also invest in robust data collection mechanisms at the national, subnational, and local levels.

6. Finally, engaging young people in data collection and monitoring can be an effective mechanism for strengthening data systems; it can present innovative and standardized survey methods to leverage digital platforms to collect quantifiable data.

I. INTRODUCTION

Access to affordable, reliable, and modern energy services is a key enabler of quality education, health, clean water, and sanitation – social services that are essential if children and young people are to survive, grow, and thrive. Reliable energy access is fundamentally interlinked with inclusive and quality education for all. Electrification has been associated with improved educational outcomes, better learning environments, and increased opportunities for children and young people.[2] Electricity in schools increases the time students spend learning and improves children's and teachers' experience;[3] it also improves children's chances of completing their primary education.[4] Similar results have also been showcased in UNICEF's Solar in Education Programme in Sudan, where solar PV systems were installed in schools, e-learning centres, and homes, and solar-powered tablets were provided for young people to continue learning.[5]

Decentralized energy solutions also enable access to clean and safe drinking water, sanitation, and hygiene in schools, as demonstrated by UNICEF's Global Solar Water Pumping Programme. Similarly, sustainable sources of energy for cooking and heating purposes are helping to improve the health of students, educators, and other school staff.[6] In contrast, a lack of clean energy compels schools,

[1] Bhatia and Angelou, (2015). Beyond Connections: Energy Access Redefined. ESMAP Technical Report; 008/15. World Bank, Washington, DC. https://openknowledge.worldbank.org/handle/10986/24368

[2] UNDESA, (2014). Electricity and education: The benefits, barriers, and recommendations for achieving the electrification of primary and secondary schools. https://sustainabledevelopment.un.org/index.php?page=view&type=400&nr=1608&menu=35

[3] Bhatia and Angelou, (2015). Beyond Connections: Energy Access Redefined. ESMAP Technical Report; 008/15. World Bank, Washington, DC. https://openknowledge.worldbank.org/handle/10986/24368

[4] Clark, (2021). Powering Households and Empowering Women: The Gendered Effects of Electrification in sub-Saharan Africa. JPIA, Princeton University. https://jpia.princeton.edu/news/powering-households-and-empowering-women-gendered-effects-electrification-sub-saharan-africa##6

[5] UNICEF has installed solar PV systems in 114 schools in 8 states, 300 households, provided more than 2,400 solar-charged tablets for young people to use and supported 78 solar-powered e-learning centres in 3 states to meet online educational needs.

[6] UNDESA, (2021). Leveraging Energy Action for Advancing the Sustainable Development Goals. Interlinkages between Energy and Education (SDG 4). United Nations https://sdgs.un.org/sites/default/files/2021-06/2021-UN_POLICY%20BRIEFS-063021.pdf

dormitories, kitchens, and staff facilities to rely on unsustainable sources of fuel such as charcoal and kerosene for lighting, heating, and cooking purposes. This may expose students and staff to indoor air pollution, creating potential health risks, ranging from respiratory to cardiovascular diseases.

The Sustainable Development Goal – SDG 4 on quality and inclusive education for all – targets the building and upgrading of education facilities that are child-, disability-, and gender-sensitive to provide safe and effective learning environments for all. These targets include providing all schools with, among other things, access to electricity (4.a.1). Unfortunately, the world is not on track to meet this target. Globally, over 186 million children attend primary schools that have no access to electricity, a significant proportion of which are in sub-Saharan Africa – a region with some of the lowest literacy rates and lowest rankings on the Human Capital Index.[7]

Despite the importance of sustainable energy in achieving education targets, there are still challenges in terms of creating synergies, one of the most urgent being a lack of data, well-defined targets, and indicators on energy access in the education sector. Sufficient quantitative and qualitative information is needed to accurately reflect the magnitude of such challenges, drive evidence-based decision-making, and spur adequate investment to electrify the education sector.[8]

The interlinkages between SDG 7 and SDG 4 must inform more robust indicators such as those that illustrate the importance of electrification in accessing information communications technology (ICT) needed to advance digital learning and thus equalize learning opportunities. It is also essential to track the impacts of incorporating renewable energy and energy conservation into school curricula to bring about behavioural changes, such as reducing energy consumption. Education will play a vital role in building a generation with the awareness and the necessary technical skills to support a global shift towards sustainable energy.[9] Indicators that track the interplay between electrification and educational attainment, completion rates, and the disaggregation of access to education by gender will also go a long way towards informing and forecasting development trends, policies, and investment priorities.

II. MEASURING AND TRACKING ENERGY'S INTERLINKAGES WITH SDG 4

2.1 Indicators with available data

The indicators listed in this section already have initial data sets available which would allow progress on them to be tracked.

INDICATOR 1: Proportion of schools (primary/secondary) with access to electricity

- **Definition of indicator 1:**

  This indicator, developed by UNESCO, measures regularly and readily available sources of power, for example, grid/mains connection as well as decentralized sources such as wind-, hydropower-, solar-, and fuel-powered generators that enable the adequate and sustainable use of ICT infrastructure for educational purposes[10] in primary, lower-secondary, and secondary schools.

[7] World Bank, (2020). Human Capital Index (HCI) (scale 0-1) - Sub-Saharan Africa https://data.worldbank.org/indicator/HD.HCI.OVRL?locations=ZG

[8] UNDESA, (2021). Leveraging Energy Action for Advancing the Sustainable Development Goals. Interlinkages between Energy and Education (SDG 4). United Nations https://sdgs.un.org/sites/default/files/2021-06/2021-UN_POLICY%20BRIEFS-063021.pdf

[9] Generation Unlimited, Global Initiative on Decent Jobs for Youth, 2020 (Action Guide 1: Secondary Education and Skills www.generationunlimited.org/media/2951/file/Secondary%20Education%20and%20Skills.pdf

[10] UNESCO, (2021). SDG 4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. https://tcg.uis.unesco.org/wp-content/uploads/sites/4/2021/02/Metadata-4.a.1.pdf

- **Which situation does the indicator measure and what is its significance?**

  The SDG 4 Indicator 4.a.1 (Proportion of schools offering basic services by type of service) seeks to measure the proportion of schools offering basic services, by type of service; electricity is one of the essential services, as are availability of drinking water, basic sanitation facilities, access to ICT services, and more. The indicator provides the basis for the interlinkages between SDG 7 and SDG 4 by showing how many schools globally, regionally, and locally, have access to electricity on an annual basis.

- **Data availability and collection, and other potential issues:**

  According to UNESCO, the data for this indicator are acquired from administrators of cross-national assessments;[11] these are typically publicly available for download. The data are reported by ministries of education or national statistical offices and gathered through the annual UNESCO Survey of Formal Education[12] on access to electricity, drinking water, sanitation, and hand-washing facilities. Some data are also collected through the Survey on ICTs in Education[13] on access to electricity, the internet, and computers.

  Moreover, every year countries are asked to report their education data to UNESCO under the International Standard Classification of Education (ISCED). The ISCED process creates incomplete data, as some countries fail to collect and report their statistics. This has adverse implications for global and regional averages, as outliers could push the average up or down and give a less representative outcome. Fewer gaps in the data sets will make the data more practical and usable.

- **Current situation regarding the indicator (baseline):**

  According to the existing data sets available from the UNESCO Institute of Statistics[14] globally, an average of 75% of primary schools have access to electricity. However, 1 in 4 primary schoolchildren attend schools without any form of electricity – for ICT, cooking, lighting, or thermal heating and cooling. Approximately 177 million of these schools are in sub-Saharan Africa, South Asia, and Latin America. In Niger and Sierra Leone, only 5% and 14% of schools, respectively, have access to electricity.[15]

- **Suggested target for 2030 on indicator 1:**

  By 2030, ensure that all schools have access to affordable, reliable, and modern electricity.

INDICATOR 2: Access to electricity in educational facilities

- **Definition of indicator 2:**

  This indicator is part of the World Bank Multi-Tier Framework (MTF). According to ESMAP, "The framework looks at the multiple dimensions of access in households, business, and community

[11] UNESCO, (2021). Learning Assesments. UNESCO Learning Portal. https://learningportal.iiep.unesco.org/en/issue-briefs/monitor-learning/learning-assessments

[12] UNESCO, (2021). Launch of 2021 Survey of Formal Education for SDG 4 Data http://uis.unesco.org/en/news/launch-2021-survey-formal-education-sdg-4-data

[13] UNESCO, (2021). SDG 4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. https://tcg.uis.unesco.org/wp-content/uploads/sites/4/2021/02/Metadata-4.a.1.pdf

[14] UNESCO Institute for Statistics (UIS), (2021) http://data.uis.unesco.org/

[15] UNESCO, (2021). SDG 4 Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. https://tcg.uis.unesco.org/wp-content/uploads/sites/4/2021/02/Metadata-4.a.1.pdf

facilities (including educational facilities). By providing more accurate, granular, and disaggregated data on the actual services received, the MTF is gearing up to become a powerful tool for tracking SDG 7 and SE4All goals, and for informing policy and investment decisions."[16]

- **Which situation does the indicator measure and what is its significance?**

  Most available data on SDG 7 and SDG 4 measure their interlinkages in binary terms, for example, does an educational facility have electricity or not? Such methodology falls short, as it fails to capture the broader elements of energy access and benefits (capacity,[17] duration, quality and reliability, affordability, and safety). The MTF however, captures these important aspects and their impact on socioeconomic development. This methodology reveals the various bottlenecks to effective energy access, thus enabling solutions leading to enhanced energy access, higher productivity, and greater socioeconomic activity.[18]

- **Data availability and collection, and other potential issues:**

  Data are collected through surveys that are structured in various ways. For example, in Ethiopia, an Education Facility Questionnaire for Impact Evaluation and Tier Analysis[19] is conducted to collect data on all the aspects of access. Similarly, Cambodia carries out a survey,[20] but this is limited to electricity availability and source of lighting. These analyses allow data users to access detailed information that facilitates comparison over time and makes it possible to compute a weighted index of access to energy for a given geographical area.[21] This kind of framework allows differing methodologies to be used for data collection, which makes data inter-comparisons among countries difficult. Moreover, data on educational facilities are not disaggregated by gender or institutional type (primary, secondary, or higher learning facilities).[22] More surveys need to be carried out in different countries; this will strengthen data usability beyond the country level, provide for a global analysis of the broader elements of access, and thus truly reflect access by educational facilities. In addition, this kind of methodology, though holistic, it is highly complex and requires collection of large volumes of data; government institutions might not be able to afford this or could lack the human resources necessary to carry out such extensive surveys.[23]

- **Current situation regarding the indicator (baseline):**

  The World Bank MTF is currently being carried out in a few countries such as Cambodia, Ethiopia, Kenya, Myanmar, Nepal, and Niger. Only 31% of educational facilities in the surveyed countries have electricity access through an on-grid source and 9% through off-grid systems; 60% have no access to electricity.[24] In Kenya, Nepal, and Ethiopia, 72%, 49%, and only 22% of the population, respectively,

[18] Bhatia and Angelou, (2015). Beyond Connections : Energy Access Redefined. ESMAP Technical Report; 008/15. World Bank, Washington, DC. https://openknowledge.worldbank.org/handle/10986/24368

[17] The capacity of the energy supply is defined as the ability of the energy system to provide a certain amount of energy per day in order to operate the applications needed in the community institutions.

[18] Bhatia and Angelou, (2015). Beyond Connections : Energy Access Redefined. ESMAP Technical Report; 008/15. World Bank, Washington, DC. https://openknowledge.worldbank.org/handle/10986/24368

[19] World Bank, (2020). MTF Ethiopia Questionnaire Facility Education. Energy Data https://energydata.info/dataset/ethiopia-multi-tier-framework-mtf-survey-2018/resource/b9cb1e5c-f278-4e6f-88ac-b680f88984ef

[20] World Bank, (2020). MTF Cambodia Questionnaire Facility. Energy Data https://energydata.info/dataset/cambodia-multi-tier-framework-mtf-survey-2018/resource/64920785-91b3-4f16-986f-afe9cc078a52

[21] Bhatia and Angelou, (2015). Beyond Connections: Energy Access Redefined. ESMAP Technical Report; 008/15. World Bank, Washington, DC. https://openknowledge.worldbank.org/handle/10986/24368

[22] World Bank, (2020). MTF Cambodia Questionnaire Facility. Energy Data https://energydata.info/dataset/cambodia-multi-tier-framework-mtf-survey-2018/resource/64920785-91b3-4f16-986f-afe9cc078a52

[23] ESMAP, (2021). Tracking SDG 7, Access to Electricity. https://trackingsdg7.esmap.org/data/files/download-documents/02-sdg7-chapter1-accesstoelectricty_0.pdf

[24] ESMAP, (2021). Tracking SDG 7, Access to Electricity. https://trackingsdg7.esmap.org/data/files/download-documents/02-sdg7-chapter1-accesstoelectricty_0.pdf

receive national grid electricity. In Niger, only 5% of schools are electrified, of which 2% comes from the grid and 3% from off-grid solar solutions. Off-grid solar solutions also provide backup power to 86% of schools in Cambodia and 15% of schools in Kenya when grid power is unavailable, underlining the key role of off-grid as an enabler of reliable electrification of schools in developing/rural areas.[25]

- **Suggested target for 2030 on indicator 2:**
  By 2030, ensure that all educational facilities have access to modern, affordable, and reliable energy services.

2.2 Indicators currently lacking sufficient data

In addition to the indicators presented in the previous section, there are other potential indicators that could provide a fuller picture of the interlinkages between energy and SDG 4. However, data availability regarding the indicators listed in the table below are currently insufficient or there are no data available for use in tracking progress.

	Indicators	Description	Data availability and collection	Proposed Target by 2030	Current Source/ Potential Institutional Actor
A	**Proportion of girls and boys with access to electricity at school (disaggregated UNESCO data)**	This indicator will measure the gender distribution of children attending school with electricity, as this demonstrates the interlinkage of SDG 4 and SDG 7. These data could help to identify any gender disparities in access and any implications for educational outcomes.	Data are limited. UNESCO data on gender equality and energy access can, however, be interlinked.[26]	By 2030, ensure that all girls and boys have access to affordable, reliable and modern, electricity in schools.	UNICEF, UNESCO
b	**Proportion of schools with access to clean cooking facilities**	This indicator will measure the number of schools with clean cooking facilities, namely those that use affordable, reliable, sustainable, and modern energy.	Data on clean cooking are available[27,28] but not interlinked with schools. Ongoing surveys on clean cooking can expand into educational facilities.	By 2030, ensure that all primary, secondary, and higher secondary schools have access to clean cooking facilities.	UNESCO, World Bank Energy Data, and MTF

However, below are potential indicators that could be considered and would need further investigation to ascertain whether any statistical correlation exists as there are no or insufficient data available.

a) **The number of vocational and higher education institutions that integrate renewable energy and energy efficiency into their curriculum.**
This indicator will measure the availability of energy programmes in formal and non-formal education, such as universities, colleges, technical training centres, and vocational education centres. Using surveys with demographic sub-questions on the number of young people engaged

[25] ESMAP, (2021). Tracking SDG 7, Access to Electricity. https://trackingsdg7.esmap.org/data/files/download-documents/02-sdg7-chapter1-accesstoelectricty_0.pdf
[26] UNESCO Institute for Statistics global databases http://uis.unesco.org/en/topic/gender-equality-education
[27] World Bank Access to clean fuels and technologies for cooking (% of population). https://data.worldbank.org/indicator/EG.CFT.ACCS.ZS
[28] Energy Data. Access to Modern Energy Cooking Services Players and Initiatives Database https://energydata.info/cooking/initiativesand-playersdatabase/initiatives

in the programmes, the indicator could also measure the proportion of youth being educated and skilled to join the renewable energy workforce. Currently, data are not available and could be collected through surveys.

b) Proportion of primary/secondary school completion rate with access to electricity
This indicator will measure the completion rate of students enrolled in primary or secondary schools which have access to affordable, reliable, sustainable and modern energy. It will also help assess whether there is a link between students with any form of electricity access who enrol in primary and secondary schools and their rates of staying in school up to their final grades. UNICEF and UNESCO track data on school completion. This data can be interlinked with UNESCO data on access to electricity in schools.

III. TOWARDS ESTABLISHING A FRAMEWORK FOR TRACKING PROGRESS ON THE INTERLINKAGES BETWEEN ENERGY AND SDG 4

1. Establish cross-sectoral, standardized monitoring of SDG 7 and SDG 4 indicators

The lack of data and evidence on the cross-sectoral dimensions of energy and development efforts inhibits integrated action.[30] Moreover, the insufficiency of data on SDG 7 and SDG 4 can be attributed to the lack of robust data collection mechanisms in national, subnational, and local contexts. Tracking the progress of electrification efforts in education settings requires a universally applicable approach.[31] To ensure quality and that readily available data are aggregated, mutually agreed indicators and data collection methodologies that cover the wide spectrum of access and education must be urgently expanded and developed. To achieve this, multiagency and inter-ministerial efforts in collecting and collating data on the interlinkages must be prioritized. Energy and education ministries must invest in data collection and monitoring. Development partners, the private sector, and civil society should also rally round to collectively shape a linked energy and development agenda to facilitate attainment of the SDGs.[32]

2. Disaggregate and expand existing data sets on SDG 7 and SDG 4 data

It is recommended that energy access data be disaggregated. This can be by gender, age, usage of electricity (lighting, thermal heating/cooling, cooking, water supply/purification etc.) by urban and rural areas, as well as by different educational levels and private/public educational facilities, whenever possible. In general, single dimension figures for rates of access to electricity are often insufficient to realistically reflect the state of access. Wherever possible, the MTF of ESMAP should be used to evaluate energy access. Furthermore, existing data sets and data collection systems already in place, such as the UNESCO UIS data, UNICEF DATA, UNICEF Multiple Indicator Cluster Surveys (MICS), and WHO/UNICEF Joint Monitoring Programme (JMP), should be refined or expanded. For example, it could be useful to add survey questions on schools' energy access to ensure that data on the interlinkages are readily available.

[29] Percentage of a cohort of children or young people aged 3-5 years above the intended age for the last grade of each level of education who have completed that grade (UNESCO, 2022)

[30] Ordano, (2020). Linking Electricity Access and Development Outcomes in Africa: A Framework for Action. World Resources Institute. http://www.indiaenvironmentportal.org.in/files/file/linking-electricity-access-developement-outcomes-africa.pdf

[31] ESMAP, (2021). Tracking SDG 7, Access to Electricity. https://trackingsdg7.esmap.org/data/files/download-documents/02-sdg7-chapter1-accesstoelectricty_0.pdf

[32] Ordano, (2020). Linking Electricity Access and Development Outcomes in Africa: A Framework for Action. World Resources Institute. http://www.indiaenvironmentportal.org.in/files/file/linking-electricity-access-developement-outcomes-africa.pdf

3. Engaging young people in data monitoring

Young people can play a key role in the collection and monitoring of energy and education data. Identifying ways for young people to champion the development of accurate and up-to-date statistics creates opportunities for youth to participate in the issues that affect them the most, in the process strengthening data systems and promoting social change.[33] Due to the complexity of collating data in existing frameworks such as the MTF, governments may wish to consider leveraging innovative and standardized methods of conducting surveys, for example, by making use of the UNICEF U-Report platform which collects quantifiable data on specific areas impacting children and young people in real time using social media messaging and text-based platforms. In that way, young people can report on energy access and reliability in the sectors that affect them the most, like their schools, bringing innovation and efficiency to an otherwise traditional way of conducting surveys and data collection.

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SECTION 3.2

ADDRESSING INTERLINKAGES **BETWEEN ENERGY AND GENDER EQUALITY (SDG 5)**

CONTRIBUTING ORGANIZATIONS:

CONTRIBUTING ORGANIZATIONS: ENERGIA INTERNATIONAL NETWORK ON GENDER AND SUSTAINABLE ENERGY, MINISTRY OF FOREIGN AFFAIRS OF THE NETHERLANDS, WORLD BANK, INTERNATIONAL INSTITUTE FOR APPLIED SYSTEMS ANALYSIS (IIASA), OXFORD POVERTY AND HUMAN DEVELOPMENT INITIATIVE (OPHI), UNITED NATIONS STATISTICS DIVISION (UNSD), UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION FOR WESTERN ASIA (UN ESCWA), UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC (UN ESCAP), INTERNATIONAL RENEWABLE ENERGY AGENCY (IRENA), UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION (UNIDO), INTERNATIONAL FINANCE COOPERATION (IFC), UN WOMEN, CLEAN COOKING ALLIANCE, BABSON COLLEGE.

Key Messages/Summary

Access to affordable, sustainable, and clean energy is a precondition for the achievement of Sustainable Development Goal (SDG) 5 on gender equality and SDG 7 on energy. SDG 7 is one of only six out of the seventeen SDGs with no gender-specific indicators, according to UN Women. Yet gender inequalities in energy are substantial in four key areas where progress made in closing gaps needs to be measured:

1) Access to electricity and clean cooking fuels and technology;

2) Employment and leadership, both managerial and political;

3) Energy entrepreneurship and productive uses of energy; and

4) The enabling environment for energy planning, policy, budgeting, and regulation.

Taking into account data availability at national level globally, three indicators with promising available data are presently proposed for interlinkages between SDG 7 and SDG 5, highlighting gender gaps under themes 1) and 4):

- Proportion of population with access to electricity, disaggregated by female-headed and male-headed households (aligned with indicator SDG 7.1.1)
- Proportion of population with primary reliance on clean cooking fuels and technology, disaggregated by female-headed and male-headed households (aligned with indicator SDG 7.1.2)
- Whether or not national energy policies and frameworks are in place that promote, enforce, and monitor equality and non-discrimination on the basis of sex (aligned with indicator SDG 5.1.1)

Gender indicators are only beginning to be developed and measured for the energy sector, and initial data sets for tracking progress are patchy. Data availability is a continuum, with all gender indicators proposed here lacking to a greater or lesser extent. ***This dearth of gender data and lack of consistency in data collection is a serious issue that needs to be brought to the attention of the energy sector.***

It is urgent that data collection and analysis be improved to ***include indicators for theme 2) Employment and leadership (managerial and political) and theme 3) Entrepreneurship (energy entrepreneurs and productive uses),*** as well as to be able to include other key indicators under theme 1) Energy poverty/ access and theme 4) Enabling environment. Table 1 identifies a number of gender and energy indicators with some data, aligned with specific SDG targets.

Key partners for the way forward on each indicator are identified in Table 1, which provides a possible framework for the establishment of a platform and partnerships to collect and expand data on gender and energy. ***A Technical Working Group on Gender and Energy Interlinkages*** comprising key partners, shown in Table 1, could undertake to prioritize further indicators and areas for coordination on data collection on gender and energy. It should also identify next steps in methodology development and refinement of indicators, political buy-in for the indicators, and communication to governments and other stakeholders on the urgency of data collection on gender and energy, as well as progress reporting on an annual basis. Making women visible in sustainable energy and highlighting the importance of expanding the gender lens on energy data collection can focus data on key gender gaps in the energy sector and on ways of better achieving gender equality in the energy sector.

I. INTRODUCTION

Gender equality and the empowerment of all women and girls are universal goals in their own right, as explicitly set out in SDG 5 in the United Nations Agenda 2030 for Sustainable Development, the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW), and the 1995 Beijing Declaration and Platform of Action. Access to affordable, sustainable, and clean energy is a precondition for the achievement of SDG 5 on gender equality and the empowerment of all women and girls. The UN Resolution adopted during the High Level Dialogue in 2021 recognized that sustainable energy access and its deployment can be both improved and accelerated by gender equality and the empowerment of all women and girls; the Resolution called upon governments, the United Nations development system, and other stakeholders to take actions to mainstream gender equality in policies and programmes.[34] SDG 7 is one of only six out of the seventeen SDGs with no gender-specific indicators, according to UN Women.[35] Yet gender inequalities in energy are substantial in four key areas where progress in closing gaps needs to be measured:

1) Unequal **Energy access** disproportionately affects women due to their gender roles and responsibilities, via time spent in domestic chores and unpaid care; this limits access to education and employment, increases women's exposure to health risks especially indoor air pollution, thus degrading their well-being, excludes them from new digital technologies that are prerequisites for decent employment and cultural and political engagement, and lowers productivity in their businesses and farms.[36] These factors could ultimately affect women's reproductive choices, and hence demographics and even future carbon emissions.[37] Multiple studies show that women are 9 to 23 percentage points more likely to gain employment outside the home following electrification.[38]

2) A "just transition" should guarantee equal opportunities for both women and men in the work force in **Employment and leadership**, where gender diversity has been shown to deliver both higher effectiveness and better financial performance. Access to quality jobs and to finance are key levers of change and empowerment for women and their families. In renewable energy, less than a third of jobs overall and only 22% of technical jobs are estimated to be held by women,[39] and in the power sector, women's share in employment in utilities may be even lower.[40] At least 30% female leadership in firms is linked with profit margins of up to six percentage points higher than in firms with no women in the top ranks.[41] Companies with women in their management tend to invest more in sustainability, are more energy-efficient, and more environmentally sustainable.[42]

3) **Entrepreneurship** is a critical vector for women's empowerment, and women entrepreneurs are the source of many innovations to mitigate climate change. Through their businesses, women entrepreneurs (often heads of households) provide income for food, healthcare, and children's education. Energy access plays a critical role in diversifying women's livelihoods through productive uses that increase income and can reduce poverty. Women entrepreneurs can also improve the effectiveness of the energy supply chain by fast-tracking the last-mile

[34] www.un.org/ga/search/view_doc.asp?symbol=A/RES/74/225&Lang=E
[35] www.unwomen.org/sites/default/files/Headquarters/Attachments/Sections/Library/Publications/2020/Progress-on-the-Sustainable-Development-Goals-The-gender-snapshot-2020-en.pdf
[36] www.unwomen.org/sites/default/files/Headquarters/Attachments/Sections/Library/Publications/2020/Progress-on-the-Sustainable-Development-Goals-The-gender-snapshot-2020-en.pdf
[37] www.nature.com/articles/s41893-021-00830-3
[38] https://esmap.org/closing_the_gender_gap#:~:text=During%20fiscal%20year%202020%2C%20ESMAP,and%20continue%20building%20partnerships%20to
[39] www.irena.org/publications/2019/Jan/Renewable-Energy-A-Gender-Perspective
[40] www.energyeconomicgrowth.org/publication/closing-gaps-womens-employment-energy-sector
[41] www.esmap.org/closing_the_gender_gap
[42] https://climatechampions.unfccc.int/why-female-leadership-is-crucial-to-tackling-climate-change-and-other-crises/

distribution of renewable energy technologies, due to their unique ability to connect with their customers; they can also increase awareness in their communities and deliver products and services through untapped social networks.[43] Globally, women represent one in three growth-oriented entrepreneurs across all sectors, yet receive less than 3% of equity financing.[44] Female entrepreneurs face more barriers to business success than men, and these need to be overcome: restricted mobility, social and cultural norms, and most important, difficulties in accessing both formal and informal credit, partly due to low asset ownership, lack of access to networks, and gender bias.

4) The **Enabling environment** for women's participation in the energy sector includes gender-responsiveness in energy planning, policymaking, regulation, and tracking and monitoring of progress. Yet energy policies and planning are often gender-blind and lack a gender perspective. Women are under-represented in energy decision-making processes, gender-disaggregated data and information are sparse, and policymakers and practitioners lack awareness with respect to gender dimensions. Gender inequality can be further exacerbated by national energy policies, regulations, and subsidies, due to women's differing labour-market and mobility patterns, as well as the difficulties they encounter in accessing subsidies and credit, especially in the informal sector. For example, fossil fuel production subsidies have largely been directed at industry and transport rather than cooking fuels and tend to be regressive. Although in 2018, $1.9 trillion was invested in electrification globally,[45] interventions and investment to address gender gaps in the sector remain minimal.

Since 2018, the SDG7 Policy Briefs developed by the SDG7 Technical Advisory Group have informed the High-level Political Forum (HLPF) and related intergovernmental discussions by providing substantive inputs prepared though inclusive multi-stakeholder consultations, including on gender. In 2021, a number of gender indicators were proposed in the theme reports on energy access and on enabling the SDGs through inclusive, just energy transitions,[46,47] and also in the High-Level Dialogue on Energy Global Roadmap for universal energy access and energy transition. The present policy brief is one of a series that will further discuss energy's interlinkages with all the SDGs; the objectives are to arrive at a set of solid indicators for measuring interlinkages of SDG 7 with all other SDGs, as well as to gather the data required to assess progress on these indicators. This brief focuses on indicators for SDG 5, which will be among those discussed at the HLPF 2022. The aim is to complement the official SDG indicators that are Goal-aligned, thereby presenting additional tools for policymakers in ways that are fit for purpose in differing circumstances.

II. MEASURING AND TRACKING ENERGY'S INTERLINKAGES WITH SDG 5

Given the lack of data, only three indicators with available data are proposed at present for interlinkages between SDG 7 and SDG5: highlighting gender gaps under theme 1) Energy access, by disaggregating electricity and cooking energy access by female- and male-headed households; and under theme 4) Enabling environment, by determining whether national energy policies and frameworks including

[43] www.energia.org/assets/2019/01/Supporting-Last-Mile-Women-Entrepreneurs.pdf
[44] www.gemconsortium.org/reports/womens-entrepreneurship
[45] www.iea.org/reports/world-energy-investment-2018
[46] www.un.org/en/hlde-2021/page/technical-working-group-1-energy-access
[47] www.un.org/en/hlde-2021/page/technical-working-group-3-enabling-sdgs-through-inclusive-just-energy-transitions

gender are in place. The three proposed indicators with available data are presented below, with their definition, situation and significance, data availability and collection, current situation (baseline), and suggested target for 2030.

2.1. Electricity access by female-headed and male-headed households

Definition of recommended indicator 2.1: Proportion of population with access to electricity, disaggregated by female-headed and male-headed households.

Situation measured and its significance: Access to electricity addresses critical issues in all the dimensions of sustainable development. It has a wide range of social economic impacts, including, for both women and men, facilitating development of income-generating activities, lightening the burden of household tasks, and enabling the building of social and human capital through education and information. Male-headed and female-headed households have differential access to electricity in many countries; and women can encounter more obstacles than men in obtaining connections. Progress on this indicator would be essential to achieving the SDG 7 target on universal access to energy as well as contributing to SDG 5 on gender equality.

Data availability and collection, and other potential issues: *This indicator is aligned with indicator SDG 7.1.1: Proportion of population with access to electricity, disaggregated by total, urban and rural access rates per country, as well as by UN regional and global classifications.* Country-level data are available for household access to electricity.[48] The custodian for SDG 7.1.1, the World Bank, does not currently have access to all the raw data to be able to disaggregate this indicator by gender of household head; however, it may be possible to make an estimation. Other possible data sources include The Global Multidimensional Poverty Index (MPI), an international measure developed by the Oxford Poverty and Human Development Initiative (OPHI) and covering over 100 developing countries through national Demographic and Health Surveys (DHS), Multiple Indicator Cluster Surveys (MICSs), and other surveys.[49] The Multi-Tier Framework (MTF) initiative launched by the Energy Sector Management Assistance Program (ESMAP) (World Bank) in 2015 is also a potential source. It collects a comprehensive set of data at the country level to redefine the way energy access is measured, going beyond the traditional binary measure of "connected or not connected" for electricity access. The MTF can provide information at country level on electricity access by male-headed and female-headed households for 14 countries to date and a total of 21 countries if ongoing work is included.[50] A comparison of the data from the

[48] The SDG 7 definition currently considers that access exists if the primary source of lighting is the local electricity provider, solar systems, mini-grids, and stand-alone systems. Sources such as generators, candles, batteries, etc. are not considered as access because of their limited working capacities and their usual role as backup sources for lighting.

[49] The Global Multidimensional Poverty Index, an international measure developed by the Oxford Poverty and Human Development Initiative (OPHI) and covering over 100 developing countries through DHS, MICSs, and other surveys, could calculate the percentage of total population by gender of household head who are deprived of electricity; the percentage and number of women/men living with/without electricity, extrapolating from demographic and household electricity access data, can also be provided. Rural/urban dimension could also be disaggregated. These data can also be aggregated at regional and global levels by OPHI (OPHI Global MPI data tables 2021, in particular Table 7.5). Electricity deprivation is defined in the Multidimensional Poverty Index (MPI) as: "…electricity variable in the data included additional categories, going beyond the usual question on 'Does your household have electricity' that is limited to the 'yes' or 'no' categories. Households with access to electricity were further probed on whether they were 'interconnected to the grid' or 'off-grid with generator or isolated system. For the purpose of the global MPI, we identified households on the electricity grid and households that were powered by alternative sources of energy as non-deprived" Alkire et al., 2021, p. 11.

[50] The Multi-Tier Framework (MTF) defines electricity access based on a combination of seven attributes of energy across six tiers of access with minimum requirements by tier of electricity access. These seven attributes are: (i) capacity, (ii) duration (including daily supply and evening supply), (iii) reliability, (iv) quality, (v) affordability, (vi) legality, and (vii) health and safety. Data can be disaggregated by these parameters and by rural/urban. MTF surveys are not repeated every year but the latest survey is used. Plans are to add countries to the MTF each year.

MPI with that for the 21 countries where the MTF has been carried out could be useful in terms of establishing validity and whether the general surveys used by the MPI can be used as proxies for the more detailed electricity access information being collected by the MTF.

Current situation regarding the indicator baseline: Electricity access rates for male- and female-headed households in a sample of countries were presented in the 2018 and 2019 Tracking SDG7 reports. In 2018, 31% of female-headed household were electrified in the sample countries. In 2019, baselines for electricity access from the sample countries ranged from 100% of urban and 70% of rural female-headed household in Bangladesh to 65% urban and 7% rural female-headed household access in Rwanda.[51] Baselines collected by the MTF are available in some country reports, for example 21.1% access by female-headed households in Rwanda in 2018.[52] For the MPI, baselines for electricity deprivation by female-headed households range from 98% in South Sudan in 2010 to 0% in Jordan and Albania in 2018, with information on a total of 109 countries available.

Suggested target for 2030 for indicator 2.1: Proportion of female-headed households with access to electricity is equal to the proportion of male-headed households with access to electricity.

2.2 Clean cooking energy access by female-headed and male-headed households

Definition of recommended indicator 2.2: Proportion of population with primary reliance on clean fuels and technology, disaggregated by female-headed and male-headed households.

Situation measured and its significance: This indicator is aligned with Indicator 7.1.2: Proportion of population with primary reliance on clean fuels and technology (%). The lack of clean cooking fuels and technology, which leads to the use of polluting fuels, contributes to climate change. It is a major health hazard, affecting mostly women and girls, and diminishes their ability to engage in productive activities. Globally, around 3 billion people cook using polluting open fires or simple stoves fuelled by kerosene, biomass, or coal. Women exposed to high levels of indoor smoke are more than twice as likely to suffer from chronic obstructive pulmonary disease than women who use cleaner fuels and technologies.[53] The use of inefficient fuels for cooking alone is estimated to cause over 4 million deaths annually, mainly among women and children. Burns from cooking are common with traditional fuels and appliances, and physical ailments, injury, and gender-based violence (GBV) are associated with fuelwood collection. These adverse impacts can be avoided by adopting clean fuels and technologies for cooking and heating. Time spent in collecting, preparing, and using inefficient fuels is a labour and drudgery burden on women and young girls and a drag on their ability to participate in productive, leisure, and family care as well as in educational, social and political activities. There may be a gender gap in access to, and interest in, clean fuels and technology between male-headed and female-headed households in a number of countries.

Data availability and collection, and other potential issues: SDG Indicator 7.1.2 now defines "clean" with reference to the emission rate targets and specific fuel recommendations (i.e., against unprocessed coal and kerosene) included in the WHO guidelines for indoor air quality: household fuel combustion

[51] https://trackingsdg7.esmap.org/data/files/download-documents/chapter_1_access_to_electricity_rev030320.pdf https://trackingsdg7.esmap.org/data/files/download-documents/chapter_2_electrification.pdf.

[52] https://energydata.info/dataset/rwanda-multi-tier-framework-mtf-survey-2018/resource/cdbda5af-176a-4a6c-aabb-40a8df7a3723 p. 16

[53] www.unwomen.org/sites/default/files/Headquarters/Attachments/Sections/Library/Publications/2020/Progress-on-the-Sustainable-Development-Goals-The-gender-snapshot-2020-en.pdf

rather than use of solid fuels.[54] WHO, the custodian for SDG 7.1.2, believes that the extrapolation of demographic data would make it possible to estimate the disaggregation of this indicator by female- and male-headed households. Other potential data sources are the Global Multidimensional Poverty Index (MPI)[55] and the Multi-Tier Framework (MTF),[56] with more detailed information for 21 countries. A comparison of the data from the MPI with those for the 21 countries where the MTF has been carried out, would be useful for establishing validity and looking at whether the general surveys used by the MPI can be used as proxies for the more detailed clean cooking access information being collected by the MTF.

A financial indicator of the gender gap in clean cooking, such as "annual tracked commitments to clean cooking" or the "cost of inaction" could also be considered to measure gender bias in investments in the energy sector. An indicator on "Cost of Inaction" on cooking energy access has been calculated in a recent World Bank/Modern Energy Cooking Services (MECS) study.[57] The Clean Cooking Alliance (CCA) also prepares an annual Industry Snapshot based on a survey in order to attract investment, R&D, and revenue data.[58]

Current situation regarding the indicator baseline: Headship-disaggregation for primary reliance on clean fuels and technology for the 21 MTF countries is available, but cannot yet be accessed online. For the MPI, baselines for being "deprived" of clean cooking fuel by female-headed households range from more than 99% in Burundi in 2017 to 0% in Iraq in 2018, with a total of 109 countries available. The gender annual cost of inaction (negative externalities) for not meeting the clean cooking target under SDG7 are estimated at US$0.8 trillion annually.[59]

[54] New evidence-based normative guidance from the WHO (i.e., WHO Guidelines for indoor air quality guidelines: household fuel combustion), highlights the importance of assessing both fuels and the technologies individually in order to adequately protect public health. These guidelines provide technical recommendations in the form of emissions targets for which fuels and technology (combinations) (stove, lamp, and so on) in the home are clean. These guidelines also recommend against the use of unprocessed coal and discourage the use of kerosene (a non-solid but highly polluting fuel) in the home. They also recommend that all major household energy end uses (e.g., cooking, space heating, lighting) use efficient fuels and technology combinations to ensure health benefits. For this reason, the technical recommendations in the WHO guidelines, access to modern cooking solutions in the home, will be defined as "access to clean fuels and technologies" rather than "access to non-solid fuels." This shift will help ensure that health and other "nexus" benefits are better counted, and thus realized. https://unstats.un.org/sdgs/metadata/files/Metadata-07-01-02.pdf

[55] The MPI (ref. 2.1.1 above) could calculate the percentage of total population by gender of household head that are deprived of clean cooking fuels. Cooking-energy deprivation is defined in the MPI as: a household cook using solid fuel, such as dung, agricultural crop, shrubs, wood, charcoal, or coal. This data can also be aggregated at regional and global levels by OPHI. We note that fuel stacking may be an issue if this question refers not to primary fuel use but to any solid fuel use. Moreover, the MPI definition of "deprived" with respect to the use of solid fuels, no longer corresponds to the SDG 7 indicator definition of "clean" fuels under WHO guidance.

[56] The MTF (ref. 2.1.1 above) could provide information on energy access for clean cooking by male-headed and female-headed households for 14 countries to date and a total of 21 countries if ongoing work is included. MTF surveys are not repeated every year, but the latest survey is used. Data can also be disaggregated by rural/urban and other parameters of availability (hours/day), affordability, and reliability. Plans are to gradually add countries to the MTF each year. Cooking-energy access is defined by the MTF and measured by six attributes: Cooking Exposure, Cookstove Efficiency, Convenience, Safety of Primary Cookstove, Affordability, and Fuel Availability, categorized into a 5-Tier system. https://openknowledge.worldbank.org/handle/10986/18677

[57] From time spent in cooking and fuel collection, an indicator on "Cost of Inaction" on cooking-energy access has been calculated in a recent World Bank/MECS study. The "Cost of Inaction" equals the annual dollar value of sustaining the status quo (i.e., continuing to cook with the latest available global fuel mix) on gender: the gender calculation follows a bottom-up approach. A factor multiple for time spent on fuel collection, cooking, and stove cleaning is applied to each country's primary-fuel proportion, using fuel-mix data; each factor multiple varies by primary fuel, and all add up to a number of hours per year. This value is then multiplied by the cost of a woman's time, which is set at a conservative estimate of $0.54 per hour. The gender annual cost of inaction (negative externalities) for not meeting the clean cooking target under SDG 7 are estimated at $0.8 trillion annually, assuming that women may spend up to six hours per day performing cooking-related tasks, including fuel collection, cooking, and stove cleaning. www.seforall.org/system/files/2021-10/EF-2021-UL-SEforALL.pdf; https://documents1.worldbank.org/curated/en/937141600195758792/pdf/The-State-of-Access-to-Modern-Energy-Cooking-Services.pdf

[58] The Clean Cooking Alliance (CCA) prepares an annual Industry Snapshot based on the use of a survey created by CCA's Monitoring and Evaluation and Market Strengthening teams in order to capture investment, R&D, and revenue data. This report was previously produced every few years, and will now be produced annually. The 2021 report shows that investment in for-profit clean cooking companies has been increasing; currently $70 million has been raised by 25 clean cooking companies tracked by CCA, out of the total estimated $11 billion in private-sector funding required annually to achieve universal access to modern energy cooking services by 2030. https://cleancooking.org/wp-content/uploads/2021/07/620-1-1.pdf

[59] www.seforall.org/system/files/2021-10/EF-2021-UL-SEforALL.pdf; https://documents1.worldbank.org/curated/en/937141600195758792/pdf/The-State-of-Access-to-Modern-Energy-Cooking-Services.pdf

Suggested target for 2030 for indicator 2.2: The proportion of female-headed households with primary reliance on clean fuels and technology is equal to the proportion of male-headed households with primary reliance on clean fuels and technology.

2.3 Gender in national, regional, and international energy policies and frameworks

Definition of recommended indicator 2.3: Whether or not national, regional, and international energy policies and frameworks are in place that promote, enforce, and monitor equality and non-discrimination on the basis of sex.

Situation measured, and its significance: This indicator is aligned with indicator SDG 5.1.1 which monitors whether or not legal frameworks are in place to promote, enforce, and monitor equality and non-discrimination on the basis of sex and with indicator SDG 5, and the proportion of countries with systems to track and make public allocations for gender equality and women's empowerment. Energy policies are not gender-neutral, yet despite progress, many national energy policies are not yet gender-responsive. Removing discriminatory policies and putting in place policies that promote gender equality are a prerequisite for ending discrimination against women and girls and advancing women's empowerment in the energy sector, and for achieving universal access to modern energy. Most indicators that have been proposed to monitor gender-related targets in SDGs focus on outcomes. Focusing on policies and frameworks complements the outcome indicators proposed under other gender-related targets.

Data availability and collection, and other potential issues: The overarching nature of this indicator makes it likely that the extent to which national energy policies are informed by gender, rather than being binary, may cover a range of categories. An International Union for Conservation of Nature (IUCN)/ ENERGIA study in 2017 assessed a sample of 192 national energy frameworks from 137 countries to understand the ways in which countries were developing gender-responsive energy sector frameworks. The study determined whether and how often gender equality and women's participation discussed in energy frameworks by counting mentions of gender-related keywords in each framework. Keywords were analysed for context to identify how gender had been characterized in each framework.[60]

Starting in 2022, the RISE database of ESMAP has been collecting a comprehensive set of gender–energy indicators that are relevant to gender roles in energy access, clean energy, and overall female participation in the energy sector, for 140 countries worldwide, including all OECD countries and 113 developing countries. The RISE indicators comprise a wide range of qualitative and quantitative data points that provide good insights into a given country's energy sector regulations with respect to gender roles and participation. Data will be verified and available for circulation as part of the RISE 2022 edition to be released in November 2022. Data points that could be used to measure the indicator proposed here include: "Has a national gender audit been conducted? " and "Is gender equality or a commitment to gender mainstreaming a guiding principle within energy frameworks?"

There are a number of global databases that collect national-level information on laws that promote gender equality, for example the World Bank's Women Business and the Law database and the Social Institutions and Gender Index (SIGI) of the Organisation for Economic Co-operation and Development (OECD). A Committee also monitors CEDAW implementation based on country reports. These could be examined for laws and policies relating to the energy sector, such as restrictions on women's employment as electricians.

[60] www.usaid.gov/sites/default/files/documents/1865/iucn-egi-energizing-equality-web.pdf

Examining how energy informs national gender policies could also be relevant. National gender policies usually include infrastructure and energy and specific actions, with lines of action for each sector, including energy, how to close gaps, focal points in ministries, human resources, etc.

Current situation regarding the indicator baseline: The 2017 IUCN report cited above found that nearly one-third of the national energy frameworks include gender considerations to some extent.[61]

Suggested target for 2030 for indicator 2.3:

- **At national level, whether or not national energy policies and frameworks are in place that promote, enforce, and monitor equality and non-discrimination on the basis of sex;**

- **At global level, 100% of national energy frameworks are informed by gender.**

III. WAY FORWARD TOWARDS ESTABLISHING A FRAMEWORK FOR TRACKING PROGRESS ON THE INTERLINKAGES BETWEEN ENERGY AND SDG 5

Gender indicators are only beginning to be developed and measured for the energy sector, and initial data sets for tracking progress are patchy. Data availability is a continuum, with all gender indicators proposed here lacking to a greater or lesser extent. ***This dearth of gender data and lack of consistency in data collection is a serious issue that needs to be brought to the attention of the energy sector.*** It is urgent that data collection and analysis be improved to ***include indicators for theme 2) Employment and leadership (managerial and political) and theme 3) Entrepreneurship (energy entrepreneurs and productive uses)***, and also to be able to include other key indicators under themes 1) Energy poverty/access and 4) Enabling environment. Table 1 identifies a number of possible further gender and energy indicators with some data being aligned with specific SDG targets.

Key partners for the way forward on each indicator are identified in Table 1, which provides a possible framework for the establishment of a platform and partnerships to collect and expand data on gender and energy. A ***Technical Working Group on Gender and Energy Interlinkages***, comprising key partners in Table 1, could undertake to prioritize further indicators and areas for coordination on data collection on gender and energy. It should also identify next steps in methodology development and refinement of indicators, political buy-in for the indicators, and communication to governments and other stakeholders on the urgency of data collection on gender and energy, as well as progress on an annual basis. Making women visible in sustainable energy and highlighting the importance of expanding the gender lens on energy data collection can focus data on key gender gaps in the energy sector and on how to better achieve gender equality in the energy sector.

[54] www.usaid.gov/sites/default/files/documents/1865/iucn-egi-energizing-equality-web.pdf

Table 1: Proposed and Possible Further Indicators for SDG 7/SDG 5 Interlinkages			
	Definition	**Key partners**	**Aligns with**
2.1	Proposed indicators with available data		
2.1.1	*Proportion of population with access to electricity, disaggregated by female-headed and male-headed households.*	World Bank, MTF, OPHI	SDG 7.1.1
2.1.2	*Proportion of population with primary reliance on clean fuels and technology, disaggregated by female-headed and male-headed households.*	WHO, MTF, OPHI	SDG 7.1.2
2.1.3	*Whether or not national, regional, and international energy policies and frameworks are in place that promote, enforce, and monitor equality and non-discrimination on the basis of sex.*	RISE/World Bank, UN Women	SDG 5.1.1 SDG 5.C.1
2.2	Other indicators with some available data		
	For Energy Poverty/Access gender gap:		
	A financial target such as "Annual tracked commitments to clean cooking" or the "cost of inaction" on cooking energy	Clean Cooking Alliance	SDG 7.1.2
	Proportion of time spent on fuel collection and cooking by men and women	MTF, RISE	SDG 5.4
	Proportion of households with lighting in kitchen/access to electrical appliances and end-uses that reduce unpaid care work	MTF, CLASP	SDG 7.1.1 SDG 5.4
	Proportion of educational facilities with adequate electricity/clean cooking, by boys'/girls' schools	UNESCO, MTF	SDG 4
	Mortality rate attributed to household and ambient air pollution, age-standardized, female (per 100,000 female population) (Indicator SDG 3.9.1)	WHO	SDG 3.9.1
	For Employment and Leadership gender gap:		
	Proportion (%) of women employed in the energy value chain for technical and administrative jobs related to the energy/renewable energy sector	IFC, ILO, IRENA, ESMAP, RISE/World Bank, IEA, UN Women	SDG 7.2 SDG 8
	Proportion of women in managerial positions and proportion of women in senior and middle management positions in the energy sector	ILO, IRENA, ESMAP, RISE, OECD/IEA, UN Women	SDG 5.5.2
	Proportion of women in senior political positions in relevant ministries, national energy agencies and entities	IRENA, RISE, IEA, UN Women, Clean Energy Ministerial	SDG 5.5.2
	For Entrepreneurship gender gap:		
	Proportion of male and female-owned businesses with electricity connections	UNIDO, UN Women	SDG 8
	Proportion of women and men energy owners/managers of established energy businesses	Global Economic Monitor/World Bank, IFC, UNIDO, UN Women	SDG 8
2.3.3	*Proportion of finance available for women-led and men-led energy businesses*	IFC, UNIDO, UN Women	SDG 8
2.4	For Enabling Environment gender gap:		
2.4.2	*Tracking systems and budget allocations for gender equality in the energy sector*	RISE/World Bank, UN Women, OECD/DAC	SDG 5.C.1

Key to new acronyms: Collaborative Labeling and Appliance Standards Program (CLASP); The United Nations Educational, Scientific and Cultural Organization (UNESCO); International Finance Corporation (IFC); International Labour Organization (ILO); International Renewable Energy Agency (IRENA); International Energy Agency (IEA); Development Assistance Committee (DAC).

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SECTION 3.3

ADDRESSING INTERLINKAGES **BETWEEN LIFE ON LAND (SDG 15)**

CONTRIBUTING ORGANIZATIONS:
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS (FAO)[62]

Key Messages/Summary

It is challenging to define appropriate and valid indicators that can be systematically and universally applied as part of a reliable tracking system for understanding interlinkages between renewable energy (RE) and land systems. The complexity of human–land interactions means that there is no static set of standards to be applicable across time, place, and scales (local to global); nor should we expect one. Identifying appropriate indicators must involve the diversity of stakeholders affected by renewable energy transitions. A cost-effective and fair tracking system on RE–land system interlinkages should be context-specific and thus designed and implemented by local land users and other relevant stakeholders through a participatory decision-making process.

A stepwise, stakeholder-led, adaptive process (Annex 2 of this Policy Brief) is recommended to examine four dimensions of RE–land system interlinkages: sustainable natural resources management, efficient use of land and biomass resources, good governance of land systems, and impacts on land users' wellbeing. As illustrated in Annex 2, adequate monitoring of the four dimensions may require thirteen or more indicators. As monitoring requires resources,

[62] Olivier Dubois (FAO), with special contributions from Keith L. Kline (ORNL), Jeremy Woods (Imperial College), Rocio Diaz Chavez (Imperial College), Göran Berndes (Chalmers University), Uwe Fritsche (IINAS), and Annette Cowie (NSW DPI/UNE)

selecting indicators that are a high priority to stakeholders is important: such indicators not only provide incentives for engagement in the process but also facilitate data collection, reporting, understanding, and socially acceptable results.

If resources required for a stakeholder-led, adaptive process are unavailable, a 'fast track' or hybrid approach could be adopted which begins with a pre-set list of common indicators. Reliance on such a list without appropriate engagement with, and adaptation by, stakeholders, may result in measurements that omit key local variables or that fail to provide timely and useful data for taking corrective and adaptive management actions. While acknowledging these limitations, a pre-set list of indicators is provided in Section II. This list could be used as a first step towards a more valid and acceptable stakeholder-led approach for developing a tracking system of RE–land systems links.

The following recommendations aim to support improved tracking of links between SDG7 and SDG 15:

- Do not assume that a fast-track approach based on a pre-defined set of indicators will be the best choice for providing relevant information. Investing in stakeholder engagement can result in more useful, valid, and reliable indicators of pertinent changes in local conditions (see Annex 2);
- Research and guidance are needed to improve the consistency, practicality, and utility of existing indicators (see Section 2.1);
- Clear, replicable assessment methods and standards for reporting that assure transparency are required for several aspects of RE–land interactions including life-cycle assessments, documenting the most likely future conditions under different RE deployment scenarios, and consistent carbon and greenhouse gas (GHG) accounting over time, while giving due consideration to heterogeneous and dynamic land and economic systems;
- Whatever the approach chosen, best practices for stakeholder engagement and citizen science should be applied as complementary and cost-effective mechanisms to prioritize indicators, collect data, monitor change, and interpret results [12,13];
- Consider employing proxy indicators for RE–land interlinkages (e.g., the degree of adoption of good practices) as an initial step; implementing monitoring and research plans will require more time, but can help verify which practices are most effective in generating desired outcomes.

I. INTRODUCTION – CHALLENGES IN MEASURING AND TRACKING INTERLINKAGES BETWEEN SDG7 AND SDG15

- Land systems lie at the heart of several development issues, including food security, biodiversity conservation, healthy soils and habitats, clean energy, and climate change action. Decisions about sustainable land management are inherently complex and multi-faceted because land systems are dynamic and can be used simultaneously for different purposes by different people. Many of these features and their implications are reflected in Figure 1.[1]

FIGURE 1. LAND SYSTEM FACTS, SUSTAINABILITY CHALLENGES, AND IMPLICATIONS FOR GOVERNANCE

	Facts About Land Systems		**Challenges** for sustainability
1	**Multiple values and meanings**	▷	Notions of land degradation and restoration are socially constructed and contested
2	**Land as complex systems**	▷	Consequences are difficult to foresee and trace
3	Irreversibility & path-dependence	▷	Loss of option value, shifting baselines, no return to original state
4	Large impacts of small footprints	▷	Spillovers may be more important than direct impacts
5	Distant connections	▷	Solving local problems can displace issues elsewhere
6	**Used Planet**	▷	No "free" land that does not already provide benefits
7	Prevalence of trade-offs	▷	Prioritizing a single goal such as carbon nearly always reduce other benefits for some
8	Multiple, overlapping, contested land tenure claims	▷	Identifying decision-makers and policy recipients is complicated
9	Unequal distribution of control and benefit	▷	Interventions always have distributional consequences
10	**Multiple dimensions of justice**	▷	Governance processes that do not acknowledge distinct from of justice will be considered as unjust

Implications for governance and practice

More sustainable and just solutions require:

- ▷ Acknowledging multiples perceptions, beliefs and values, multiples versions of justice, and power differentials
- ▷ Developing contextual and adaptive solutions, avoiding silver bullets and "one-size-fits-all" panaceas
- ▷ Considering spatial and temporal spillovers
- ▷ Preventing undesired irreversible impacts
- ▷ Fostering synergies but also acknowledging and mitigating unavoidable tradeoffs
- ▷ Explicitly addressing inequalities and acknowledging unclear land tenure

Source: [1]

The challenges summarized in Figure 1 are relevant when considering linkages among renewable energy (RE)[63] interventions, sustainable land management, and appropriate indicators of progress and impacts. Additionally, the findings, as updated from the 2021 UN-Energy Policy Brief on this topic [2], bring key aspects into focus:

- Energy supply is just one possible use of land, which means that multiple uses and integrative approaches need to be considered when the location of energy systems is being planned;
- While the conventional land footprint of fossil fuels is generally smaller than that of renewable energy, there are many cases where RE footprints are minimal, such as in-stream hydro and bioenergy based on residues, wastes, or the co-products from land management designed primarily to achieve other objectives;

[63] This policy brief focuses on land-based renewable energy. However, many indicators suggested both in the core text and in Annex 2 can also be used for non-renewable energy.

- The comparative land implications of energy options also depend on whether one considers the land footprint of mining, drilling, the energy distribution infrastructure [3], the co-location of different types of renewable energy [4], and the potential implications of subterranean footprints (e.g., drilling bore holes or fracking) for water aquifers and the stability of geologic formations [5];

- The links between energy and land are influenced by climate and human activities and affect natural resources, especially water, nutrients, and carbon. Energy–land use planning must give due consideration to a potentially diverse range of locally important factors;

- While non-renewable energy systems generally have greater environmental risks than renewable energy systems [3,5], renewable energy can also have environmental effects that need to be considered. These include biodiversity reduction (e.g., through extensive areas of monocropping of energy crops, large-scale solar panel installations), unsustainable mining of minerals needed for manufacturing (e.g., solar and wind, and batteries), lack of effective end-of-life recycling/recovery of the manufactured articles [3], and the unsustainable management of biomass harvests. A sound assessment of the land impacts of different energy technologies requires the consideration of all significant impacts, if any, on a life-cycle basis, including fuel extraction and processing, transformation, and decommissioning. Such an assessment utilizes land intensity metrics that include an analysis of how much land is needed, for how long, and whether it can be restored after use [3];

- Compared to other types of energy, a particular feature of bioenergy is that it can be a co-product of land management designed to improve watershed and soil conditions, forest health (wildfire fuel reduction), habitat for endangered species (removal of invasive species), and other land-based ecological services, while also supporting phytoremediation and restoration of degraded lands [6,7,8];

- Sustainable energy systems should be planned starting not from the energy side but from the land use side, so as to appropriately consider and address potential conflicts with stakeholders, find the best fit for RE systems to minimize negative effects, and optimize synergies with other land management goals, such as productivity and biodiversity conservation [9];

- RE solutions require transparent, inclusive decision-making to maximize benefits and minimize harm to the environment and to local communities. Some RE projects, in particular large-scale hydropower dams, can interfere with local ecosystems and communities' traditional forms of land management and may themselves have unfavourable effects on the climate. Given the possible multiple simultaneous and sequential uses of land by different actors, land based RE solutions and decision-making processes should extend beyond those who hold formal rights over the land or directly benefit from it; it should also include those with a stake in the land and those who derive benefits from it or perceive burdens (see recommended approach in Annex 2).

Observations regarding the current status of indicators related to RE–land interlinkages are summarized here:

- While there are several agreed targets on land use and soil management, there are currently no similar agreed targets on linkages between RE and land and/or soils;

- There is also little consensus on a shortlist of RE–land systems indicators, although bioenergy indicators have been developed and applied in many contexts. At national scales, the Global Bioenergy Partnership (GBEP) indicators reflect consensus among several national governments and incorporate indicators that include renewable energy (in this case bioenergy)–land use links [10]. Many additional private, voluntary certification schemes include indicators linking bioenergy and land, such as those recognized by the EU [11];

- Indicators should capture impacts across the pillars of sustainability (environmental, social, economic) as well as the distribution of burdens and benefits, with special attention to groups that have traditionally been marginalized but are affected by RE deployment;
- Annex 2 provides examples of criteria and indicators associated with four categories: sustainable natural resources management, efficient use of land and biomass resources, good land systems governance, and effects on land users' wellbeing;
- It is inappropriate to rely on aggregate or average values for assessing effects, as these may obscure important trade-offs. The costs and benefits affecting specific groups of people, species, and habitat types should be monitored. To assess equitable sharing of burdens and benefits, the distributional effects should be considered for every indicator;
- Land systems are heterogeneous, dynamic, and multi-functional, making it challenging and costly to collect adequate data for baseline and targets, and also impossible to define a short list of indicators that is appropriate in every situation;
- Contextual and adaptive solutions are required when considering energy–land–human interactions in order to foster the synergies and minimize the potential negative implications mentioned in Figure 1.
- The points listed above show that a standard set of appropriate targets, indicators, and supporting data for RE–land linkages are not readily available, as they depend on location and socioeconomic context.
- Systematic processes are needed to arrive at socially acceptable solutions, and developing indicators of this type requires patience and consensus.

II. PROPOSED WAY FORWARD TO MEASURE AND TRACK INTERLINKAGES BETWEEN SDG 7 AND SDG 15

The complexity of human–land interactions means that there are no simple, standard indicators applicable across global and local scales; nor should we expect any. A cost-effective and fair tracking system on RE–land interlinkages should be context-specific and thus be carried out by local land users and other relevant stakeholders in a participatory way. A stepwise process to that effect is presented in Annex 2. This covers environmental, social, economic, and governance factors; encourages continued stakeholder participation in developing a flexible and contextualized set of indicators; and allows adaptation to different conditions and land user needs.

The stakeholder-led adaptive process described in Annex 2 is recommended for selecting indicators to track RE–land use interactions because it is technically robust (i.e., reliable, valid, useful), and covers all required dimensions of sustainable RE–land use interlinkages using a minimum set of indicators. Moreover, developing indicators with stakeholders has proven to provide more socially acceptable outcomes, and is therefore more likely to be implemented in an effective and equitable manner over time. Implementing such a process, however, requires time, money, expertise, and information. If these resources are limited, a 'fast track' and less valid approach would be to use a pre-set list of indicators. It should be noted that a fast-track approach might result in measurements that omit key local variables or fail to provide timely and useful data for taking corrective and adaptive management actions. While acknowledging the limitations, to fulfil the scope of this policy brief and provide an immediate starting point for practitioners, a pre-set list of indicators is provided below. Bearing in mind its risks and limitations, a fast-track approach could and should be considered as a first step towards a more valid and acceptable stakeholder-led approach to developing a tracking system of RE–land system interlinkages.

2.1 Indicators with available data

The indicators listed below have some data available to support the tracking of progress related to bioenergy. They are based on contributions from countries that have tested the indicators of the Global Bioenergy Partnership (GBEP). Some of these indicators might be adaptable to other types of renewable energy when national-scale impacts are being considered. As a result, in the case of this policy brief, the GBEP indicators have been slightly modified to replace bioenergy with RE deployment. It should be cautioned that, based on the testing of these indicators, the GBEP concluded that further guidance is needed on the "complex and crucial issue of the attribution of impacts to bioenergy" (hence, similar issues of attribution may arise with other types of RE) and that the "proactive engagement of all relevant stakeholders… is key to the effective implementation of the indicators, and to a proper interpretation and use of the results" [12].

Indicator 1

- Definition of indicator 1: changes in biological diversity caused by RE deployment.
- Which situation does the indicator measure and what is its significance?

  This indicator should be measured in the following way:

  - Area and percentage of nationally recognized areas of high biodiversity value or critical ecosystems not affected or positively impacted by RE deployment;
  - Area and percentage of the land used for RE deployment where nationally recognized invasive species are removed to improve habitat and provide a source of feedstock for bioenergy;
  - Area and percentage of the land used for RE deployment where nationally recognized conservation methods are used.
- Data availability and collection and other potential issues: data were examined in 14 nations for test applications with bioenergy under GBEP; several data limitations were also identified [13];
- Current situation regarding the indicator (baseline): testing of the indicator by the GBEP identified limitations in terms of spatial variability of indicator values, lack of baselines, and demarcation difficulty between traditional and bioenergy land uses [12];
- Suggested target for 2030 on indicator 1: no detrimental changes in biodiversity attributable to RE deployment.

Indicator 2

- Definition of recommended indicator 2: change in lifecycle GHG emissions attributed to RE deployment;

- Which situation does the indicator measure and what is its significance?

  This indicator should be measured in the following way:

  - Change in lifecycle GHG emissions from energy sector at national/sub-national level, taking into consideration the substitution of RE for fossil fuels;

  - Changes in lifecycle GHG emissions from land based RE compared to those from the fossil fuels for which they are substituted, expressed as GHG intensity of RE quantified on a lifecycle basis.

- Data availability and current situation: same as noted above for Indicator 1;

- Current situation regarding the indicator (baseline): reports and publications that measure lifecycle GHG emissions rely on assessment-specific data and assumptions related to baselines and counterfactual conditions, leading to variable results. GBEP test applications were also impacted by the limitations noted for indicator 1 [12,13];

- Suggested target for 2030 on indicator 2: net reduction in GHG emissions attributed to RE deployment (targets to be set locally).

Indicator 3

- Definition of recommended indicator 3: changes in land cover and land management attributed to RE deployment;

- Which situation does the indicator measure and what is its significance?

  This indicator should be measured in the following way:

  - Total area of land for RE deployment as compared to total national surface and agricultural and managed forest land area;

  - Percentages of RE production attributed to increased efficiency and waste reduction, for example, from yield increases, residues, wastes, and production on degraded or contaminated land;

  - Net annual rates of conversion between land-use types caused directly by RE deployment, including the following (among others): arable land and perennial crops, permanent meadows and pastures, and managed forests, natural forests, and grasslands (including savannah, but not natural permanent meadows and pastures), peatlands, and wetlands.

- Data availability and collection, and other potential issues: some data are available for 14 nations but are limited to test applications for bioenergy under GBEP [13];

- Current situation regarding the indicator (baseline): this indicator has only been measured in countries where GBEP indicators have been used. Test applications of the indicator identified several limitations in terms of spatial variability of indicator values, lack of baselines, attribution for change, and demarcation difficulty between traditional and (RE-related) land uses [12];

- Suggested target for 2030 on indicator 3: no negative changes in land cover and management attributable to RE deployment.

Indicator 4

- Definition of recommended indicator 4: changes in allocation and tenure of land caused by RE deployment;

- Which situation does the indicator measure and what is its significance?

  This indicator should be measured in the following way: Percentage of land – total and by land use type – used for RE deployment in cases where:

  - a legal instrument or domestic authority establishes title and procedures for change of title; and

  - the current domestic legal system and/or socially accepted practices provide due process and the established procedures are followed to determine legal title.

- Data availability and collection and other potential issues: some data are available in 14 nations but limited to test applications for bioenergy under GBEP [13];

- Current situation regarding the indicator (baseline): this indicator has been measured only in countries where GBEP indicators were used;

- Suggested target for 2030 on indicator 3: in deploying RE, land users' rights to be acknowledged and respected, particularly for socially marginalized groups, as per published guidelines on land tenure and resource access [14].

4.2. Indicators currently lacking sufficient data

Additional indicators would provide a fuller picture of the interlinkages between renewable energy (SDG 7) and sustainable land management (SDG 15). However, data for establishing reliable baselines and targets are not currently available for these indicators. Two types of indicators are considered here, namely:

i. Indicators related to existing relevant SDG indicators

These indicators are suggested because governments already have some familiarity with them due to periodic reporting requirements. They include changes caused by RE deployment on:

- SDG 5.a.1 (a) Proportion of total agricultural population with ownership or secure rights over agricultural land, by sex; and (b) share of women among owners or rights-bearers of agricultural land, by type of tenure;

- SDG 5.a.2 Proportion of countries where the legal framework (including customary law) guarantees women's equal rights to land ownership and/or control;

- SDG 15.1.2. Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type;

- SDG 15.4.1. Coverage by protected areas of important sites for mountain biodiversity;
- SDG 15.5.1. Red List Index;
- SDG 15.3.1. Proportion of land that is degraded over total land area;
- SDG 15.2.1. Progress towards sustainable forest management.

In addition, the following SDG indicators apply to land users instead of the whole population: changes caused RE deployment on:

- SDG 1.4.2. Proportion of total adult land user population with secure tenure rights to land and/or forest, (a) with legally recognized documentation, and (b) who perceive their rights to land/forest as secure, by sex and type of tenure;
- SDG 1.7.1. Proportion of land user population with access to electricity;
- SDG 1.7.2. Proportion of land user population with primary reliance on clean fuels and technology;

Targets regarding SDG-related indicators should be the same as those of the SDGs themselves.

ii. Indicators related to good practices related to RE–land use links

These indicators are suggested because they are relatively easy to measure compared to those related to specific aspects of RE–land use interlinkages. This is because their quantitative measurement concerns the proportion of land users or hectares; the technical opinion on the quality of implementation and the expected effects on specific attributes should be added to this. In the case of RE–land interlinkages, suggested good practice indicators are:

Changes caused by RE deployment on:

- Proportion of land users adopting sustainable land or forest management practices;
- Proportion of agricultural area under productive and sustainable agriculture and forestry;
- Proportion of agricultural land where agricultural residues not used for other purposes are used for bioenergy production;
- Proportion of land where RE solutions are combined with other land uses to create synergies and improve overall land use efficiencies, including proportion of land where different types of RE systems are co-located;

Baseline and targets for these indicators are time- and place-specific; they will depend on the prevailing conditions when and where RE systems are deployed. They should therefore be defined by local land users and stakeholders affected by a proposed RE system.

III. WAY FORWARD TOWARDS ESTABLISHING A FRAMEWORK FOR TRACKING PROGRESS ON THE INTERLINKAGES BETWEEN ENERGY AND SDG 15

The following actions are recommended in support of establishing a framework for continuously and reliably tracking progress on the interlinkages between renewable energy transitions (SDG 7) and land management (SDG 15).

- Do not assume that a fast-track approach based on a pre-defined set of indicators will address all the important aspects of RE–land interlinkages. Such an approach may be an expedient and necessary first step, but it is ultimately unlikely to be socially and technically acceptable for resolving trade-offs and identifying synergies between the SDGs at local level. Instead, or as an immediate next step, the development of indicators and monitoring systems with local stakeholders as described in Annex 2 will be required;

- In parallel, more work is needed to improve the consistency and transparency of approaches applied for measuring the effects of RE deployment using current indicators (e.g., those listed in section 2.1 above);

- Transparent and replicable methods are required for conducting life-cycle assessments, documenting the most likely future conditions under different deployment scenarios, and for consistent carbon accounting over time, while accounting for heterogeneous and dynamic land and economic systems;

- Whatever the approach chosen, best practices for stakeholder engagement and citizen science should be applied as being complementary to conventional methods for prioritizing indicators, collecting data, monitoring change, and interpreting results [15,16].

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ANNEX 1: PROPOSED PRIORITIZED INDICATORS WITHIN THE FAST-TRACK LIST OF PRE-SET INDICATORS.

Note: Distributional effects of every indicator should be considered to promote equity and justice.

Full List of Indicators (max 10)	
Definition	**Data Availability**
Changes to biological diversity caused by RE deployment	Very little or no data available
Change in life-cycle GHG emissions attributed to RE deployment	Some data is available
Changes in land cover and land management attributed to RE deployment	Some data is available
Changes in allocation and tenure of land caused by RE deployment	Some data is available
Changes caused by RE deployment to SDG 15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type	Very little or no data available
Changes caused by RE deployment to SDG 15.3.1 Proportion of land that is degraded over total land area	Very little or no data available
Changes caused by RE deployment to SDG 1.7.1.: Proportion of land user population with access to electricity	Very little or no data available
Changes caused by RE deployment to the proportion of land users adopting sustainable land or forest management practices	Very little or no data available
Changes caused by RE deployment to the proportion of agricultural land where agricultural residues not used for other purposes are used for bioenergy production	Very little or no data available
Changes caused by RE deployment to the proportion of land where RE solutions are combined with other land uses	Very little or no data available

ANNEX 2: GUIDANCE ON A STAKEHOLDER-LED AND ADAPTIVE APPROACH TO DEVELOP A TRACKING SYSTEM REGARDING RE–LAND USE LINKS

1. The Approach

The complexity of land systems means that there are no simple, standard indicators that work everywhere, nor should we expect them. Local conditions, time horizons, and scale are all important variables that influence indicator selection. A cost-effective and fair tracking system on RE–land interlinkages should be context-specific, and thus carried out by local land users and other relevant stakeholders in a participatory way. A stepwise process to that effect is presented in Appendix 1 [1].

As source of information for the above-mentioned process, a list of principles, criteria, and Indicators to measure the links between RE and land systems is presented in Appendix 2:

- The proposed principles encompass the four dimensions that need to be addressed in implementing RE solutions to ensure sustainable land system management (i.e. sustainable natural resources management, efficient use of land and biomass resources, land systems governance, and distributional effects on land users' wellbeing);

- Each principle includes criteria to help operationalize its implementation and facilitate the step of developing context-appropriate indicators;
- The list of proposed indicators constitutes an initial 'menu' from which users can choose those that are more relevant and convenient to their situation. Users should include at least one indicator per relevant criterion while respecting stakeholder inputs – hence, at least 13 indicators. Novel indicators may be required to address stakeholder priorities in a particular context;
- When possible, selected indicators should link to SDG 15 and other relevant SDGs, bearing in mind that governments are familiar with the SDG indicators due to periodic reporting;
- National reporting should address the four principles presented in Appendix 2. A challenge to this is that some indicators concern only local or national levels, while others may be measured at both levels. Care must be taken to avoid aggregation or indices in developing national-level tracking systems, as these may mask impacts on specific sites, species, or socioeconomic groups. As a result, national-level tracking may offer only a qualitative indication of the status of RE–land use links. More specifically:
  - If similar results are obtained from local level measurements, then a national trend can be reasonably derived from these assessments;
  - If results from local measurements are quite different from each other, then no national trend can be inferred, and the issue at stake deserves due consideration in terms of national policies and regulations.
- When measurement of indicators is complex and requires significant time and money, it might be useful to use proxy indicators as a first step towards indicating where things stand. This can be achieved using indicators regarding the implementation of agreed RE good practices related to sustainable land use – combining quantitative information (e.g., how many land users use good practices, how many hectares are covered by these practices) and a qualitative assessment (i.e., quality of implementation of good practices);
- As for indicators, the identification of good practices should be undertaken by local land users and other relevant stakeholders through a participatory process – this is illustrated in Appendix 3. The list of indicators includes some examples of indicators related to generally agreed good RE practices in terms of sustainable land use – highlighted in green in Appendix 2;
- In selecting and implementing good RE practices, it is important to address trade-offs between benefits to land and possible risks regarding other development aspects. For instance, biogas is deemed a good practice for land, as it uses biomass residues and generates a digestate that can be used to fertilize soils. However, the opportunity costs of this option need to be considered within the context of other options and the needs of local stakeholders. For example, biogas systems require water that could be used for other purposes, such as drinking water, to irrigate agricultural fields or clean health centres. Another example of a trade-off is the use of agricultural residues for bioenergy instead of soil cover or animal feed.

Feedback loops are included in the identification of both indicators and good practice. This is due to contextual conditions being linked to sustainable land use and because land users' needs can change over time; a mechanism is thus needed to review the validity of existing indicators and practices.

The inclusive and iterative character of the proposed indicator-selection process significantly enhances cost-effectiveness and acceptance, hence increasing the likelihood that indicators are effectively measured on a regular basis and in a satisfactory manner.

The application of the approach is not meant to be a one-time effort but rather an ongoing and systematic process.

2. Recommendations

The following recommendations are proposed regarding the stakeholder-led approach to selecting indicators on RE–land use links:

- It is important to start by defining clear objectives related to the management of natural resources through a truly inclusive decision-making process that adequately involves all land users (and uses) so as to identify how best to integrate the deployment of RE. The overarching goals are to ensure sustainable land management and land users' wellbeing, with specific objectives towards these goals being defined by local stakeholders;

- The above goals and objectives should account for possible trade-offs and synergies, and these should normally be addressed at the preliminary stages of the planning and indicator selection process;

- Once the main goals and specific objectives are defined and agreed upon with stakeholders, the selection of indicators should:
  - Reflect the four principles presented in Appendix 2 and be designed to provide useful information about the sustainability of land use associated with RE deployment;
  - Be suitable in terms of informing stakeholders about the potential effects on their defined goals and objectives;
  - Combine practicality, simplicity, and robustness (i.e., provide useful, valid, and reliable results);
  - Inform users regarding the resilience of RE systems (reliable supplies of affordable energy) and of the ecological services provided by the specific land area affected by the project, noting that resilience requires adaptability to unforeseen extreme events of all types including, but not limited, to extreme weather, health, or political events that disrupt society.

- Consider prioritizing the use of indicators regarding the implementation of good practices as a first step towards the measurement of indicators when this is complex and resource-intensive;

- As regards data gathering, data from citizen science – namely the direct involvement of citizens in research work – represent one new data source that has been used for SDG reporting and monitoring, in particular for SDG 15 [4] [5].

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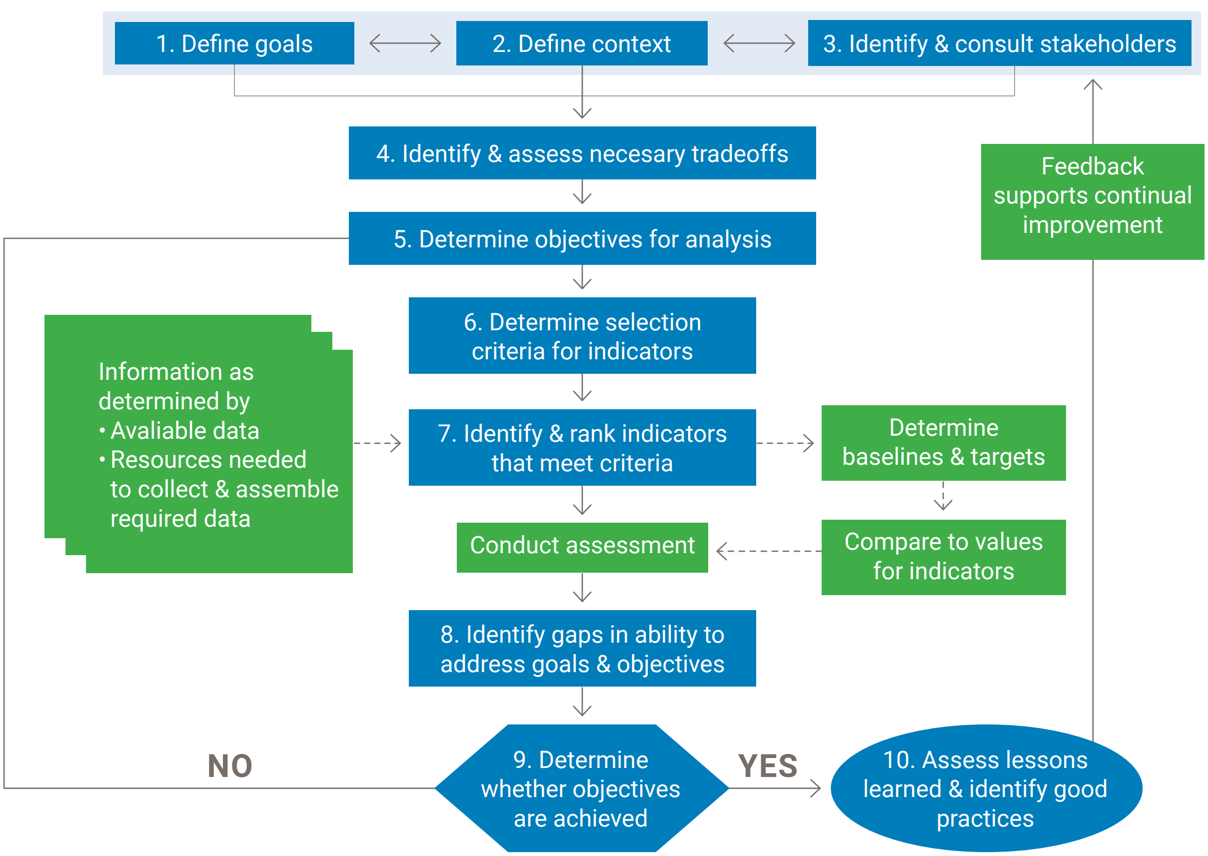
APPENDIX 1: PROPOSED PROCESS TO DEFINE INDICATORS ON RE–LAND USE LINKAGES



Source: Dale et al., 2015

APPENDIX 2: SET OF PRINCIPLES, CRITERIA, IMPACT CATEGORIES, AND INDICATORS ON ENERGY–LAND INTERLINKAGES

Note: Distributional effects of every indicator should be considered to engender equity and justice.

Principles	Criteria	Indicators of changes caused by RE deployment on N (National level) and L (Local Level)	Measurement-Quantitative units/indices/qualitative: improved/no major change/worse
Principle 1 Sustainable RE development should ensure that land systems are sustainably managed, and their resilience harnessed	**Criterion 1.1** Biodiversity conservation is ensured	SDG 15.1.2 Proportion of important sites for terrestrial and freshwater biodiversity that are covered by protected areas, by ecosystem type (N)	Total and % change[64]
		SDG 15.4.1 Coverage by protected areas of important sites for mountain biodiversity (N)	Total and % change[64]
		SDG 15.5.1 Red List Index (N/L)	0–1 index[65]
		Biological diversity in the landscape (N/L)	0–1 index[65]
	Criterion 1.2 Climate change mitigation, adaptation and resilience are enhanced	Lifecycle GHG emissions (N)	Tonnes CO_2-eq per MJ energy product or emissions saved per ha, through displacement of fossil energy sources[3]
		Above-ground carbon stocks/Carbon sequestration (N/L)	Tonnes/ha & tonnes /ha/year
		Soil carbon stocks /Carbon sequestration (L)	Tonnes /ha
		Proportion of arable and forest land per capita of agricultural population (N/L)	Total and % change
		Proportion of agricultural and forest land damaged after extreme weather events (N/L)	Total and % change
		Proportion of diversified decentralized RE systems (N)[66]	Total and % change
	Criterion 1.3 The degradation of land, soil, and forests is prevented, stopped, or reversed	SDG 15.3.1 Proportion of land that is degraded over total land area (N/L)	% change (index including land cover, land productivity and carbon stock)[2]
		Percentage of land for which soil quality, in particular in terms of soil organic carbon, is maintained or improved out of total land on which RE systems are deployed (L)	Total and % change[65]
		SDG 15.2.1 Progress towards sustainable forest management (N/L)	Qualitative assessment of an index change that combines 1. Annual forest area change rate; 2. Aboveground biomass stock in forest; 3. Proportion of forest area located within legally established protect areas; 4. Proportion of forest area under a long-term forest management plan; and 5. Forest area under an independently verified forest management certification scheme)[64]
		Land cover and land management; changes attributable to RE deployment	Total and % change[3]
		Proportion of land users adopting sustainable land or forest management practices (L)	Total , % change and qualitative
		Proportion of agricultural area under productive and sustainable agriculture and forestry (L)	Total , % change and qualitative

[64] https://unstats.un.org/sdgs/metadata/?Text&Goal=15&Target#:~:text=Goal%2015.,degradation%20and%20halt%20biodiversity%20loss
[65] http://www.globalbioenergy.org/fileadmin/user_upload/gbep/docs/Indicators/Report_HYPERLINK_updated_CM_25-05-2017.pdf
[66] https://energypedia.info/wiki/Climate_Change_Mitigation_and_Adaptation_Potential_of_Basic_Energy_Services

Principles	Criteria	Indicators of changes caused by RE deployment on N (National level) and L (Local Level)	Measurement-Quantitative units/indices/qualitative: improved/no major change/worse
	Criterion 1.4 Amount of water needed for RE and other land uses is given due consideration	Amount of water withdrawn for RE and other land uses purposes, disaggregated into renewable and non-renewable water (L)	Total and % change[3]
	Criterion 1.5 Quality of water needed for non-RE land uses is maintained, and, if possible, enhanced	Amount of water pollutants in land (L)	Total and % change in water pollutants in land[3]
Principle 2 Sustainable RE development should rely on improved efficiency in the use of land and biomass	**Criterion 2.1** Sustainable intensification and provision of services from land is promoted	Change in land / biomass use intensity: inputs/outputs and system based; e.g., felling ratio, and/or crop yields (L), or other environmental services provided	% change of felling and yield ratios
		Proportion of land occupied/impacted for RE deployment (N/L)	Total and % change
	Criterion 2.2 Sustainable integrated energy systems are promoted	Proportion of land-management wastes and residues not used for other purposes, that are used for RE deployment (N/L)	Total , % change and qualitative
		Number of projects and share of RE-impacted land, where RE solutions are combined with other land uses (N/L)	Total , % change and qualitative
		Number of projects and share of RE-impacted land where different types of RE systems are co-located (N/L)	Total , % change and qualitative
		Proportion of municipal waste directed to waste-to-energy (as opposed to landfill)	Total , % change and qualitative
Principle 3 Responsible, equitable, and effective land and forest governance mechanisms should underpin sustainable RE development	**Criterion 3.1** Adequate land and forest rights are guaranteed	SDG 1.4.2 Proportion of total adult land user population with secure tenure rights to land and/ or forest: (a) with legally recognized documentation and (b) who perceive their rights to land/forest as secure, by sex and type of tenure (N/L)	Total and % change[67]
		SDG 5.a.1 (a) Proportion of total agricultural population with ownership or secure rights over agricultural land, by sex; and (b) share of women among owners or rights-bearers of agricultural land, by type of tenure (N/L)	Total and % change[5]
		SDG 5.a.2 Proportion of countries where the legal framework (including customary law) guarantees women's equal rights to land ownership and/or control	Total and % change[5]
		Share of indigenous groups among owners or right-bearers of agricultural and forest land	Total and % change

[67] https://unstats.un.org/sdgs/metadata/files/Metadata-01-04-02.pdf

Principles	Criteria	Indicators of changes caused by RE deployment on N (National level) and L (Local Level)	Measurement-Quantitative units/indices/qualitative: improved/no major change/worse
		Proportion of land or forest – total and by land-use or forest type – used for RE deployment where: (1) a legal instrument or domestic authority establishes title and procedures for change of title (proportion); and (2) the current domestic legal system and/or socially accepted practices provide due process, and the established procedures are followed for determining legal title (N/L)	Total and % change[3]
		Local land and/or forest users' access to land and forests (L)	Qualitative
	Criterion 3.2 Adequate, Inclusive, and fair stakeholder involvement in decision-making on RE deployment is ensured	roportion of RE deployments where rights, responsibilities, and benefits, within and between land users and other relevant stakeholder groups, are well balanced (L)	% change[68]
		Degree of land user and other relevant stakeholder involvement in decisions related to RE deployment	Qualitative
		Degree to which stakeholders are well informed of RE deployment plans, indicator values, and any problems as they arise (L)	% and qualitative[69]
	Criterion 3.3 Enabling environment[70] on sustainable RE solutions are promoted and/or strengthened, and implemented	Degree of implementation of policies and regulations relevant to the deployment of RE (N/L)	Qualitative
		Degree of coordination between institutions relevant to the deployment of RE (N/L)	Qualitative
	Criterion 3.4 Level of knowledge and capacity on RE-land use links enhanced	Level of knowledge and capacity on RE–land use links within national and local Institutions and stakeholders	Qualitative
`Principle 4 RE deployment should lead to land users' improved wellbeing	**Criterion 4.1** Land users' wellbeing improved	Level of land users' wellbeing, disaggregated by income and social groups	Social Performance Index (SPI) that includes wellbeing dimensions to be identified by local stakeholders[71]
	Criterion 4.2 Land user's access to modern energy enhanced	Proportion of land user population with access to affordable electricity	% change[72] and burden (share of electricity among total household costs)
		Proportion of land user population with primary reliance on clean fuels and technology	% change[73]

[68] https://policy-powertools.org/Tools/Understanding/docs/four_Rs_tool_english.pdf

[69] www.sciencedirect.com/science/article/pii/S1470160X12003652

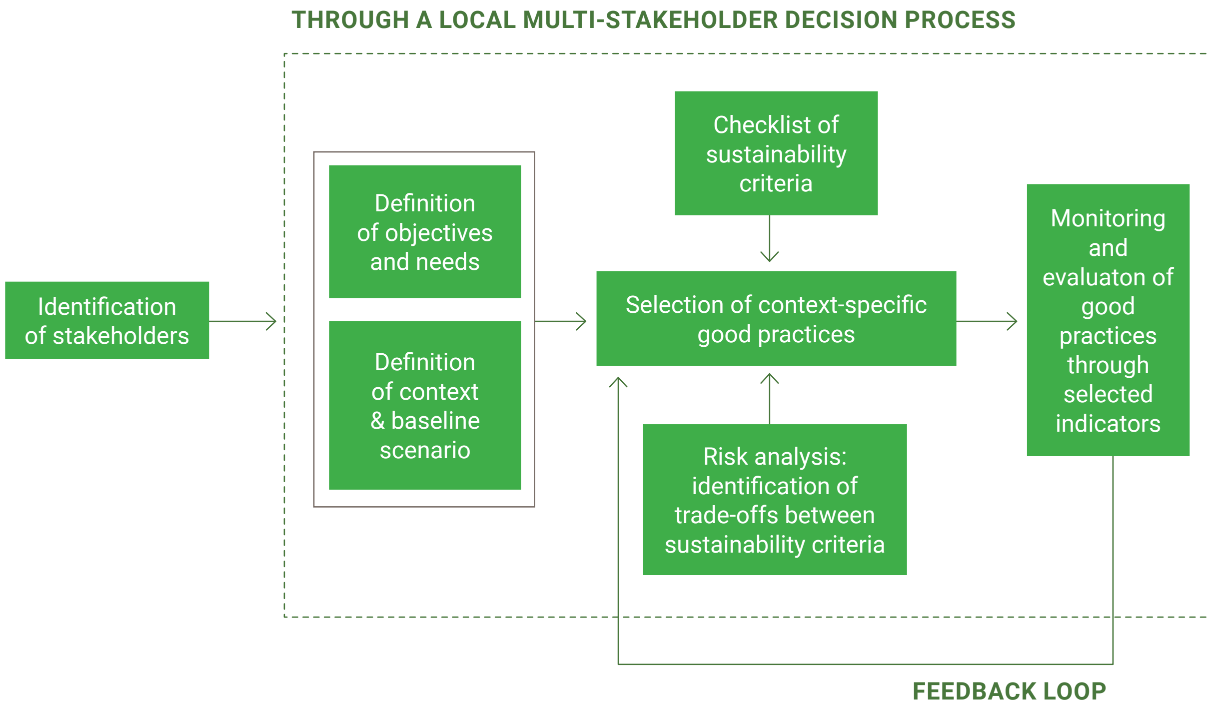
[70] In this document enabling environment includes policies, regulations, institutions, knowledge/capacities, and inclusive stakeholder decision-making

[71] The Social Performance Index (SPI) Assessing and monitoring community well-being through energy sector investments www.cobenefits.info/wp-content/uploads/2021/11/IASS-Discussion-Paper_Social-Performance-Index_211122.pdf

[72] https://unstats.un.org/sdgs/metadata/files/Metadata-07-01-01.pdf

[73] https://unstats.un.org/sdgs/metadata/files/Metadata-07-01-02.pdf

APPENDIX 3: PROCESS TO SELECT GOOD PRACTICES



SECTION 4

REGIONAL **PERSPECTIVES**

ADVANCING SDG7
AFRICA
ASIA AND THE PACIFIC
THE ARAB REGION
UN ECE REGION
LATIN AMERICA AND THE CARIBBEAN
LDCS, LLDCS, AND SIDS

SECTION 4.1

ADVANCING SDG 7 IN AFRICA

CONTRIBUTING ORGANIZATIONS:
UNITED NATIONS ECONOMIC COMMISSION FOR AFRICA (UN ECA), AFRICAN, UNION COMMISSION (AU), AFRICAN UNION DEVELOPMENT AGENCY (AUDA-NEPAD), GLOBAL ENERGY INTERCONNECTION DEVELOPMENT AND COOPERATION ORGANIZATION (GEIDCO), AFRICAN ENERGY COMMISSION (AFREC), THOMRO BIOFUELS, RES4AFRICA (RENEWABLE ENERGY SOLUTIONS FOR AFRICA)

Key Messages/Summary

Africa is still dealing with the impacts of COVID-19 and plans to expand its energy infrastructure have stalled due to supply chain interruptions and budget cuts. Infrastructure development has been identified as a vital pillar in the reconstruction of African economies. The COVID-19 pandemic also increased the urgency of efforts to address Africa's long-standing energy access problem. Evidence suggests that the pandemic has reversed progress in terms of power access, with numerous nations experiencing reductions and stagnation in 2020–2021.

Reduced access to electricity translates into low consumption. In comparison to other regions and countries, the continent's average per capita electricity consumption is unacceptably low, at around 600 kilowatt hours (kWh) per year – less than 20% of India's and only 5% of China's. Africa's per capita consumption ranges from less than 100 kWh in countries like Benin, Ethiopia, and South Sudan to over 1,500 kWh in only a few countries like Botswana, Egypt, Libya, Mauritius, Namibia, and South Africa. When South Africa and North Africa are excluded, per capita electricity usage is around 200 kWh. In terms of energy generation, Africa's yearly output of 854 terawatt hours (TWh) was just 55% of India's and 12% of China's in 2018.

As the pandemic's health and energy components converged, the significance of accelerating clean cooking solutions in Africa was emphasized, mainly in rural areas. Data show that clean cooking is a significant challenge requiring more imaginative rules and practices than those already in place. Over 800 million people on the African continent still lack access to clean cooking solutions and technology, relying on traditional biomass for their energy needs, which results in 500,000 early deaths per year due to indoor pollution. Africa's installed capacity of 233,000 megawatts (MW) is insufficient compared to other regions and countries, accounting for only 12% and 63% of China's and India's capacity, respectively. This capacity is centred mainly in North African countries and South Africa, with the rest of Africa's installed capacity roughly equal to that of South Africa.

Despite the enormous potential of all types of energy resources (especially renewables), renewables still have a small share of the power mix. However, advancements in Egypt, Ethiopia, Kenya, Morocco, Senegal, and South Africa have accelerated the deployment of renewable energy on the continent over the previous five years. African countries can build on this momentum with pragmatism, transformational leadership, and ambitious policies and initiatives. This momentum could also help stimulate significant global measures to combat climate change and promote inclusive growth that leaves no one behind.

In addition to the recommendations of the previous Policy Brief (2021), the following actions are recommended:

- The African Union (AU) supports several partnership cooperation agreements and initiatives. As a result, African nations must completely support and actively engage in the programmes. The AU, its agencies, and strategic partners should ensure that the least-electrified countries are included and benefit from these collaborations and cooperation arrangements. These initiatives include, but are not limited to, Programme for Infrastructure Development in Africa (PIDA), African Single Market (AfSEM), the African Continental Free Trade Agreement, the "Light Up Africa project of the African Development Bank (AfDB), and the Regional and Global Energy Interconnection (RGEI) initiative of the Global Energy Interconnection Development and Cooperation Organization (GEIDCO).

- African countries should find novel techniques for mobilizing renewable energy infrastructure and technology funding. Public money alone will not suffice to close the access gap; private-sector financing and other sources of investment will be required. As a result, countries should move quickly to create an enabling context and open up the energy industry to private investment. Organizations like the European Court of Auditors (ECA), African Union (AU), and the Africa Union Development Agency–New Partnership for Africa's Development (AUDA- NEPAD), as well as financial institutions like the AfDB and AFREXIMBANK should work together to develop tools for resource mobilization for African member states.

- Now that the Africa Climate Resilience Investment Facility (AFRI-RES) is operational, African countries must use it to strengthen their capacity to build resilience in energy infrastructure planning. AFRI-RES is an Africa-based networked centre of technical competence and excellence with the overall goal of strengthening the capacity of African institutions (such as national governments, river basin organizations, regional economic communities, and power pools), as well as the private sector (project developers and financiers), to plan, design, and implement climate-resilient infrastructure investments in selected areas.

I. PROGRESS TOWARDS THE ACHIEVEMENT OF SDG 7

Africa remains the least energized region, with close to 80% of the 760 million people globally without access to electricity and 36% of the 2.6 billion people without access to clean cooking. While significant efforts have increased electrification, the rate is not enough to close the continent's energy access deficit rapidly. Despite its abundant clean energy resources potential, with over 40% of global solar irradiation falling on Africa, deployment of renewables on the continent remains very small, with Africa's share of global electricity generation from hydropower, wind, and solar power being only 3.3%, 1.2%, and 1.1%, respectively. Energy efficiency remains a challenge on the continent. With an increasing industrialization agenda, there are tremendous opportunities to drive energy efficiency efforts on the continent. In terms of investments, less than 2% of global clean energy investments flow to Africa, mainly to just a few countries. Africa's private sector is largely absent in the energy investment space. There is thus an urgent need to address Africa's energy access challenges and to do so in a coordinated way. It is becoming clear that many countries will be unable to change the energy sector independently. While the number of energy transformation torchbearers continues to rise, the situation in most African countries remains stagnant. According to the International Renewable Energy, the continent's lack of access to power costs up to 5% of its yearly GDP growth. It is commonly acknowledged that there can be no significant economic growth without inexpensive and reliable electricity.

Electricity access (SDG 7.1.1)

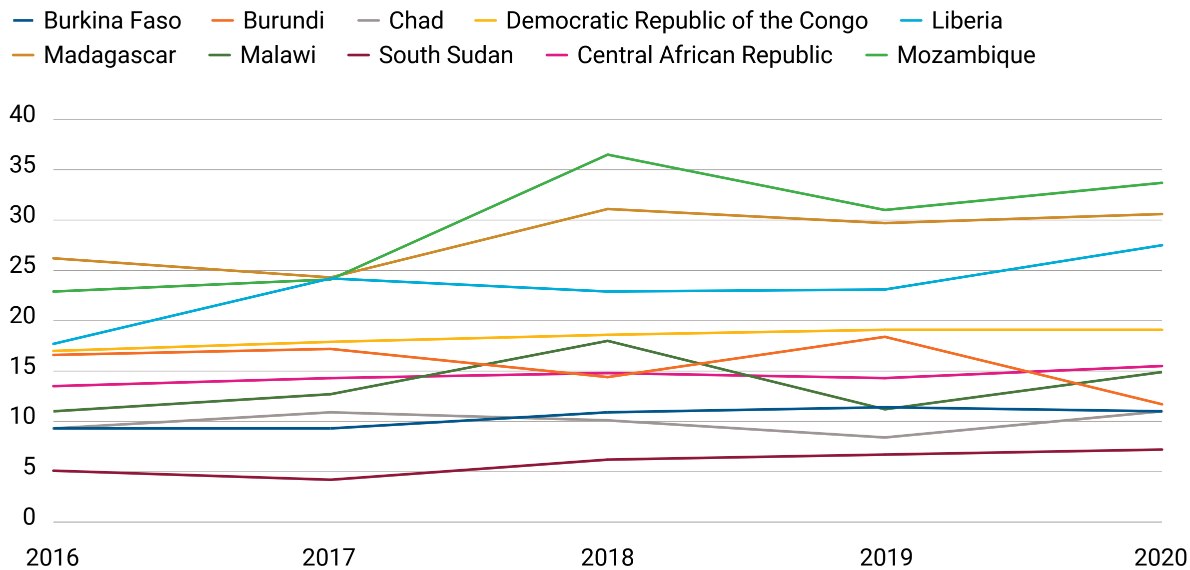
Little has improved in terms of access to electricity in Africa. With the emergence of COVID-19, plans and measures to improve Africa's energy industry have been slowed or halted. There is mounting evidence that the pandemic has reversed some countries' gains in better electricity access, owing to supply chain bottlenecks and lockdowns that slowed economic activity. The pandemic has halted this progress, with the number of Africans without access to electricity rising to 590 million in 2020, an increase of 13 million individuals, or 2%, from 2019.[74]

At the same time, data show that Africa's electricity use has increased over the last five years. For example, Africa's average electricity (excluding North Africa) was 43.8% in 2016. By 2020, the rate of access had risen to 48.4%.[75] The impact of the pandemic on access to electricity in 2021 and 2022 has yet to be fully estimated. The renewable energy sector growth in Nigeria, for example, has been severely disrupted. According to a recent poll, approximately 88% of solar off-grid operators have faced delays in importing solar components (such as panels and batteries) since the pandemic's emergence until the end of 2020. The country's efforts to expand access to electricity through renewable energy were hindered due to a lack of these crucial components. Other African countries have experienced similar incidents.

Regardless, more than half of Africa's countries (28 in total) still have an electricity access percentage of less than 60%. The Democratic Republic of Congo (DRC), Ethiopia, Nigeria, and Tanzania, which are the most populous, have access rates of 19.1%, 51.1%, 55.5%, and 39.9%, respectively.[77] More than 470 million Africans live in these countries, accounting for 34% of the continent's population of about 1.4 billion. Most people in these countries who do not have access to electricity live in rural areas.

[74] www.iea.org/reports/world-energy-outlook-2020
[75] https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=ZG
[76] https://aec.afdb.org/en/papers/how-covid-19-pandemic-affecting-electricity-access-africa-evidence-nigeria-399
[77] https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=ZG

FIGURE 1. ELECTRICITY PATTERNS AND TRENDS IN AFRICAN COUNTRIES THAT HAVE BELOW 40% ACCESS TO ELECTRICITY



Source: World Bank data

With an access rate of less than 20%, six African countries have a more severe scarcity of power – South Sudan (7.2%), Chad (11%), Burundi (11.7%), Malawi (14.9%), Central African Republic (CAR) (15.5%), and Burkina Faso (19%). Due to a lack of resources (primarily financial) and also a lack of competent and effective policies, it is unlikely that these countries can solve their electricity problems independently. As a result, these are the continent's poorest countries in economic development and political stability.

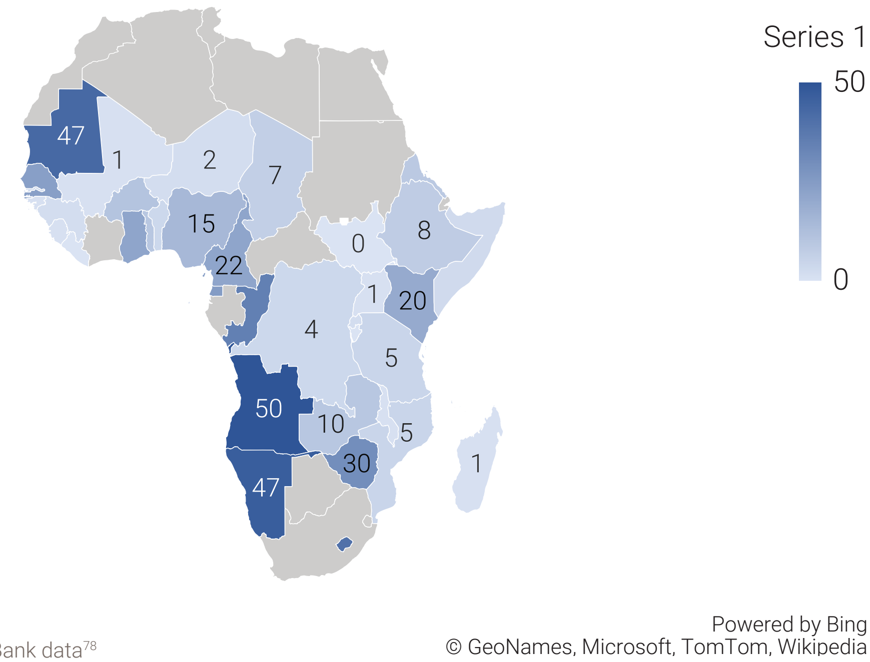
Another concerning trend in other African countries is the stagnation and reduction of electricity access in some cases. Figure 1 depicts the rate of electricity availability in ten of Africa's least electrified countries (those with less than 40% access) from 2016 to 2020. Electricity access in Burkina Faso, Burundi, Madagascar, Malawi, and Mozambique decreased between 2020 and prior years. In Madagascar, for example, electricity access was 36.5% in 2012 but since then has dropped to 33.7% in 2022.

Although COVID-19 may have played a role in these countries' gains in increased electrification, there had been some regression and a lack of electricity growth in the pre-pandemic era. For Africa to achieve universal access to electricity, the continent must work together to help lagging countries modernize their energy landscape. The scenario in these countries will remain the same in the next five years unless strong policies, measures, and actions are taken.

Access to clean cooking technologies (SDG 7.1.2)

While access to electricity has improved slightly over time, access to clean cooking fuels and technologies (CCFTs) has not. In 2016, 15.1% of Africans (excluding North Africa) had access to CCFTs, up barely 2% since 2010. Due to population growth, the number of people without access increased by 10% to almost

FIGURE 2. AFRICAN COUNTRIES THAT HAVE 50% AND LESS ACCESS TO CLEAN COOKING TECHNOLOGIES



Source: World Bank data[78]

940 million in 2020, making Africa the only continent with an increasing number of people without access. Because of the stagnation of CCFT deployment, millions of people die due to harmful fuels such as biomass (wood, crop wastes, and dung), charcoal, coal, and even kerosene. Women and children are susceptible to home air pollution. COVID-19 has also hindered access, switched government objectives, interrupted supply chains, raised energy prices, and imposed social distancing measures. The energy poverty, exacerbated by the pandemic, has caused many rural and peri-urban households to revert to utilizing charcoal, kerosene, or wood for heating.[78]

In some instances, there is a correlation between electricity access and the deployment of CCFTs. All countries in North Africa have universal access to CCFTs, mirrored by their universal access to electricity. There are also a few countries in other regions that with high achievements in deploying CCFTs – Cabo Verde, Gabon, Mauritius, Seychelles, and South Africa – where there is over 80% penetration of the CCFTs. In other instances, there appears to be little correlation between high electricity access and access to CCFTs. Countries like Ghana, Kenya, and Senegal, etc., have had great success in increasing electricity access. Yet, such success has not translated into an increase in CCFTs, as most households in these countries continue to rely on biomass for thermal applications.

Figure 2 depicts 38 African countries with less than 50% availability of CCFTs. Several national and regional initiatives have been launched to improve access, but these programs have yet to produce the desired results. In most African countries, peri-urban and rural households' traditional biomass and charcoal use has not decreased significantly. Two-thirds of African countries still rely on biomass for

[78] https://data.worldbank.org/indicator/EG.CFT.ACCS.ZS?locations=ZG
[78] www.iea.org/reports/world-energy-outlook-2021

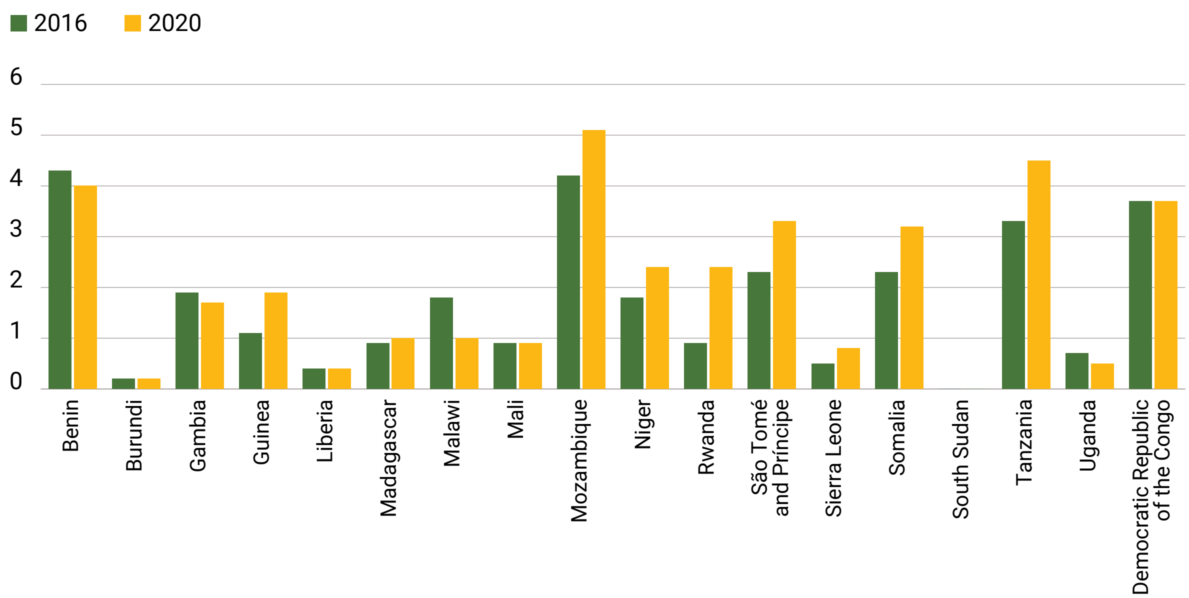
more than half of their total final energy use. At present, two-thirds of the African countries still depend on more than 50% of total final energy consumption for biomass. One-third are estimated to depend on this resource for more than 80%, and a few countries for over 90%.[80] Notably, 18 African countries have access rates ranging from 0% to 5%. These countries have made no substantial headway in closing this vast disparity. Instead, since 2016, many of these countries have stalled or declined. Figure 3 depicts how CCFT deployment in these nations is static or even regressive.

Despite several attempts at the national and regional levels, to increase access to clean cooking, this is primarily considered a persistent problem that is difficult to handle sustainably. This challenge addresses Africa's sluggish energy transformation directly. According to the International Energy Agency (IEA), the number of people without access to clean cooking solutions will rise by 6% between 2020 and 2030. Indoor air pollution will cause a rise in the number of early deaths.[81] Now that the pandemic has struck, it has become clearer than ever that a more radical and comprehensive approach to clean cooking, as one of the most effective ways of combating the current and future pandemics, is needed.

Access to modern renewable energy (SDG 7.2)

Renewable energy's tremendous potential makes it a critical resource for Africa's energy transformation. Renewable energy resources can be found in abundance throughout the continent. There are wind resources in the north and south of the continent, solar resources all over the continent, vast hydro resources in most regions, biomass resources in most parts of the continent, and geothermal resources in the east. Every resource is only marginally exploited, and the continent has the potential to lead the

FIGURE 3. AFRICAN STATES WITH THE LEAST ACCESS TO CLEAN COOKING SINCE 2016

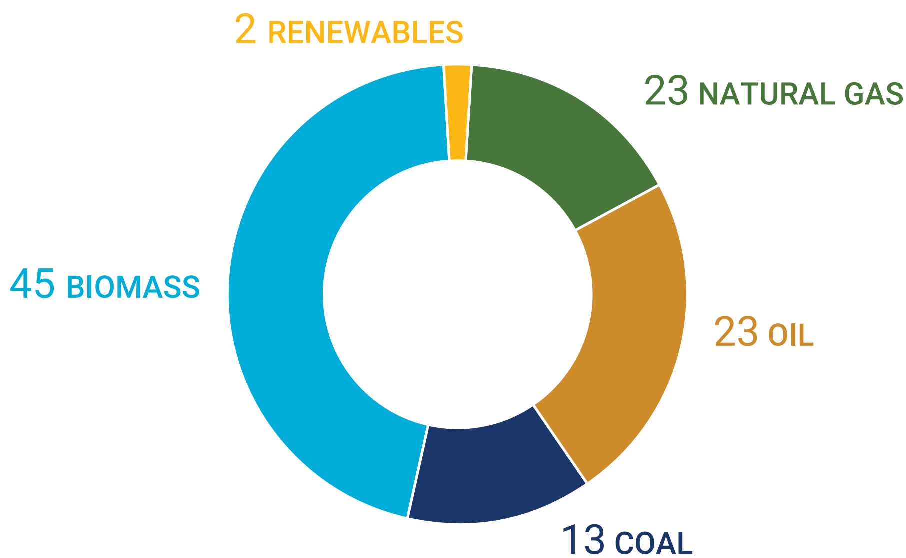


Source: World Bank data

[80] https://au-afrec.org/en/programs/bioenergy-programme

[81] This is according to the STEP or Stated Policy Scenario, which provides a "business-as-usual" outlook for the future based on the current and planned policies, measures and plans in countries. See, www.iea.org/reports/sdg7-data-and-projections/access-to-clean-cooking

FIGURE 4. MODERN RENEWABLE ENERGY IN THE CONTEXT OF PRIMARY ENERGY SUPPLY IN AFRICA



Source: IRENA (2021)

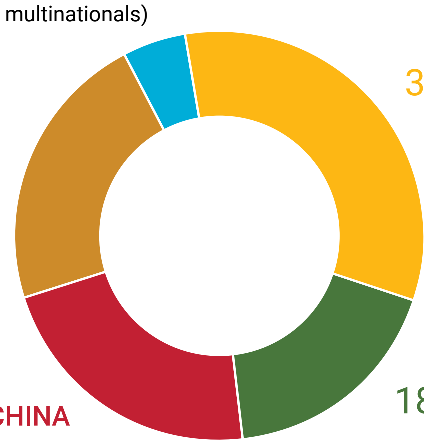
renewable energy revolution. Some countries have made significant investments in large-scale renewable energy programmes, significantly impacting electricity output. Most emerging independent power producers (IPPs) rely on renewable energy as a starting point. Three significant points were highlighted in a recent report by the International Renewable Energy Agency (IRENA).[82] First, the deployment of renewable energy has increased during the last decade, with more than 26 GW of renewable-based generation capacity added– solar energy received the most significant upgrades. Secondly, yearly renewable energy investments increased tenfold from less than $0.5 billion in 2000 to $5 billion in 2010–2020. Finally, distributed renewable energy solutions, such as stand-alone systems and mini-grids, are constantly increasing to expand electricity availability in off-grid areas while enhancing supply in areas already connected.

Despite the numerous initiatives to boost renewables on the continent for power generation, only 2% of global investments in renewable energy in the last two decades were made in Africa, with significant regional disparities. More investments are in North Africa and South Africa. Globally, renewable energy provides an avenue for new jobs, but less than 3% of the global renewable energy jobs are in Africa.[83]

Nonetheless, except for big hydropower plants, the deployment of current renewable energy technology is negligible compared to other energy sources (Figure 4). The biomass economy dominates the energy landscape, explaining why clean cooking alternatives are still scarce. As a result, robust policies

[82] www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/March/Renewable_Energy_Transition_Africa_2021.pdf
[83] www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/March/Renewable_Energy_Transition_Africa_2021.pdf

FIGURE 5. WHO IS FINANCING INFRASTRUCTURE IN AFRICA?



Source: ICA[84]

and measures are required to address the biomass issue directly by increasing investments in the radical adoption of innovative technologies to replace biomass. Clear paths or roadmaps should be developed, and current efforts should be tripled to accelerate the adoption of renewable energy technology across Africa.

II. WHAT CAN BE DONE TO FAST-TRACK ENERGY TRANSITION IN AFRICA?

There have been many efforts to help Africa overcome its energy constraints, and these projects should be recognized for their impact on Africa's energy sector. Since 2010, these programmes' activities have increased energy access and investment levels in several African countries. It is essential to recognize the involvement of development partners, such as China, multilateral development banks, and others, in investing in renewable energy over time. Despite severe budget constraints, African governments continue to play an essential catalytic role at the national level, including investing directly in energy infrastructure. The energy sector has seen increased, albeit limited, private-sector finance.

Compared to other regions, however, the African energy landscape is transitioning at the slowest rate, a situation aggravated by the COVID-19 pandemic. Most African countries will not fulfil all of the SDG 7 targets by 2030. Even if the targets are not met, crucial areas of focus can help Africa accelerate its energy transition. There is widespread agreement that the pandemic has heightened the need to accelerate the delivery of electricity infrastructure. Energy has emerged as a critical sector that can help alleviate the effects of COVID-19 or any future pandemic. The critical areas of focus thus are (a) a regional approach to addressing energy challenges, (b) increasing the share of private sector investments in the sector,

[84] www.icafrica.org/en/topics-programmes/key-achievements-in-the-financing-of-african-infrastructure-in-2018

(c) focusing on building resilient energy infrastructure, (d) expanding the use of gas as a transitional fuel, (e) prioritizing reliable electricity access to healthcare facilities to combat the effects of pandemics and recovery, and (f) biodiversity protection in pursuance of the energy transition.

a. The regional approach to addressing energy access in Africa

There is now widespread agreement that many African countries, particularly those with the lowest levels of electricity access, lack the resources and finance to build their energy infrastructure. Furthermore, it is recognized that regional collaboration is one of the most cost-effective ways to improve Africa's electrification rate. There is now a renewed emphasis on establishing regional infrastructure projects that benefit more than one country and constructing a continent-wide integrated electrical network and market. The construction of large-scale, cross-border regional grids – which connect areas with abundant energy resources and high generating capacity with areas with high demand – can help to address variability and grid stability issues by balancing supply and demand. By connecting resources, African countries can trade energy and generate a reliable supply of affordable, clean, and secure energy across vast continent regions. The economic rationale for linked grids is the benefit of trading the cheapest source of electricity at any given time with the centres of most significant demand.[85]

BOX 1: THE PROGRAMME FOR INFRASTRUCTURE DEVELOPMENT IN AFRICA (PIDA) AND AFRICAN SINGLE ELECTRICITY MARKET (AFSEM) SUPPORTS REGIONAL ELECTRICITY INTEGRATION

PIDA, an African Union Commission (AUC) initiative, in partnership with the AU Development Agency (AUDA)-NEPAD, the African Development Bank, and the ECA, aims to accelerate infrastructure development. The PIDA as a strategic framework will run through 2040 to develop continental (cross-border) infrastructure (Energy, Transport, Information and Communication Technologies (ICT), and Transboundary Water Resources). PIDA's primary purpose is to strengthen the consensus and ownership of sizeable cross-border infrastructure projects that integrate energy, transportation, and water development on a continental scale.

Currently, PIDA is in Phase 2 of implementing the PIDA Priority Action Plan (PIDA PAP 2). After a systematic process, 69 regional projects (of which 17 are electricity projects – generation, transmission and distribution) were selected across all four infrastructure sectors. Each selected project had to be assessed against several criteria. Broadly, these criteria entailed (a) the focus on fewer high impact projects with a higher level of readiness, (b) alignment with the Integrated Corridor Approach, and (c) inclusion of economic, job, gender, climate, and rural connectivity criteria.

Supporting the PIDA energy projects and other projects in the electricity sector, in general, is the creation of the African Single Electricity Market (AfSEM). The latter will consist of a series of targeted interventions to facilitate sustainable development of the African electricity sector through an integrated continental electricity market based on the 2019 AfCFTA Agreement. The goal is to give African households, businesses, and industries more secure, sustainable, reliable, competitive, and affordable energy. AfSEM will be the largest single electricity market globally, covering 55-member states serving a population of over 1.3 billion. AfSEM will be the most cost-efficient response to the strong growth of electricity demand in Africa, an essential tool to use the continent's renewable energy sources' full potential, and an effective accelerator for gaining 100% access to electricity in the continent. The AfSEM will be completed through phases and governed by pan-African energy institutions. The first phase is projected to be achieved as early as 2023, and the full realization will be reached by 2040.

[85] www.esi-africa.com/industry-sectors/transmission-and-distribution/the-benefits-of-cross-border-renewable-energy-trading

TABLE 1. THE LEAST ELECTRIFIED AFRICAN COUNTRIES AND THEIR PARTICIPATION IN PIDA PAP 2 PROJECTS

Benefitting countries	PIDA PAP 2 projects	Energy subsector
Burkina Faso		
Democratic Republic of Congo	• Grand Inga Phase 1 • Inga 3 Transmission Interconnector • Construction of the 287 MEW Ruzizi IV Hydropower project • Interconnection of Electrical Networks between Inga-Cabinda and Pointe-Noire • Development of BAC and LOTEMO hydroelectric sites on the Lobaye River and related works in CAR	• Generation – hydro • Transmission lines • Generation – hydro • Transmission lines
Malawi		
Mozambique		
Burundi	• Construction of the 287 MEW Ruzizi IV Hydropower project	• Transmission lines
Liberia		
South Sudan		
Chad		
Madagascar		
The Central African Republic	• Development of BAC and LOTEMO hydroelectric sites on the Lobaye River and related works in CAR • Development of the CHOLLET hydroelectric site and associated transmission lines	• Generation – Hydro • Generation – Hydro

Source: https://pp2.au-pida.org/approved-projects

Regional electricity projects should thus be prioritized, as they could be the primary catalyst for universal electricity access in Africa and assist the less-resourced countries in achieving their electricity targets. As cited above, PIDA is the high-level mechanism to boost the regional approach to electricity infrastructure. However, it is noted that most of the countries with the least resources are not sufficiently represented in the PIDA PAP 2 projects.

To ensure that regional projects cover the least resourced countries, there should thus be a deliberate process of engaging non-participating countries in the regional projects.

[84] www.icafrica.org/en/topics-programmes/key-achievements-in-the-financing-of-african-infrastructure-in-2018

b. Crowding-in private-sector investment in energy infrastructure

Mobilizing enough private-sector investments in clean energy in Africa remains one of the main challenges to addressing the continent's energy access deficit. This mainly concerns Africa's private sector and implementing project finance in local currency. ECA has launched two initiatives to address these challenges. The SDG7 Initiative for Africa - based on three pillars of sustainability, governance, and finance – aims to align the interest of countries, the private sector, project developers, and development partners to mobilize at scale and speed private-sector finance for investment in clean energy on the continent for electricity access and climate action. In October 2021, the SDG 7 Initiative facilitated its first green bond issuance by Pacific Investment Management Company (PIMCO) and South Africa; this amounted to raising 3 billion South African rand as a green bond to finance renewables in the country. In collaboration with Sustainable Energy for All (SEforALL) and the African Energy Chamber, the second initiative, Team-Energy Africa, brings together Africa's private sector and captains of industry to work with member States and the global private sector to mobilize Africa's capital and finance from outside Africa for Africa's energy transition.

Crowding-in private sector investment is vital to sustaining long-term investment in the electricity market of Africa. Doing so requires addressing regulatory hurdles to private-sector participation in the electricity-sector value chain. According to the latest continental electricity market regulatory conditions assessment by ECA and the (Renewable Energy Solutions for Africa) RES4Africa Foundation, these hurdles often affect the *openness, attractiveness, and readiness* of Africa's electricity market value chains. Addressing these barriers is crucial to strengthening regulation for private-sector investment.

The latest assessment reveals that some progress has been made in Africa's electricity generation market related to regulatory authority independence, participatory procurement, business models for private- sector participation, competition in generation markets, and short- and long-term sector planning. One of the most pressing issues, however, is a lack of clarity on energy policies and plans for private-sector engagement. Off-taking choices are frequently restricted to public utilities. Furthermore, regulatory challenges persist in credit enhancement, tariff setting, and introducing specific incentive schemes. Power generation investors that connect to the grid system, maintain specific standards, operate within dispatch constraints, and handle bulk supply and price are all subject to regulatory uncertainty.

The ECA and RES4Africa regulatory assessment of the transmission market in Africa reveals that markets face policy, strategy, and planning challenges. Even though public procurement regimes allow private-sector participation, direct investment is generally limited. State monopoly and the lack of suitable business models are all significant obstacles. Furthermore, regulatory challenges are observed in transmission tariffs, contract regulation, and credit enhancement. Significant obstacles are also faced regarding authorization and permissions, grid code clarity regarding system standards and operation, and access to Africa's grid infrastructure.

Regulatory challenges in the distribution market include poorly defined national energy policies and plans, existing public monopolies, and limits to the engagement of the private sector, as well as retail tariffs, contract regulation, credit enhancement authorization and permits system, and availability and clarity of grid codes.

The assessment for the off-grid market, which plays a significant role in access roll-out, indicates that challenges are faced related to national energy policies, strategies, plans, limited private-sector participation models, risk reduction through credit enhancement, and poorly structured incentives. The lack of dedicated off-grid regulation also poses a significant obstacle.

Africa's power market value chains offer enormous growth potential, but growth will necessitate extension of investment opportunities along the value chain. As governmental resources grow increasingly limited, local and international private-sector participation will be necessary. To effectively engage private-sector investment in Africa's energy markets, legislative adjustments and reforms must solve the concerns throughout the value chain. If this is done, Africa's markets will be among the most open, appealing, and ready to capture a growing share of global energy market investments.

c. Deployment and investing in gas as a transitional fuel

Africa is the last global frontier for transformative investments in clean energy and climate action, with a large deficit and rich renewable energy resources. A stable and robust energy system with high flexibility that can integrate substantial proportions of variable renewable power sources such as solar and wind is a real business case for attracting these massive investments. System flexibility can be achieved through generation, transmission and distribution, storage infrastructure, and demand-side control.[86] In Africa, system flexibility for more significant proportions of variable renewables is provided chiefly through flexible generation due to inadequate grids, pricey storage, and a lack of demand-side control. Natural gas and hydropower facilities are two important flexible-generation sources that might help Africa achieve its clean energy goals. They are highly dispatchable and provide system flexibility by reacting quickly to variations in demand and supply, such as those induced by variable renewable energy sources like wind and solar power plants. With hydropower becoming more vulnerable to climate change impacts, natural gas power plants are also becoming more reliable, subject to feedstock availability. This is the case because more than half of African countries have gas reserves, and the implementation of the African Continental Free Trade Area (AfCFTA) provides the means for countries without gas reserves to have ready access to supplies.

Increasing natural gas use in power generation helps African countries to transition out of more polluting fuels like biomass, coal, diesel, and heavy fuel oil (HFO) while bringing more renewables into use. The demand for natural gas for power generation in developing countries is predicted to rise until around 2030. As renewables become more cost-competitive and competitive with natural gas for grid-connected generation, fossil fuel power plants lose market share. According to the Energy for Growth Hub projections, increasing the use of gas to meet Africa's energy demands will result in a slight rise in global emissions because the continent is starting from a low point.[87] Algeria, Ghana, Mozambique, Nigeria, Senegal, and Sudan are among the African gas-producing countries that have included natural gas actions in their Nationally Determined Contributions (NDCs) under the Paris Agreement.

African countries must seize the opportunities available to address the various obstacles to unlocking the continent's gas as a transition fuel. This will enable the continent to increase its climate ambitions, creating an economic renaissance that will support a just transition, the right of Africa to further development, and the achievement of its development goals. Countries that produce gas must:

- prepare national just transition plans outlining the role and timelines for new investments in gas as part of revised NDCs and enhanced climate ambitions under the Paris Agreement;

[86] See IRENA's paper on solutions to integrate high shares of variable renewable energy. www.irena.org/publications/2019/Jun/Solutions-to-integrate-high-shares-of-variable-renewable-energy
[87] www.weforum.org/agenda/2020/07/12-reasons-gas-africas-renewable-energy-future/

- consider the development of a continent-wide strategy and approach on a just transition and also the role of natural gas in phasing out high-polluting energy sources towards transformative investments via the continent's abundant clean energy sources;
- address policy, regulatory and uncertainty barriers to attracting long-term private-sector finance for gas in the energy transition;
- invest in gas storage and transportation infrastructure for natural gas, including liquefied natural gas; and
- capitalize on the Africa Continental Free Trade Area to develop an intra-African regional gas market.

Development partners and the private sector should recognize the urgency of closing Africa's development gap by supporting investments in gas to further the continent's energy transition; developers should recognize that Africa has contributed the least to climate change and also that investing in gas to meet the continent's energy for development needs will result in negligible emissions.

d. Building resilience in energy infrastructure

To address many African countries' growing energy deficiencies, current activities and plans must be doubled or tripled in some situations. At the same time, the energy infrastructure must survive the vagaries of climate and non-climate challenges to enable economic growth and development with reliable, secure, and affordable electricity. Hydropower is the most important source of present and future energy transformation in Africa. PIDA, for example, plans to increase hydroelectric generation by 54 GW by 2040, with the Inga project in the Democratic Republic of Congo as the primary source.[88]

Natural, technological, and human-made risks to the power system can result in everything from power outages to chronic undersupply. Hurricanes and other extreme weather occurrences, such as earthquakes, wildfires, winter storms, and rising sea levels put energy infrastructure at risk. Potential fuel supply shortages for transportation and energy generation, physical infrastructure damage, swings in energy demand, and disruption of electricity supply to end-users are all consequences of these risks.

Systematically identifying and resolving vulnerabilities through proactive resilience planning is required to improve power-sector resilience. Planning for power-sector resilience can be done at several geographic scales. It should be included in existing power-sector planning processes like integrated resource planning and power-development planning.[89] The effective incorporation of climate change into the planning and design of infrastructure projects supported by PIDA, regional plans, and national plans can significantly reduce the risk presented by future climate to the physical and economic performance of hydropower and irrigation investments. Climate risk analysis is integrated into the project cycle, starting with upstream planning phases at the national, river basin, regional, and power-pool levels. Climate hazards can be significantly addressed cost-effectively in pre-feasibility studies of specific investments.[90] The best method for governments to prepare for and recover from natural disasters is to have a good emergency preparedness plan that includes strategic investments to reduce disaster recovery time and impact. This is attainable if a comprehensive plan for assessing and addressing dangers is already in place.[91]

[88] www.worldbank.org/content/dam/Worldbank/Feature%20Story/Africa/Conference%20Edition%20Enhancing%20Africas%20Infrastructure.pdf
[89] www.nrel.gov/docs/fy19osti/73618.pdf
[90] www.worldbank.org/content/dam/Worldbank/Feature%20Story/Africa/Conference%20Edition%20Enhancing%20Africas%20Infrastructure.pdf
[91] www.worldbank.org/en/news/feature/2017/11/10/energy-resilience-takes-on-renewed-urgency

e. Better access to electricity in Africa's healthcare systems

The COVID-19 pandemic put even more strain on Africa's healthcare system, highlighting the significance of stable energy access for delivering quality healthcare. Rural communities face particular difficulties, as they usually have few primary hospitals, a shortage of medical personnel, low health literacy, insufficient access to clean water, and a poor transportation infrastructure.[92] The lack of a stable power supply in health facilities jeopardizes the quality of care for millions of people, particularly in sub-Saharan Africa, where approximately 60% of healthcare centres lack electricity, and of those that do have it, just 34% of hospitals and 28% of health clinics have power that is reliable.[93] This implies that over 60% of refrigerators used in African health clinics lack the reliable energy required for safe vaccine and drug storage. In fact, due to a lack of refrigeration, 50% of all vaccines distributed globally are spoiled.[94]

Electricity delivery through national networks frequently fails to keep up with demand; in some African countries, power interruptions occur up to 50% of the time. Many hospitals and clinics are forced to rely on diesel-powered generators as they are unable to acquire electricity from the grid. These generators are frequently unreliable, expensive to operate, and harmful to the environment. Renewable energy provides medical centres with efficient, low-cost, reliable, and independent sources of electricity, potentially significantly increasing and improving health care access and delivery in areas where power is scarce, particularly in rural areas.[95] It will take years, if not decades, to connect thousands of clinics in remote areas to power networks. Fortunately, the possibilities for quickly deployable energy solutions have expanded dramatically in recent years.

Reliable power is required for effective responses to COVID-19 and other pandemics. Improving the reliability of power for health institutions should prioritize sub-Saharan Africa's short-term policy response to COVID-19. In the long run, efforts to enhance health system resilience and speed up economic recovery will require greater access to reliable and sustainable power at health facilities.

f. Renewable energy development as a facilitator of ecological restoration

The urgency for biodiversity protection overlaps with and reinforces the need for energy transition, especially in African countries. Solar energy resources are abundant in desert areas of Africa. Photovoltaic (PV), solar thermal power generation, and other clean energy power-generation facilities can slow down the ground wind speed, reduce the impact of precipitation and soil moisture evaporation, and prevent deserts from quick expansion. Agrivoltaics, using the shade provided by the PV set-up and rainwater harvesting to provide a more nurturing environment for crops, combines solar energy and agriculture, therefore increasing land-use efficiency. It is estimated that the deployment of a 1 GW ecological PV project can reduce CO_2 emissions by about 1.2 million tons per year, with wind prevention and a sand fixation area of 4,000 hectares, which is equivalent to planting 640,000 trees.

In a more interconnected approach, the "electricity-water-land-forest" development mode is beneficial for ecological restoration, and clean electricity is a catalyst for ecological sustainability. In dry coastal regions of Africa, electricity from zero-carbon renewable energy can be used for seawater desalination to produce the freshwater needed for residential use and ecological restoration, thus combining the prevention, treatment, and utilization of desertified land and forging a virtuous circle of energy development, seawater desalination, and ecological management.

[92] www.sciencedirect.com/science/article/pii/S2542435121004384
[93] https://openknowledge.worldbank.org/bitstream/handle/10986/31333/9781464813610.pdf?sequence=6&isAllowed=y
[94] www.seforall.org/news/health-facility-electrification-in-sub-saharan-africa
[95] www.nationalgeographic.com/science/article/partner-content-energizing-africas-health-care

Energy for all (SDG 7) should advance the protection of the global climate (SDG 13) and biodiversity (SDG 15). However, there has been a lack of synergistic governance between biodiversity and energy, not to mention a systematic solution with a global perspective. This calls for cross-sector endeavours to ensure post-pandemic economic recovery and sustainable development worldwide. It is thus recommended that countries integrate related solar PV deployment into their desertification control and seawater desalination objectives and keep track of this progress as an indicator for land restoration and habitat conservation.

III. POLICY RECOMMENDATIONS

It is recognized that African countries are implementing measures to increase access to reliable, affordable electricity. Many countries have also realized the central role of sustainable electricity infrastructure in Africa's energy transition. Africa has had chequered successes in implementing electricity programmes, and countries with resources have succeeded mainly in ensuring universal access to electricity. However, the majority of African countries continue to face significant challenges. It is also realized that, without significant assistance, many countries in Africa may find it challenging to make a just energy transition. Given the above, the following policy recommendations are proposed in the short to medium term:

a) Countries with the least electricity-access rate should be prioritized in regional programmes, such as PIDA, as these countries cannot provide adequate electricity infrastructure. As the principal custodian of PIDA and other regional electricity initiatives, the African Union should ensure that the least-electrified African countries have equitable participation in these initiatives. Development partners should be mobilized to assist them and capacitate regional electricity institutions, such as the African power pools.

b) Accelerating private-sector investment is crucial to bridging the financing gap to meet SDG7. African member States should address key regulatory barriers that limit effective private-sector participation across the electricity value chain and enhance electricity market openness, attractiveness, and readiness for private investment. Considering the vital role of the off-grid market, the member States should provide specific regulatory guidance to this market segment to reduce risks for robust access-enhancement for private-sector investment.

c) Gas-producing countries need to consider the development of a continent-wide strategy and approach to the just transition as well as to the role of natural gas in phasing out high-polluting energy sources towards transformative investments able to tap the continent's abundant clean energy sources

d) Development partners and the private sector should recognize how urgent it is to close the development gap in Africa. They should support investments in gas to support Africa's energy transition, recognizing that the continent has contributed the least to climate change and that investing in gas to meet the energy for development needs of the continent will result in negligible emissions.

e) AUC, ECA, World Bank, and the AfDB have teamed up to establish the Africa Climate Resilient Investment Facility (AFRI-RES), with initial funding from the Nordic Development Fund (NDF). AFRI-RES brings to bear the comparative strengths of each of the partners to integrate long-term climate resilience in investments in climate-sensitive sectors, including water, infrastructure, energy and agriculture, under five components of project-level support; training, advocacy, dissemination and communication of lessons-learned to enhance public- and private-sector understanding of climate risks; guidelines, standards, and compendium of good practice; a knowledge and climate information portal; and overall programme management. The AU assembly has also endorsed AFRI-RES as the mechanism of building resilience in infrastructure development in Africa. The member States and PIDA PAP 2 projects should actively support the facility's activities, including its capacity building programme on integrating resilience into infrastructure planning.

SECTION 4.1

ADVANCING SDG 7 IN ASIA AND THE PACIFIC

CONTRIBUTING ORGANIZATIONS:
UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION FOR ASIA AND THE PACIFIC (UN ESCAP)

Key Messages/Summary

The progress of the Asia-Pacific region towards achieving SDG 7 targets is mixed. At the national level, there are good examples of policy and measures in each of the areas of energy access, renewable energy, and energy efficiency; however, improvement is very patchy among the countries of the region. The region as a whole will not achieve the 2030 targets unless new policy efforts are rapidly developed and adopted.

Access to electricity

Regional progress towards achieving universal access to electricity is well on track; there are several national examples of rapid electrification, and only a few nations are struggling to make good progress. Electrical connections are nearly universal in urban centres, while the access deficit remains concentrated in rural areas. Remote and sparsely populated regions are being reached with expanded national grids and off-grid solutions. In addition to ensuring that each household has an electrical connection, the key challenge facing Asia-Pacific nations is to supply universal access to higher tiers of energy services with improved reliability and better quality.

Access to clean cooking

Asia-Pacific nations are making weak progress in expanding access to clean cooking fuels and technologies. Recent years have seen a decline in the total number of people making the transition to clean cooking, reversing a previously improving trend. Some examples of effective national policies and programmes have emerged, offering concrete evidence of how prioritizing the clean cooking issue can lead to rapid progress in this area. However, more policy attention is needed across the region, including measures such as the adoption of clean cooking standards in line with World Health Organization (WHO) air quality guidelines.

Renewable energy

Modern renewable energies, particularly wind and solar, are helping renewables make small gains in their share of final energy consumption. Several nations are actively pursuing additions to their renewable energy capacity, although progress varies widely among nations and is concentrated in the power sector. The bulk of regional capacity additions are in a handful of countries, with poorer economies seeing fewer additions. To achieve SDG 7, greater efforts are needed to increase investment readiness, strengthen grids and connectivity, and expand renewables to the transport and heating sectors.

Energy efficiency

The pace of improvement of regional energy intensity is slowing, falling seriously short of the global target. While a few nations have successfully implemented energy efficiency measures across sectors, many have faced difficulties in achieving scale. An increasing share of final consumption is being covered by minimum energy performance standards (MEPS), but standards often fail to reflect the best available technologies.

Larger economies of the region have ambitions to introduce electric vehicles into the transport sector. Cost and charging convenience remain barriers to widespread uptake, but innovative business models for charging networks and battery services have the potential to accelerate adoption.

I. PROGRESS TOWARDS ACHIEVING SDG 7

The region continues to advance towards universal electrification

Of all the SDG 7 targets, electrification is the area in which the Asia-Pacific region has made the strongest gains. In 2020, the regional rate of access to electricity rose to 97.3%, and universal access by 2030 is within reach. The electrification of urban areas continues to inch upwards, rising to 99.4% in 2020, while headway is being made in rural areas, where energy access stood at 95.1% that same year. The number of people in the Asia-Pacific region who are still without an electrical connection is approximately 126 million; this remaining deficit is concentrated in low- and lower-middle-income countries, mostly in rural areas.

Several countries with large populations are well on track to achieving universal access, including Bangladesh, India, Indonesia, and the Philippines. At the same time, rapid progress has been made in a number of large deficit countries, allowing them to achieve or move closer to universal access. Timor-Leste is the region’s fastest electrifying nation, having raised the national access rate from just 38% in 2010 to 96% in 2020. Nevertheless, electrification is not on track everywhere, and efforts need to be increased in countries such as the Democratic People’s Republic of Korea, Myanmar, and Pakistan.

The growing rates of electrification can be attributed to significant efforts to expand and upgrade national power grids and the introduction of decentralized household and community solutions in hard-to-reach areas. Since the mid-2000s, the average number of people gaining access to electricity has held relatively steady, with the majority located in urban areas. The most recent period of 2018–2020 has shown a slowdown, which can in part be explained by the increasing difficulty of reaching similar numbers of people in increasingly dispersed and remote locations and the amount of investment needed to do so.

Reaching the end-of-the-line and off-grid households of the region with affordable, adequate, and reliable electricity remains the greatest challenge to achieving universal access. The long-term, sustainable operation of rural decentralized systems and the provision of energy access to more than the lowest-tier households have proven difficult in some contexts. Although public, private, and international actors have introduced numerous business models and technical approaches, regular maintenance activities are more challenging; moreover, the bundling of system operations across regions is financially inefficient because of the absence of service and equipment standards. Without ongoing financial support, some off-grid communities will remain vulnerable to the business failures of small operators and suppliers.

The clean cooking challenge is extensive, but new approaches are emerging

Access to clean cooking fuels and technologies is beginning to gain widespread attention among Asia-Pacific policymakers. The complex and multi-faceted aspects of the clean cooking challenge, however, combined with low levels of investment, mean that progress is slow, and the region is far from being on track to achieve universal access by 2030.

In 2020, primary reliance on clean cooking fuels and technologies reached an estimated 71% of the population, in line with a long-term steady improvement trend. Between 2015 and 2020, 622 million people gained access to clean cooking, but in 2020 an estimated 1.3 billion people continued to rely on dirty and polluting fuels and cookstoves. National rates of access to clean cooking in the region generally correlate with the income levels of economies, while nations with difficult geography and large rural populations tend to have larger share deficits.

The timeframe for achieving universal access is narrowing, and the pace of uptake needs to accelerate. Instead, the annual number of people in the Asia-Pacific region who have gained access to clean cooking has declined in recent years. In 2017, the estimated number of people annually who made the transition topped 136 million, but by 2020, this number had fallen to 118 million. The pandemic and recent escalations in fuel prices have only added to the challenges. Households have faced financial and logistical barriers under lockdown, as supply chains were disrupted and prices rose, causing many to revert to traditional cooking methods. Without a significant growth in numbers in the immediate term, hundreds of millions of people will remain reliant on polluting and unhealthy cooking fuels and technologies in 2030.

India, which has the world's largest clean cooking deficit of 548 million people, is also the fastest improving nation globally and can thus offer some valuable lessons for the region as a whole. In India, access increased by an average of 4.4 percentage points between 2016 and 2020, an achievement that can, in part, be attributed to the large-scale Pradhan Mantri Ujjwala Yojana (PMUY) initiative. Under the programme, low-income households receive a free stove, regulator, and 5kg gas cylinder, along with the first LPG refill. In total, as of January 2022, one hundred million connections to LPG had been made with women as account holders.

While the Indian programme provides an example of an ambitious and innovative approach to the cooking challenge, the initial free connections have not been enough to sustain LPG usage by some users. LPG cylinder refill rates suggest fuel stacking and the continued use of fuel wood, while, according to one study, 25% of beneficiaries never returned for a refill.

Affordability is a major barrier to the clean cooking transition. To help address the LPG cooking affordability gap in India and in a number of other Asia-Pacific countries, distributors have introduced smaller, cheaper cylinders, while scheduled home deliveries are reducing the time and effort for households and help increase the number of refills.

Electric cooking is emerging as an increasingly viable option as nations expand and strengthen power supplies and distribution. Nations such as Bhutan and Indonesia are promoting electric cooking to take advantage of surplus power supplies. In addition, the switch from gas to electric is being promoted to conserve strained foreign currency reserves, reduce dependency on fuel imports, and lower vulnerability to supply disruptions and fluctuating market prices. Electric cooking is being promoted in India under the 'Go Electric' campaign. Nepal has set an electric cooking target of 25% of households by 2030. Indonesia – with its highly regarded and successful kerosene-to-LPG fuel switching programme which has contributed to a rapid rise in clean cooking access – is now pushing an LPG-to-electricity stove switch by offering free induction stoves and electricity subsidies.

In rural areas where agricultural and livestock wastes are abundant, biogas is playing an important role. Cambodia, India, Lao People's Democratic Republic (PDR), and Vanuatu have programmes and targets for the deployment of biodigester technologies, providing households and small businesses with waste-to-energy solutions. However, with feedstock costs to consider and limited distribution capabilities, the application of biogas is largely constrained to on-site usage and to places where sufficient, low-cost waste feedstock is produced.

While high- and middle-income countries are seeing rapid growth, the region is falling short on renewable energy

The Asia-Pacific region has abundant renewable energy resources. Until recent years, however, the renewable share of final energy consumption was on a steep downward trend as the region experienced rapid development largely fuelled by coal, oil, and natural gas. Only when the use of modern renewable sources, such as wind and solar, began to ramp up, did the Asia-Pacific renewable share begin to recover. In 2019, modern renewable energy rose to 9.8% of regional total final energy consumption, helping drive the total share of renewables, including modern and traditional forms, to a 10-year high of 15.8%.

The region is experiencing a shift in its modern renewable energy mix, of which hydropower has long been the foundation, and ongoing development in the sector has been strong. As potential dam sites dwindle, however, and climate change and shifting hydrological conditions increasingly make this energy source unreliable, hydropower development has slowed. Wind and solar now represent the greatest shares in annual new installed capacity. In 2020, for the first time, solar and wind cumulative capacity exceeded that of hydropower. This was due to continued strong solar installations across the region and a jump in wind installations in China. Regional renewable energy installations in 2020 were approximately 79 GW each for wind and solar, while hydro installations accounted for 17 GW.

China is the global and regional powerhouse in terms of renewable energy technology development and deployment, while India and Turkey have also seen large scale installations in recent years. The Asia-Pacific region currently leads the world in renewable energy auctions, which are playing an important role in the shift to wind and solar, attracting new investments, and driving prices downwards.

While per capita installed renewable generating capacity has increased more than six-fold for the region, there is a clear divide in the pace of progress between wealthier and poorer nations. High- income and upper-middle-income economies are experiencing rapidly rising renewable electricity- generating capacity, while lower-middle- and low-income economies are progressing slowly. Poorer countries generally have few actors in the renewable energy space and limited domestic technical and financial capacities.

In terms of investment, international financial flows to Asia-Pacific developing countries in support of clean energy research and development and renewable energy production fell significantly in 2019 for the second year in a row to $3.4 trillion, the lowest level since 2010 and just over one-third of peak investment of $9.3 trillion in 2017. While many Asia-Pacific nations have successfully attracted investors, others require additional support to advance planning, policy, and investment readiness.

Growing pressures to take action on climate change, along with the increasing affordability of renewable energy, has led to energy development plans with an increasing focus on renewables. This has been coupled with a shift away from coal. In 2021, including at COP-26 in Glasgow, governments, banks, and organizations announced coal phase-outs; countries announcing phase-outs included Indonesia, Malaysia, Nepal, Pakistan, Philippines, Republic of Korea, Singapore, Sri Lanka and Viet Nam. In a statement entitled ‘Global coal to clean power transition statement’, governments also committed to scaling up clean power and ensuring a just transition. This development follows announcements from the governments of China, Japan, and Republic of Korea that they were ending overseas coal financing.

Despite the indication of significant policy change, policymakers have not turned their backs, at least in the near-term, on fossil fuels, which have served as the backbone of the region’s economic growth. In 2020, coal energy supplies reached historic highs in Bangladesh, China, Indonesia, Philippines, Republic of Korea, Tajikistan, Thailand, and Viet Nam. The 14th five-year plan (FYP) (2021–2025) for the energy sector of China, while targeting large-scale installations of wind and solar, also looks to increase oil and gas production, while continuing coal use, including as a flexible power source to balance out variable renewable energy supplies.

With continued reliance on fossil fuels, much of the region is falling short of renewable energy targets. For example, in Southeast Asia, the aspirational 23% renewable energy target for regional primary energy in the countries of the Association of Southeast Asian Nations (ASEAN) and the 35% for electricity access by 2025 are unlikely to be achieved. Having targets alone is not enough, and without policy and investment alignment, the momentum of continued fossil fuel development will be difficult-to-slow, as data from Southeast Asia demonstrate. According to the ASEAN Centre for Energy, coal, oil, and gas are expected to make up approximately 69% of capacity additions in 2022. The cost of renewable energy deployment, coupled with insufficient technical and financial capacity, continues to be a barrier to achieving the scale of renewable energy deployment needed in many contexts.

Despite some of the region's cautious uptake of renewables, updated Nationally Determined Contributions (NDCs) and recently adopted net zero targets are ushering in more ambitious clean energy strategies. In line with this, some Asia-Pacific nations are looking to increase power grid connectivity within national systems and with neighbouring countries. These efforts will increase capacity and help provide flexibility, allowing for larger shares of renewable energy. For example, in Indonesia, the state power utility has plans for a supergrid that includes inter-island and cross-border electricity interconnections and intersects with the larger ASEAN Power Grid. The government of India has approved 23 new inter-state transmission system projects. The country may miss its renewable target of 175 GW by 2022, having been hampered by pandemic-related delays and differing approaches being taken by individual states, but the nation has recently raised its ambitions, targeting a cumulative 500 GW and 50% share of non-fossil fuel energy by 2030. Green power corridors to evacuate renewable power, the waiving of interstate transmission charges, and priority dispatch are some of the supporting measures.

China's extensive ultra-high-voltage (UHV) grid interconnections have allowed the country to dominate global renewable capacity additions and enabled the long-distance transport of clean energy from western regions to eastern and central load centres. Building on existing systems, the newly announced 'grand base project' is focused on desert regions and is estimated to produce an additional 400 GW of installed renewable capacity, around half of which will be completed during the 14th FYP period.

Several new initiatives are addressing some of the region's investment and financing shortfalls. The ASEAN Catalytic Green Finance Facility will help de-risk green infrastructure projects and mobilize public and private financing. At the same time, the Asian Development Bank (ADB)-backed Energy Transition Mechanism and Climate Investment Funds are looking to utilize market-based approaches to support the early retirement of coal power plants in India, Indonesia, and the Philippines, with the potential to expand to other countries in the region. Other promising developments include the Regional Comprehensive Economic Partnership (RCEP), a free trade agreement between 10 Southeast Asian economies and Australia, China, Japan, New Zealand, and Republic of Korea; this came into force in 2022 and is expected to support the energy transition with new levels of regional cooperation, strengthened trade, and expanded investment opportunities.

Energy efficiency requires scaled deployment

The Asia-Pacific region accounts for nearly two-fifths of the world's GDP and nearly half of energy consumption. It continues to gain shares in these areas and thus plays a critical role in the achievement of the global energy efficiency target. In contrast to development needs, the regional rate of primary energy intensity improvement has slowed in recent years, from 2.8% in the 2010–2015 period to 1.9% in 2015–2019. Without a significant acceleration in energy efficiency measures, both the region and the world will fall short of the SDG 7 target.

In comparison to other aspects of the energy sector, energy efficiency has not been provided with the level of attention or means of implementation needed to realize its full development benefits, while the COVID-19 pandemic has raised barriers to the expansion of energy efficiency. Investments have declined due to competing public-sector interests and government prioritization of economic recovery, resulting in a fall back to familiar development strategies. Investments in the industrial and commercial sectors were constricted during the pandemic as economic activities were scaled back and supply chain disruptions impacted service and product delivery. At the same time, businesses facing financial hardships cut investments, while the erosion of the creditworthiness of those businesses, due to the lower economic activity, made financing for energy efficiency more difficult.

Energy efficiency needs to be deployed at scale. ESCO-based models[96] are one means of delivery, but for many Asia-Pacific contexts these have not resulted in the needed pace or scale of improvements. Challenges include lack of opportunity identification, hurdles to financing, and scepticism among building and facility owners regarding investment returns. Small projects undertaken individually can be difficult to implement in a cost-effective manner, while performance-based models can be difficult to finance because of low lender confidence and high perceived risks, while also potentially leading to debates on cost savings calculations.

Greater focus is needed on developing national strategies for scaled energy efficiency efforts. One pathway includes targeting large-scale facilities in a sector or a series of facilities. For example, China has achieved impressive industrial energy savings, first by applying energy performance requirements to the largest operators in a sector, then by introducing a requirement for smaller actors. Across industries, benchmark performance levels have been regularly adjusted to meet increasingly ambitious energy performance targets. Under the country's recently released FYP for the energy sector, China is looking for a significant increase in energy efficiency and plans to lower its energy consumption per unit of GDP by 13.5% during the 2021–2025 period, in part through a new series of sector targets.

Scale can also be achieved by improving or replacing technologies that can be aggregated, such as municipal street lighting, boilers, and motors, across a portfolio of locations or facilities, while bulk procurement can offer savings that lower investment risks. One example is India which has used bulk procurement to purchase and make available energy-efficient light bulbs, motors, and air conditioning units at significantly reduced costs.

Energy efficiency progress is also reliant on market availability and consumer choice. Countries are gaining ground in introducing MEPS across sectors, but more needs to be done not only to tighten standards, but also to raise awareness of the benefits of high-efficiency choices through labelling, consumer awareness, and incentives. To support the development and application of improved MEPS, governments require better data across the range of end uses. Harmonized testing and labelling requirements could also support regional technology trade and development.

In the transport sector, electric vehicles are poised to improve transport energy efficiency. Many nations are mobilizing towards adopting e-vehicles (EVs), including light-duty passenger cars, medium- and heavy-duty commercial trucks, and two- and three-wheeled vehicles. Current high fuel prices and growing energy security concerns are giving EVs an additional boost. In Thailand, for example, surging oil and power prices have prompted several key property developers to start including solar roofs and EV chargers in new houses.

China produces more than half of global EVs and is also a leader in electric bus and commercial vehicle manufacturing. The country is aggressively pursuing EVs with expanded charging networks, battery-swapping stations, and battery subscription service innovations. In India, the 'Go Electric' campaign aims to boost confidence in electric vehicles, and EV policies are being drafted in several Indian states. The nation's first EV-friendly highway is being developed under the FAME-1 (Faster Adoption and Manufacturing of [Hybrid] & Electric Vehicles in India) scheme, while investments at several airports are transforming commercial fleets and helping push towards net-zero for these facilities. In Indonesia, where motorcycles outnumber cars, cooperation between the State-owned oil and gas companies and

[96] Energy service companies (ESCOs) develop, design, build, and arrange financing for projects that save energy, reduce energy costs, and decrease operations and maintenance costs at their clients' facilities.

EV manufacturers aims to develop electric motorcycles and EV battery–swapping networks. In Malaysia, a Memorandum of Understanding (MOU) between a highway operator and the country's power utility is also looking to create a network of electric vehicle charging stations.

II. POLICY IMPLICATIONS/RECOMMENDATIONS

While the Asia-Pacific region has demonstrated leadership, innovation, and progress across energy access, renewable energy, and energy efficiency objectives, the current pace of progress will not enable achievement of SDG 7 targets by 2030. Poorer nations, smaller economies, and those with difficult geographic conditions face some of the greatest challenges. Countries are not uniformly equipped with the policies and capacities needed to support accelerated progress; nor do they have access to financing mechanisms.

Encouragingly, the technology and know-how to achieve SDG 7 already exist within the region, and increased regional cooperation can be a major contributor to speeding up the pace of clean energy development. In 2022, the Indonesia G20 presidency, which is prioritizing the energy transition with focuses on energy access, technology, and financing, offers prospects for greater regional and global cooperation.

In terms of energy access, policy attention should focus on ensuring equitable, high-quality energy services. Electrification plans need to target achieving the upper tiers of energy access; special attention should be paid to off-grid communities where standardization of technologies and business models could support more sustainable and affordable operations. To advance the clean cooking agenda, reliable and affordable energy distribution networks are needed. The potential to couple electric cooking with electrification and power grid expansion and upgrade efforts should be considered.

Clean energy technology development and deployment underpin renewable energy and energy efficiency goals. Greater efforts are needed to drive technology costs down, while raising performance levels and introducing increasingly effective service delivery models across sectors. Both supply and demand sides should be addressed in parallel as clean energy technology is scaled.

Financing for sustainable energy has declined in recent years, but to achieve SDG 7 and net-zero pledges, tremendous investments are needed. Although the pandemic and high energy prices have reduced fiscal spaces and shifted policy priorities to economic recovery, the region is at a critical point where the energy pathways chosen will determine how close the region comes to achieving the SDG 7 targets by 2030. Smart investments in clean energy supplies, power grids, and energy efficiency can offer a multitude of economic and social benefits, but nations must align planning and policy frameworks to create investment-friendly environments that are able to attract the levels of financing needed.

Finally, the benefits of regional cooperation must not be forgotten. The common energy challenges faced by the Asia-Pacific nations can be better solved through the continuation of open dialogue and information exchange.

SECTION 4.3

ADVANCING SDG 7 IN THE ARAB REGION

CONTRIBUTING ORGANIZATIONS:
UNITED NATIONS ECONOMIC AND SOCIAL COMMISSION FOR WESTERN ASIA (UNESCWA), GLOBAL ENERGY INTERCONNECTION DEVELOPMENT AND COOPERATION ORGANIZATION (GEIDCO) AND UNITED NATIONS INSTITUTE FOR TRAINING AND RESEARCH (UNITAR)

Key Messages/Summary

Progress towards achieving SDG 7

The Arab region is lagging behind in achieving Sustainable Development Goal (SDG) 7. Supply chain disruptions, economic downturn, conflict, and instability in several Arab countries has impacted progress. Efforts in the first half of the decade are vital if the Arab region is to achieve SDG 7 by 2030. An increase in electricity prices due to an increase in global fuel prices could not only impact vulnerable households but also reduce the reliability of the power supply. Given the geopolitical situation and rising energy prices, there is a strong incentive for governments to shift to renewable energy (RE) sources and invest in energy efficiency as soon as possible.

Access to energy

Access to electricity in the Arab region was around 90% in 2020, with about 42 million people having no electricity access. Although the number decreased by about 3 million between 2019 and 2020, there was a noticeable slowdown in the rate of access to electricity. Electricity access was higher in urban areas with 98% having electricity access in urban and only 82% of rural areas. In Arab countries 53 million people had no access to clean cooking. Although the overall access to clean cooking fuels and technologies was about 87%, there were large sub-regional disparities. Only 35% of the people in Arab LDCs had access to clean cooking, while other countries had full or almost full access.

[98] The Arab region, as mentioned here, includes: Maghreb (Algeria, Libya, Morocco, and Tunisia); Mashreq (Egypt, Iraq, Jordan, Lebanon, State of Palestine, and Syria); the Gulf Cooperation Council (GCC) (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and United Arab Emirates); and the Least Developed Countries (LDCs) (Comoros, Djibouti, Mauritania, Somalia, Sudan, and Yemen).

Efficiency

Primary energy intensity in the Arab region was 4.9 megajoules per US dollar at 2017 purchasing power parity (4.9 MJ/US$ 2017 PPP); this was higher than the average global primary energy intensity (4.7 MJ/US$ 2017 PPP) in 2019. While there have been improvements over the past decade, there was a slowdown in the improvement of energy intensity, and the compound annual growth rate (CAGR) decreased from -2.3% (2017–2018) to -1.4% (2018–2019), indicating a shortfall from the SDG 7.3 target of improving energy intensity by 2.6% per year till 2030.

Renewables

Renewable energy penetration rates continue to lag behind other regions, with about 13.4% of the Arab population having access to renewables. In term of consumption, only 4.6% of the region's total final energy consumption comes from renewables, mainly from traditional biomass. Three countries (Egypt, Somalia, and Sudan) account for 72% of the region's renewable energy consumption, including traditional renewable sources such as solid biofuels, which comprise 78% of renewable energy in the region. Modern renewables, however, continue to grow as their falling costs have made them increasingly cost-competitive with conventional sources, particularly in the Gulf Cooperation Council (GCC) countries.[98]

Priority actions over the next four years

- Integrate sustainable energy action plans into development strategies with clear SDG targets and set ambitious GHG reduction targets.
- Clearly identify cross-sectoral interlinkages between SDG 7 and other SDGs, such as education, gender equality, impact on life on land and below water, manage the trade-offs and synergies between them, and harness these to achieve multiple benefits.
- Implement decentralized renewable energy solutions, especially in remote areas without grid connectivity.
- Invest in technical capacity-building and involve all stakeholders in collaborative decision-making processes to enable faster resource mobilization and on-ground action.
- Tap into climate finance to increase funding for SDG 7 and leverage public finance to catalyse private financing for deployment of decentralized electricity and clean-cooking solutions.

Towards 2030

- Pursue regional grid interconnection to increase energy security and the share of renewables in the power sector by connecting demand centres with remote sources of low-cost renewable generation while increasing system flexibility.
- Integrate gender equality and women's empowerment in policies for universal energy access by providing technical, financial, and material support in the form of gender-specific programmes for production and distribution of modern energy services.
- Involve the private sector in developing renewable energy resources and energy infrastructure, and strengthen human and institutional capacity for energy governance.
- Develop a digital strategy that leverages innovative technologies such as machine learning and blockchain to increase access to, and the quality of, modern and sustainable energy services for rural and urban communities.

[98] Data from the World Energy Balances provided by IEA.

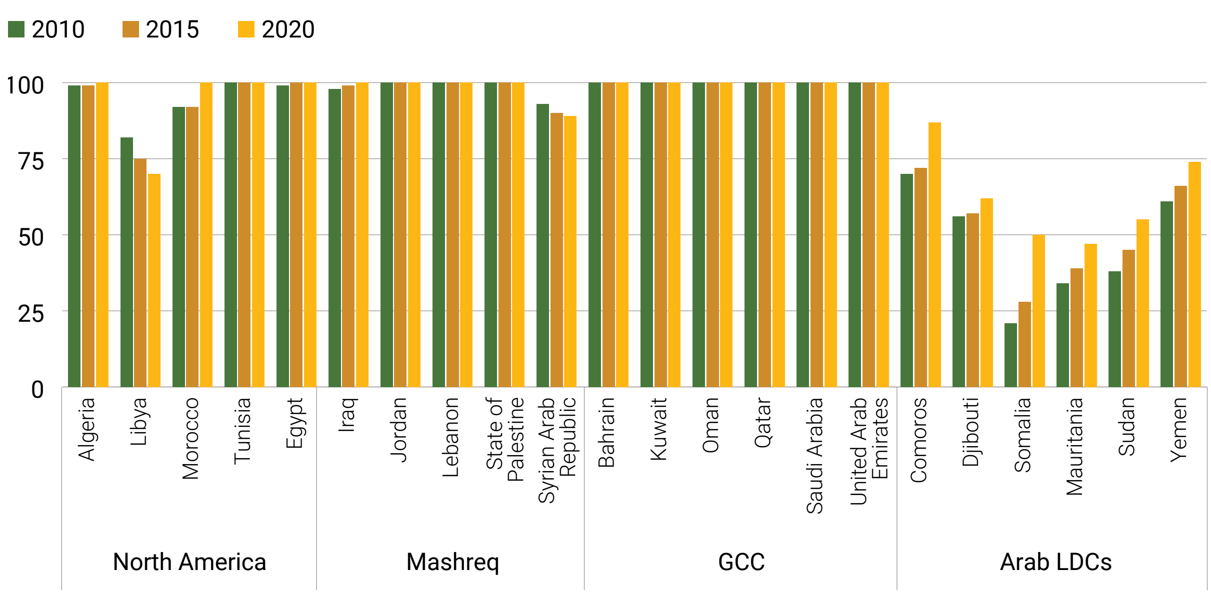
I. PROGRESS TOWARDS ACHIEVING SDG 7

Energy Access

Electrification – The total number of people without access to electricity decreased from 45 million in 2019 to 42 million in 2020 in the region, but there was a noticeable slowdown in the rate of electrification. Electricity access in the Arab LDCs showed an improvement of 3.8 percentage points from 2018 to 2019 but just 1.1 percentage points from 2019 to 2020. As a result, there was only a marginal improvement and the overall access to electricity in the Arab region continued to be around 90% in 2020. Inequity in electricity access was evident with approximately 53%, 50%, and 45% of the population in Mauritania, Somalia, and Sudan, respectively, still not having access to electricity.[99] Further, the share of people without electricity access increased in conflict-ridden countries such as Libya (30%) and the Syrian Arab Republic (11%), which is a setback to universal electricity access.[100]

Rural – urban divide. In 2020, 98% of urban areas in the Arab region had access to electricity compared to only 82% of rural areas. The rural–urban divide was prominent in Arab LDCs where urban electricity access was 83%, as against 47% in rural areas.[101] Lack of access to electricity in rural areas restricts economic opportunities for people and promotes migration to cities, putting additional burdens on city infrastructure. Standalone solar PV systems, micro- and mini-grids, and modular energy storage solutions such as batteries could provide cost-effective alternatives to a centralized electricity grid in the short to medium term.

FIGURE 1. SHARE OF POPULATION WITH ELECTRICITY ACCESS IN THE ARAB REGION, 2010, 2015, AND 2020 (%)



Source: Data from database provided by World Bank.

99 Data from database provided by World Bank.
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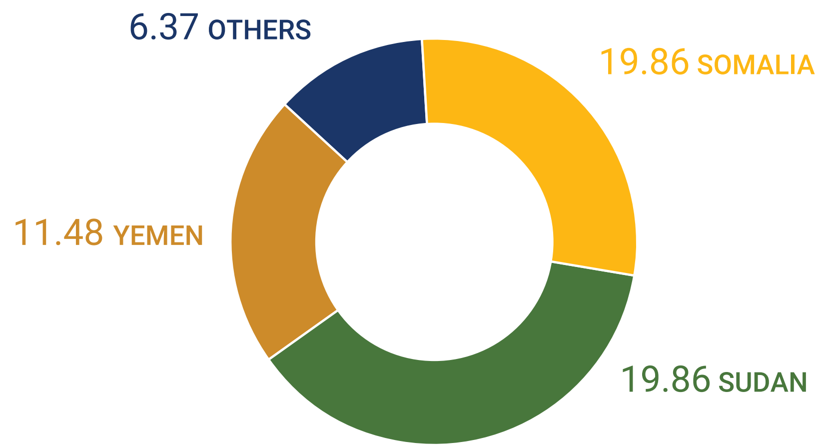
101 Data from database provided by World Bank.

FIGURE 2. SHARE OF POPULATION WITH ELECTRICITY ACCESS IN THE ARAB REGION, 2010, 2015, AND 2020 (%)



Source: Data from database provided by World Bank.

Quality and affordability of electricity supply. Access to electricity is a binary parameter, but households also require a higher quality of electricity supply. Reliability of electricity is a major challenge in some countries, and many households do not have a round-the-clock supply of electricity. Rising fuel prices has led to the cost of electricity increasing, and high electricity prices disproportionately impact households in the lower-income deciles. On the other hand, many countries in the Arab region provide untargeted subsidies, which puts additional burdens on government budgets, while at the same time causing energy inefficiency.

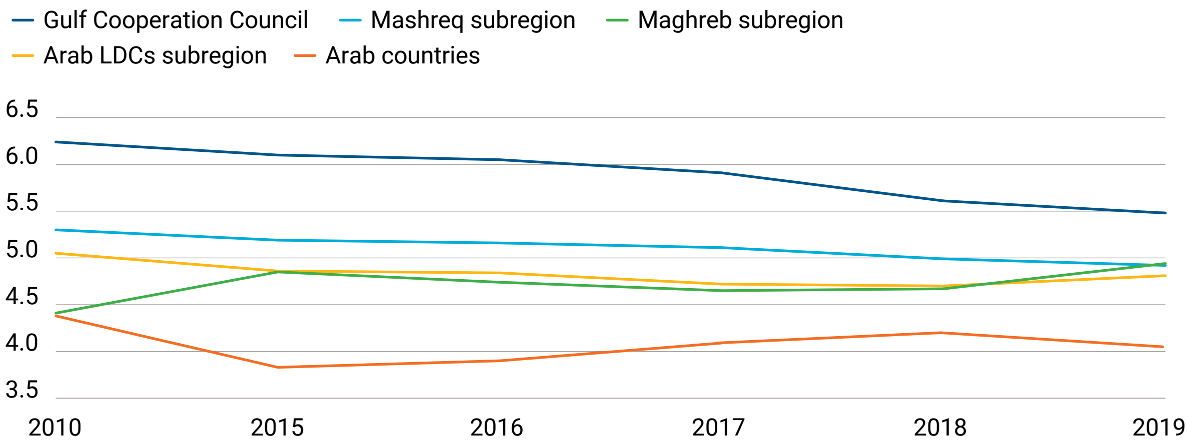
Clean Cooking. In the Arab region, 87% of people have access to clean cooking fuels and technology (CFTs), but there are large sub-regional disparities. In 2020, 53 million people in the region did not have access to CFTs. Access to clean cooking is severely restricted in three Arab LDCs, namely Somalia, Sudan, and Yemen, such that 88% of the population in the Arab region do not have access to clean cooking. Lack of CFTs is a chronic problem in Comoros, Djibouti, and Somalia, where more than 90% of the population have no access to clean cooking.[102]

Estimates indicate that there was a marginal increase in the number of people without access to clean cooking between 2019 and 2020, which is a setback to the achievement of SDG 7. In addition to the LDCs, there has been a decline in the population with access to clean cooking in the Syrian Arab Republic, due to migration and conflict.

Rural – urban divide. The rural–urban divide also has an impact on overall access to clean cooking for the Arab region due to the access deficit for population in rural areas. In the Arab region 6% of the urban population had no access to clean cooking, while 22% of the rural population suffered from a clean cooking deficit. The rural–urban divide was most evident in Yemen, Mauritania, and Sudan where there was a difference of 52, 46, and 21 percentage points, respectively, between people in rural and urban areas with access to CFTs. Less than 3% of the rural population had access to CFTs in Somalia, Djibouti, and Comoros, indicating the quantum of effort required to provide clean cooking access to these people.

[102] Data from database provided by WHO.

FIGURE 3. ARAB SUB-REGION ENERGY INTENSITY TRENDS FROM 2010–2019 (MJ/ US$ 2017 PPP)



Source: Data from the World Energy Balances provided by IEA.

Energy Efficiency

Energy Intensity in the Arab region declined from 5.3 MJ/US$ 2017 PPP in 2010 to 4.9 MJ/US$ 2017 PPP in 2019. The gradual decline in energy intensity was driven by lower energy intensity in the GCC sub-region which decreased from 6.2 MJ/US$ 2017 PPP (2010) to 5.5 MJ/US$ 2017 PPP (2019). A declining trend was also observed in Arab LDCs until 2017, possibly due to the replacement of traditional forms of energy, such as biomass for cooking, with modern forms of energy and the use of efficient cookstoves, but a marginal uptrend was observed in 2019. Energy intensity in the Maghreb sub-region also increased over the last two years, marking a reversal in the declining trend. Energy intensity in the Mashreq sub-region (4.05 MJ/US$ 2017 PPP) was lower than the global primary energy intensity (4.7 MJ/US$ 2017 PPP), but all other sub-regions had a higher energy intensity in 2019, which points to the high potential for energy savings in the Arab region. A slowdown in the improvement of energy intensity was also observed, and the CAGR decreased from -2.3% (2017–2018) to -1.4% (2018–2019), reflecting the impact of COVID-19 on energy efficiency improvements. This also indicates the large shortfall from the SDG 7.3 target of improving energy intensity by 2.6% per year until 2030.

Continued shortfalls – below rates that would meet the target of SDG 7.3 – imply that as policies on energy efficiency are not yielding the desired results, greater efforts are needed by all countries. Furthermore, each year's shortfall in meeting the target increases the average rate of improvement needed in the remaining years until 2030, and the global target of energy intensity improvement has now increased to 3.2% per year through 2030 to make up for slow progress in past years. Early action on energy efficiency through well designed and effectively implemented energy efficiency policies can deliver multiple benefits quite apart from lifetime savings of energy and GHG emissions. Price signals also play a vital role in attracting private investments in energy efficiency; countries in the Arab region thus need to move ahead with gradual rationalization of energy prices in order to accelerate efforts to meet the SDG 7.3 target. Renewable Energy

[103] Data from the World Energy Balances provided by IEA.

Renewable Energy

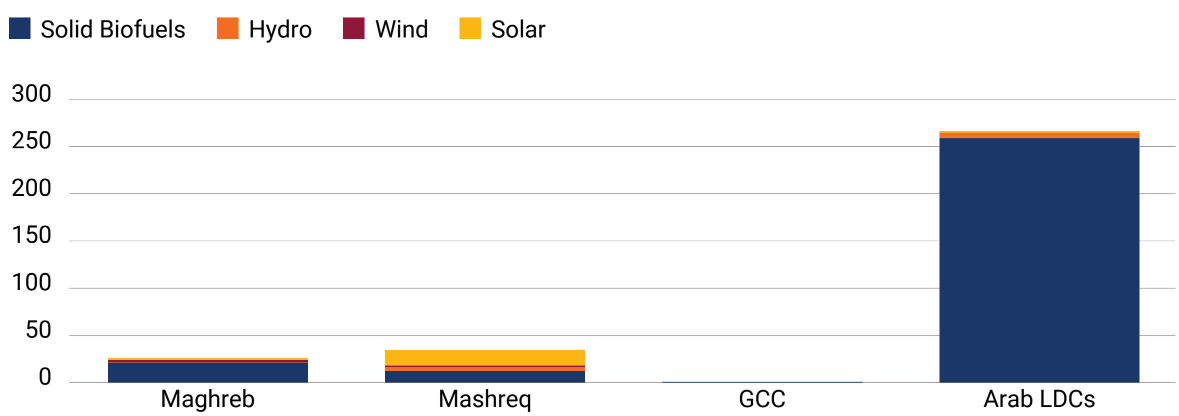
Renewable energy penetration rates continue to lag behind other regions, with about 13.4% of the Arab population having access to renewables. In term of consumption, only 4.6% of the region's total final energy consumption comes from renewables, mainly from traditional biomass. Three countries (Egypt, Somalia, and Sudan) account for 72% of the region's renewable energy consumption, including traditional sources such as solid biofuels, which at 78% accounts for the lion's share of renewable energy in the region. Total installed renewable capacity in the region more than doubled over the past decade, reaching nearly 23GW in 2020,[104] with recent additions primarily in solar.

Solid biofuels continue to account for the largest share of renewable energy consumed in the Arab region – around 78% of total renewable energy consumption, with over 86% of the region's total consumption concentrated in Egypt, Morocco, Somalia, and Sudan. Most of the region's solid biofuel is traditional and is largely used for cooking, heating, and even lighting, with resultant low efficiency levels and adverse effects on health due to indoor air pollution.

In 2019 solar and wind energy account for 11% of the region's renewable energy consumption, with solar the fastest growing renewable energy source in power generation. Jordan, Lebanon, the State of Palestine, and Yemen had the highest shares of solar in their mix relative to other countries in the region, while Morocco leads the way in wind energy, accounting for 45% of the region's total wind energy consumption. Unlike solar, wind resources are unequally distributed in the region, but wind power is gaining ground in several countries, including Egypt and Jordan.

Significant cost reductions for solar power utility-size projects and wind power have been achieved in the Arab region, driven more recently by effective policies designed to remove market barriers and encourage private-sector investments. This includes a positive investment climate for utility-scale solutions and attractive financing rates, particularly in the GCC, resulting in a series of world

FIGURE 4. SHARE OF INDIVIDUAL RE SOURCES IN TOTAL FINAL ENERGY CONSUMPTION, BY ARAB SUB-REGION, 2019



Data source: Data from the World Energy Balances provided by IEA

[104] IRENA (2021a), Renewable Capacity Statistics

record-breaking tenders for PV. The years 2020 and 2021 witnessed three record low bids for solar PV, all of which were in the GCC subregion: USD 0.0157/kWh in Qatar; USD 0.0135/kWh in the United Arab Emirates; and USD 0.0104/kWh in the Kingdom of Saudi Arabia.[105]

II. POLICY IMPLICATIONS & RECOMMENDATIONS

Take action to accelerate achievement of SDG 7 to mitigate energy security risks. Increasing demand for oil and gas and the Ukraine crisis have led to a spike in the global price of fossil fuels which may lead to cascading risks from inflation and possible fuel supply-chain disruptions. Access to clean energy sources for electricity and cooking, localized electricity generation from renewable energy, and improvements in energy efficiency contribute to improved energy availability and mitigate the impact of rising fossil fuel prices. Increased regional grid interconnection can also increase energy access, while lowering energy costs for consumers and increasing the share of renewables in the power sector.

Increase public investment for clean energy access. Governments should make clean energy access a top political priority by setting ambitious targets, plans, and policies, while implementing specific projects for achieving clean energy access. Detailed implementation plans for on-grid as well as off-grid solutions should be backed by public investments and supported by technical and financial resources from the international community to achieve progress on the ground.

Implement policies for economy-wide energy savings. Implementing specific policies to promote energy efficient technologies and processes leads to energy and GHG emission savings over the lifetime of the project. Economy-wide energy savings decrease the impact of volatility in oil and gas prices and assure the availability of resources for future generations.

Leverage digital technologies to provide on-demand access to energy services. Innovative project financing models using blockchain technology have unlocked global funds to accelerate off-grid solar PV deployment in developing rural areas, while artificial intelligence and machine learning have enabled more accurate renewable generation forecasting and thus better grid management. Mini-grids and peer-to-peer energy trading have the potential to deliver increased access to clean electricity, while improving energy quality for those beyond the reach of centralized grids. These innovative business models have the potential to scale and produce positive social and economic outcomes, such as increased local employment and entrepreneurship. Best practices from across the region and the world must be studied and adapted for local implementation.

Deploy solar PV for desalination and to aid in ecological restoration. The Arab region has one of the highest solar insolation levels in the world. Use of solar PV for desalination of water can increase the availability of fresh water for drinking and agriculture. Deployment of solar PV in desert areas can result in slowing down the ground wind speed, and reducing the impact of precipitation and soil moisture evaporation, thereby slowing desertification, and leading to ecological restoration, including biodiversity enhancement.

Implement multi-stakeholder partnerships. Multi-stakeholder partnerships and enhanced efforts to meet SDG 7 will contribute to the goal of global net-zero emissions by 2050. A higher share of RE in the energy mix, decreasing energy intensity, and increased access to clean energy in the Arab region will complement global efforts to achieve carbon neutrality by 2050.

[105] IRENA (2021b), Renewable Power Generation Costs in 2020

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SECTION 4.4

ADVANCING SDG 7 IN THE ECE REGION (CENTRAL ASIA, EUROPE AND NORTH AMERICA)

CONTRIBUTING ORGANIZATION:
UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE (UN ECE)

Key Messages/Summary

The countries of the United Nations Economic Commission for Europe (ECE) region continue to make progress on key indicators for Sustainable Development Goal 7. The results on energy access, clean cooking fuels, energy efficiency, and renewable energy have not changed significantly since previous reports. The region has achieved 100% access to modern energy services and clean cooking fuels though there are still remote communities whose access does not register in the reported statistics and that require attention. Distributed renewable generation, small-scale storage, and microgrids are notable opportunities for these communities. With respect to energy efficiency indicators, the region's results are better than the global indicators, but there are still significant opportunities for improvement. Regarding renewable energy, the western reaches of the ECE region have seen a great deal of investment in renewable energy technology, whereas in the eastern reaches, activity has been more limited. The main issues relate to end-use tariffs, market design, and investment policy.

As of 2019, the ECE region accounted for 43% of world gross domestic product and 38% of its total energy supply. Both percentages have grown significantly at global and regional levels. The pace of improvement of energy intensity in the ECE region has accelerated, outpacing global indicators.

Looking at the sustainability challenge from a purely climate perspective, in 1990 the energy mix in the region was 80% fossil. More recently, following major efforts on renewables and on energy efficiency, the energy mix in the region was reported to be 82% fossil. Despite efforts, the results are retrograde and the region is not delivering on its objectives and commitments.

In 2022, the big development for the energy sector in the region was the war in Ukraine and its consequences for energy prices and energy security. The response of energy importers to this forced energy crisis has been, in part, to diversify gas supplies while searching for alternatives to gas and, in part, to seek energy independence. These efforts have has led to a reversion to existing infrastructure based on coal. That shift will show up in the statistics in a couple of years as degradations in technical efficiency and emissions. An optimistic view of the situation is that the conflict will provoke a pivot away from oil, gas, and coal; however, that begs the question as to how such a pivot will affect energy balances and the energy trade. Energy security and energy resilience are now top of the agenda. Neither the climate agenda nor the sustainable development agenda have been forgotten, but security is the current priority.

The most important opportunity to address security, climate, and quality of life quickly and at scale is in the built environment. Improvements in this area are an imperative, given the opportunity it represents. A second area of attention is in methane management – done properly it is possible to address accumulating concentrations of methane in the atmosphere while providing economic energy and contributing to a just transition. Achieving carbon neutrality will require a pragmatic approach on policy and technology choices, and there is likely to be closer attention to and investment in carbon capture and storage, high efficiency/low emissions fossil technology, nuclear energy, and renewable gases, including hydrogen. There are calls for a real price on carbon (greenhouse gases) that would change the economic equilibrium in energy markets if managed properly. In the current price environment, discussions about carbon pricing and subsidies remain difficult.

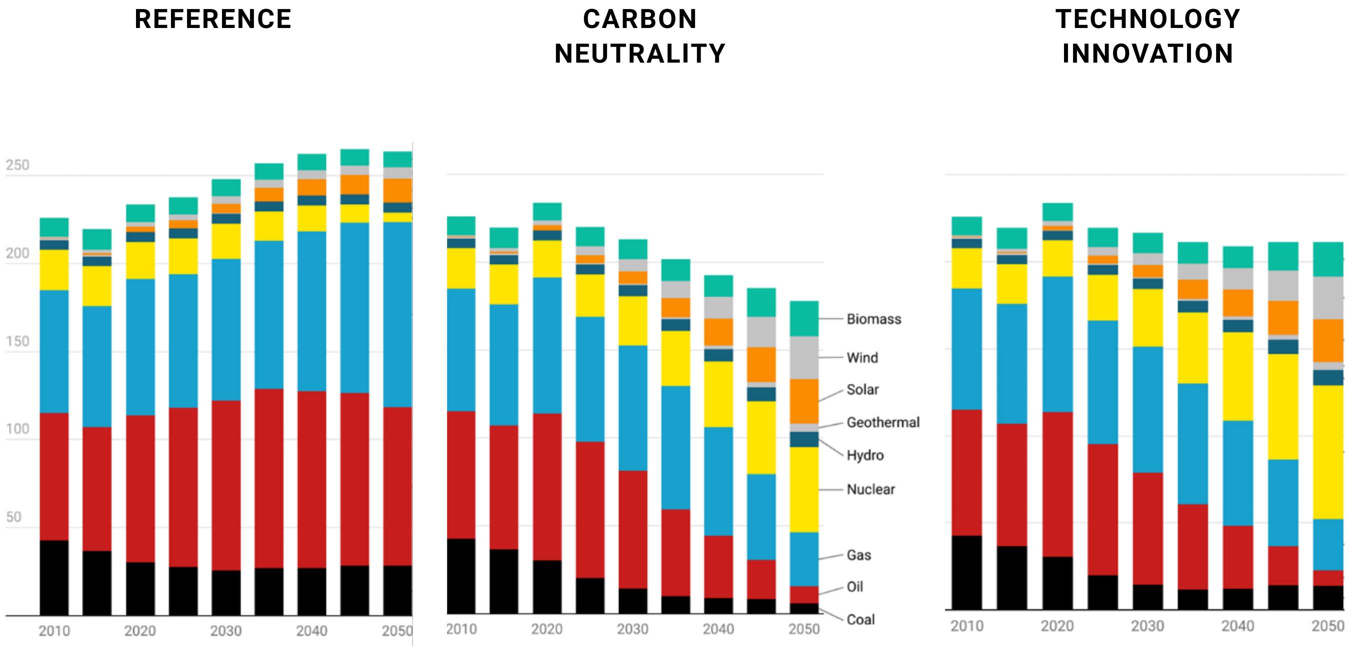
In conclusion, the statistics, while showing good results for energy access, also show the region to be falling short on the other targets of SDG 7 and on the broader role that energy must play in the quest for a sustainable future. Tools are at hand for major steps forward. It is expected that the statistics for the current period will reveal deterioration when they are collected and reported in the coming years; but thereafter rapid shifts will be possible.

I. PROGRESS IN THE REGION

Technology Interplay

National actions and international climate targets set in the Paris Agreement and at COP26 are falling short in terms of limiting global warming to 1.5–2°C. It is possible to design and implement a carbon-neutral energy system through: i) accelerated phase-out of conventional fossil fuels; ii) accelerated deployment of renewable energy and nuclear power; and iii) innovation in low- and zero-carbon technologies (including carbon capture, use, and storage, hydrogen and next-generation nuclear power). The region must transfer technology effectively, expand the institutional capacity needed to support technology deployment, and engage all stakeholders in order to secure an affordable and carbon-neutral energy system. Actions to secure the technology needed to achieve carbon neutrality include raising awareness

FIGURE 1. PRIMARY ENERGY SUPPLY IN ECE REGION



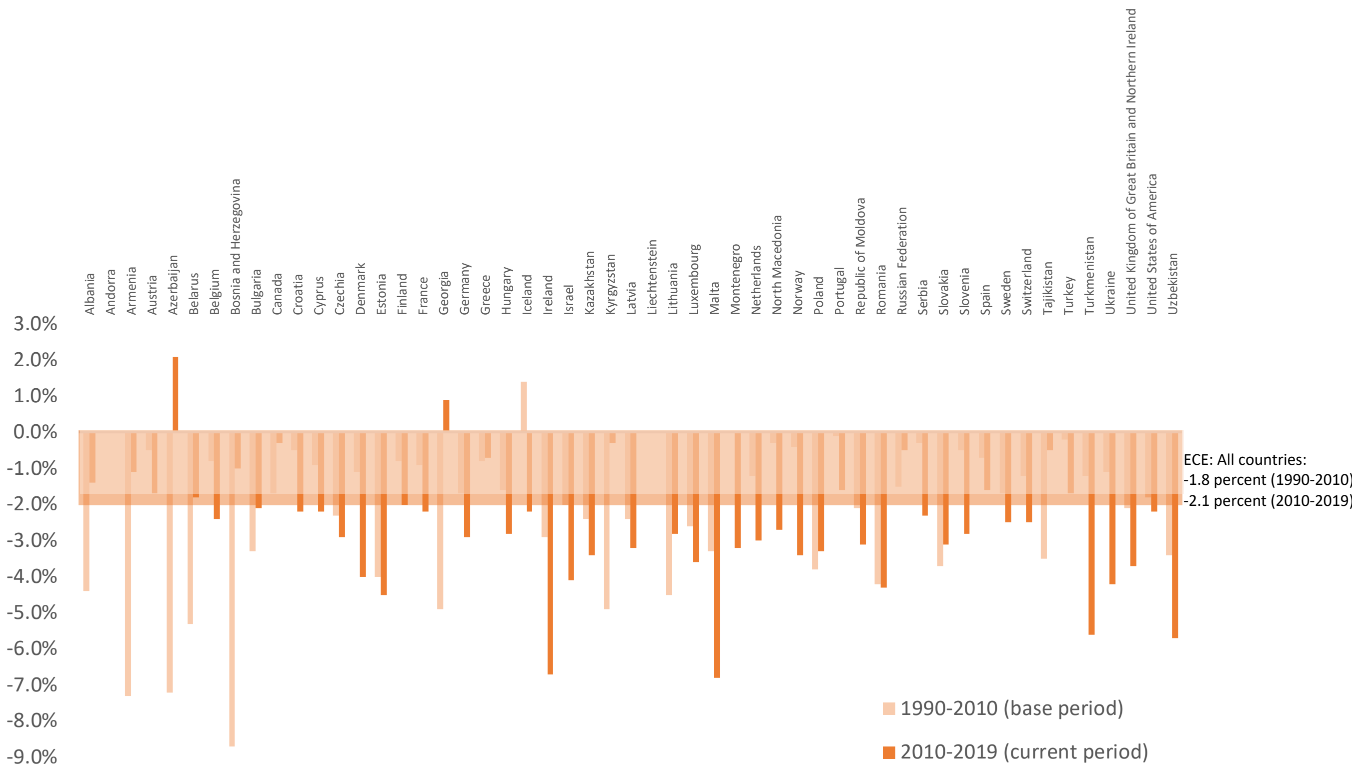
about the merits of an all-of-the-above approach to low- and zero-carbon technologies, developing policy frameworks that enable attainment of carbon neutrality, providing the financial resources for investment, and addressing the social and cultural issues surrounding energy transitions.

Analysis of the energy mix needed to deliver carbon neutrality is summarized in Figure 1. A reference case that does not meet stated targets describes business-as-usual as including countries' current commitments and current (pre-invasion) price environments. The carbon neutrality case involves major efforts on the demand side and accelerated deployment of existing low- or no-carbon energy sources, while the technology innovation case involves major progress on hydrogen, advanced fossil technology, and next-generation nuclear technology (small modular reactors).

Energy Efficiency

In 2019, the ECE region accounted for 43% of world GDP and 38% of total energy supply (TES). Both figures reflect a decline from their 1990 share (from 62% and 61%, respectively), although both GDP and TES have grown significantly in the intervening years. The pace of improvement in energy intensity accelerated from 2010 to 2019 compared to the period 1990 to 2010 and outpaced the global rate of improvement. The contributions of individual ECE member states towards the regional performance on the energy intensity indicator are illustrated in Figure 2.

FIGURE 2. ECE MEMBER STATES' ENERGY INTENSITY DEVELOPMENT 1990–2010 AND 2010–2019



Source: ECE, based on data provided by custodian agencies to Regional Commissions, April 2022

In the ECE region, energy intensity declined by 42% by 3.04 MJ per 2017 USD – from 7.16 to 4.12 MJ per 2017 USD, over the period 1990–2019. TES and GDP growth in the region have decoupled. From 1990–2019, the GDP of the ECE region grew by 78%, while TES increased by only 2%.

There are ways to improve the efficiency of the production, transmission, distribution, and consumption of energy, and these – to the extent they prove operationally, technically, and economically feasible – should be given priority before investments are made in new primary energy supply. Attention also should be turned to digital solutions to improve energy efficiency.

FIGURE 3. HIGH-PERFORMANCE BUILDINGS AND QUALITY OF LIFE

Source: A Commitment Trifecta https://unece.org/sites/default/files/2021-08/UNECE%20A%20Commitment%20Trifecta.pdf

ECE is deploying a vision of building performance that recognizes buildings and communities of buildings as complex systems (Figure 3) through its principles-based Framework Guidelines for Energy Efficiency Standards in Buildings.[106]

Buildings are central to meeting SDG 7. They are complex systems embedded in energy, communication, water, and mobility networks. They consume over 70% of the electric power generated, 40% of primary energy, and are responsible for 40% of carbon dioxide emissions from the energy services they require. Buildings also represent locations where people spend most of their time. Renewable energy technology alone cannot meet the energy requirements for buildings. Managing the energy performance of buildings will accelerate the sustainable energy transition by improving the efficiency with which energy services are provided to them.

[105] See: https://unece.org/documents/2020/12/updated-framework-guidelines-energy-efficiency-standards-buildings

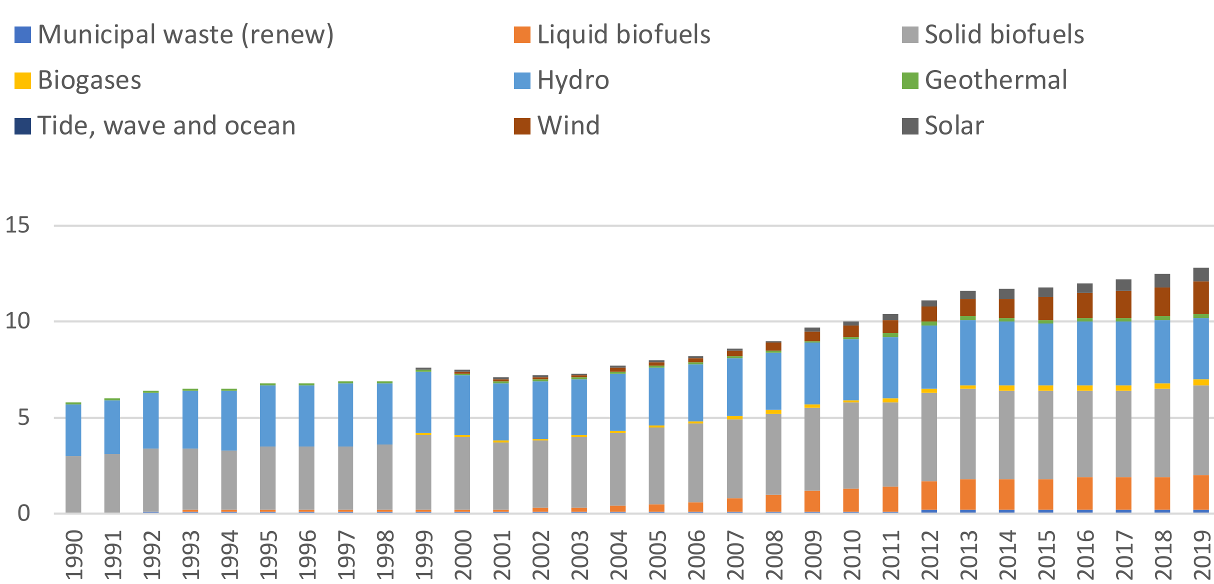
Although the ability to meet the energy challenges presented by buildings exists today, there is also significant potential for improvement. Achieving high-performance buildings could improve energy efficiency, eliminate emissions, and enhance quality of life globally. Considering these components and their role throughout the whole value chain from design to decommissioning puts into perspective how industry that produces materials and equipment and perfecting construction techniques can deliver on quality of life.

There are many technologies and solutions available to achieve higher energy performance in residential, commercial, and industrial buildings throughout their lifecycle (construction, occupancy, or retrofitting), and many are enabled by digitalization. Digitalization could reduce energy use by as much as 10% globally by 2040 if applied throughout buildings' value chain and life cycle. Achieving that potential would require the existence of a customer-centric energy economy, the purpose of which would be to achieve carbon neutrality and build a skilled workforce.

Renewable Energy

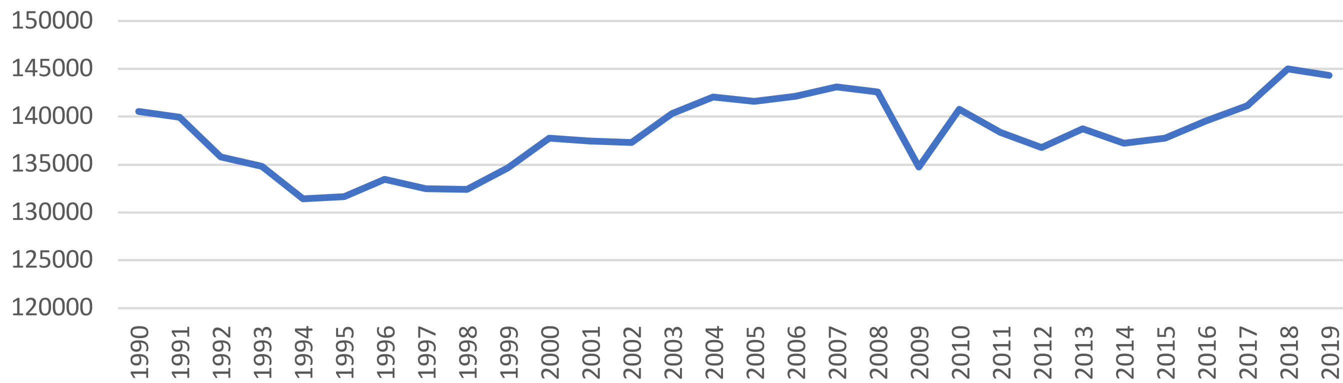
The ECE region increased the share of renewable energy in the mix progressively over the tracking period. The share in TFEC in the ECE region doubled from 1990 to 2019 from 5.8% to 12.8%. In terms of investments, the eastern reaches of the ECE region lag behind global trends and have even declined over the past five to six years. Even though barriers to investment persist, there could be growth in the future given government plans to attract more investors. Renewable energy infrastructure is limited in the Caucasus, Central Asia, East and Southeast Europe.

FIGURE 4. RENEWABLE ENERGY SHARE IN TOTAL FINAL ENERGY CONSUMPTION (%) IN THE ECE REGION BY TECHNOLOGY



Source: IEA, World Energy Balances (2021); UN Statistics Division, Energy Balanced (2021)

FIGURE 5. TOTAL FINAL ENERGY CONSUMPTION IN THE ECE REGION, 1990–2018 (PJ)



Source: IEA, World Energy Balances (2021); UN Statistics Division, Energy Balanced (2021)

Renewable technologies deployed in the ECE region include hydro, solid biofuels, wind, solar, liquid biofuels, biogases, geothermal, tide, wave and marine, and municipal waste (Figure 4). As seen in Figure 5, the overall level of TFEC in the ECE region varied over the period 1990–2019. In 2018, TFEC was higher than in any other year over the period 1990–2018, while in 2019, the ECE region witnessed a remarkable decrease in TFEC because of the COVID-19 pandemic. While TFEC increased slightly from 1998 to 2018, its distribution among electricity consumption, transport, and heat has shown a consistent trend in an increasing use of renewable energy in the transport sector, in particular in the last two decades. The current conflict in Ukraine and the resulting energy crisis in the ECE region may be the start of a negative trend.

National renewable energy development strategies and capacity-building activities would provide useful frameworks for accelerating deployment of renewable energy. In most countries, the lack of adequate enabling policy, legislative, and institutional frameworks have proven to be major obstacles to attracting foreign and domestic investments to the power and energy sectors. Social resistance and lack of local technical capacity and data on renewable energy potential in several countries could be addressed through public outreach and awareness. Network congestion issues and a lack of grid capacity can also be barriers, and technical standards for renewable energy integration need to be defined. Countries should gradually shift from the subsidized approach to the market-based approach so that renewable energy procurement can ensure the long-term financial sustainability of the support scheme. Policies on the use of renewables in sectors other than power (namely, heating/cooling and transport) should be strengthened. Business models and enabling technologies (such as batteries, smart energy systems, digitalization, and electric vehicles) could be deployed to enable the integration of renewables and reduce the costs of renewables.

[105] See: https://unece.org/documents/2020/12/updated-framework-guidelines-energy-efficiency-standards-buildings

II. POLICY IMPLICATIONS AND RECOMMENDATIONS

Bold action in three areas will deliver concrete, near-term outcomes, and – in the longer term – achieve the 2030 Agenda for Sustainable Development and the Paris Agreement:

- achieving superior performance in buildings;
- addressing growing concentrations of methane in the atmosphere; and
- modernizing resource management.

Longer-term, fundamental shifts in the energy system will require sustained action in three areas:

1) achieving carbon neutrality through the improvement of energy efficiency and productivity, shifting to low- or no-carbon primary energy sources, controlling greenhouse (GHG) emissions, removing CO_2 directly from the air, deploying smart technology for systemic decarbonization, and managing carbon sinks;

2) removing social and cultural barriers to an energy transition via industrial modernization to address the short-term political drivers, notably employment in coal mining regions, that impede real action on energy for sustainable development, including climate change; and

3) enabling the hydrogen ecosystem of the future by carrying out coordinated action at the national, sub-regional, and regional levels to establish a full industrial ecosystem of policy and infrastructure – thereby facilitating an ecosystem of the electrons-to-molecules (E2M) technologies that contribute to decarbonization.

SECTION 4.5

ADVANCING SDG 7 IN LATIN AMERICA AND THE CARIBBEAN

CONTRIBUTING ORGANIZATION:
UNITED NATIONS ECONOMIC COMMISSION FOR LATIN AMERICA AND THE CARIBBEAN (UN ECLAC)

Key Messages/Summary

Progress towards the achievement of SDG 7

The Latin America and the Caribbean (LAC) region continues to make progress on the implementation of Sustainable Development Goal (SDG)7. Access to electricity has improved, and the region's energy intensity has maintained a downward trend, particularly in the Caribbean. However, the negative impacts on the region's economy caused by the COVID-19 global pandemic have limited the progress made. This pandemic has heightened the urgency of solving the region's energy access gap, and the current situation strongly calls for a united effort between the public and private sectors.

Access to electricity

Access to electricity has been steadily increasing in the region. Overall, coverage is about 97.4%, according to the Latin American Energy Organization (OLADE) but rural areas remained disadvantaged, with coverage of only around 95%. As of 2020, around 16.7 million people still had no access to electricity (OLADE, 2021). A significant effort must be made to expand coverage, especially as recent studies in Latin America and the Caribbean have highlighted the conditions of unequal access to quality energy services in the region (ECLAC, 2020).

Access to clean cooking technologies

In many LAC countries, including Belize, Bolivia, Dominica, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Paraguay, and Peru, more than 10% of the population did not have access to clean technologies for cooking in 2019. Due to this slow progress, the region is unlikely to reach the 2030 target, which requires replacement of traditional biomass in cooking and heating uses by modern sources and a long-term focus on electrification for cooking needs.

Renewable energy

The share of renewables in the primary energy supply increased from 30% (2019) to 33% (2020). This exceeds the global average in primary supply, which is only 13%. On the other hand, electricity generation by renewable sources increased from 58% (2019) to 61% (2020), totalling 952 terawatt-hours (TWh) during 2020 (75% hydropower and 25% solar, wind, biomass, and geothermal) (OLADE, 2021).

The region has continued to make significant progress on incorporating renewable energy. Installed capacity of hydro energy increased from 185 gigawatts (GW) to 186 GW between 2019 and 2020 (excluding pumped storage) (IRENA, 2022). The regional share of the energy mix has, however, decreased due to greater use of wind and solar energy. Wind energy has become the largest source of variable renewable generation, increasing from 22.6 GW in 2019 to 26.4 GW in 2020. Solar energy sources are also registering significant progress, increasing from 10.8 GW in 2019 to 15 GW in 2019. Bioenergy sources grew from 20.4 GW in 2019 to 20.8 GW in 2020, and that trend will continue as government policies promote the use of renewable energies (IRENA, 2022).

Energy efficiency

The Latin American and the Caribbean (LAC) region has historically had the lowest energy intensity in the world. There has, however, been no reduction in the region's energy intensity level since 2014, and additional efforts will be required to reach the target set for 2030 (ECLAC, 2021).

During 2020, Chile launched a program to support the productive sector, Energize your SMEs, with the aim of promoting energy efficiency and renewable energy in micro, small, and medium-sized enterprises (MSMEs). Colombia launched Efficient Caribbean (PEECES), which is an energy efficiency program in the department of Atlántico, Colombia for strata 1 and 2; its goal is to replace more than 54,000 inefficient refrigerators. The Government of Jamaica allocated a budget for the Energy Conservation and Efficiency Program to be executed during fiscal year 2020–2021. The initiative involves the design and implementation of practical cost-saving measures for energy efficiency (EE) and energy conservation (EC) in the public sector. Panama reported 100% execution in the following projects, Support for Panama to strengthen the efficiency financing mechanism for energy management programs in the public sector; the Economic Commission for Latin America and the Caribbean (ECLAC) supported the publication of the Panama–Uruguay Energy Efficiency Indicators Database and launched the 2020 edition of the National Energy Efficiency Award, an initiative to publicly recognize institutions, organizations, and companies for their efforts and achievements in relation to energy savings and efficient use of energy in different sectors of the country's economic activity.

Priority Actions

- Strengthen the role of governments in ensuring basic access to energy services, which are particularly critical in crisis periods, such as the COVID-19 pandemic and the Ukraine crisis. Reinforce the active role of governments as facilitators of the development of the energy sector to allow each country's advantages (natural resource endowments) to be converted into competitive advantages in terms of access to clean and accessible energy. Increased cooperation among the countries of the region is also important for progress towards greater sustainability. Key to achieving economic stability after current global crisis are: greater energy integration to reduce dependence on resources external to the region; and the use of the advantages offered by energy complementarity such as hydro, solar, and wind.

- The Ukraine crisis has increased the urgency of accelerating the adoption of renewables in the region. The volatility of fossil fuels due to the war has also exacerbated energy poverty in Latin America and the Caribbean. Hydrogen has gained strength in the region, and countries such as Brazil, Chile, Colombia, Panama, and others are not only developing plans for the production of this fuel for use in transportation systems but also exploring its potential for replacing natural gas. ECLAC has proposed using the current gas infrastructure in the region to increase energy integration by producing green hydrogen.

- Promote the deployment of renewable energy technologies, particularly in rural areas, through government policies, regulations, and tax benefits encouraging the use of renewable energies.

- Deepen the implementation of national programmes to promote the use of efficient and clean stove technologies and support the replacement of traditional biomass in cooking and heating by modern energy sources and increased electrification.

- Promote the development of national energy efficiency plans that define goals and provide the instruments and resources necessary for implementation.

I. PROGRESS MADE IN LATIN AMERICA AND THE CARIBBEAN ON SDG 7 TARGETS

The region continues to make progress on the implementation of SDG 7. Access to electricity has improved, and the region's energy intensity has maintained a downward trend, particularly in the Caribbean. However, the negative impacts on the region's economy caused by the COVID-19 global pandemic have limited the progress made. The pandemic has heightened the urgency of solving the region's energy access gap, and the current situation strongly calls for a united effort between the public and private sectors.

Access to Electricity

Latin America and the Caribbean have been successful in moving towards universal access to electricity services. The region has steadily expanded its coverage since 2000, reducing the overall deficit from 43.6 million people in 2000 to 16.7 million in 2020. More than 5% of people at the country level lack electricity coverage in Belize, Bolivia, Grenada, Guatemala, Guyana, Haiti, Honduras, Nicaragua, Panama, and Suriname (OLADE, SIELAC, information based on country sources).

The urban–rural electrification gap narrowed between 2000 and 2020. To further address this gap, urgent policy action is required to promote decentralization of electricity generation and continue to incorporate renewable energies. As renewable energy systems do not require networks to be fed by centralized generation sources, they allow local energy resources to be used.

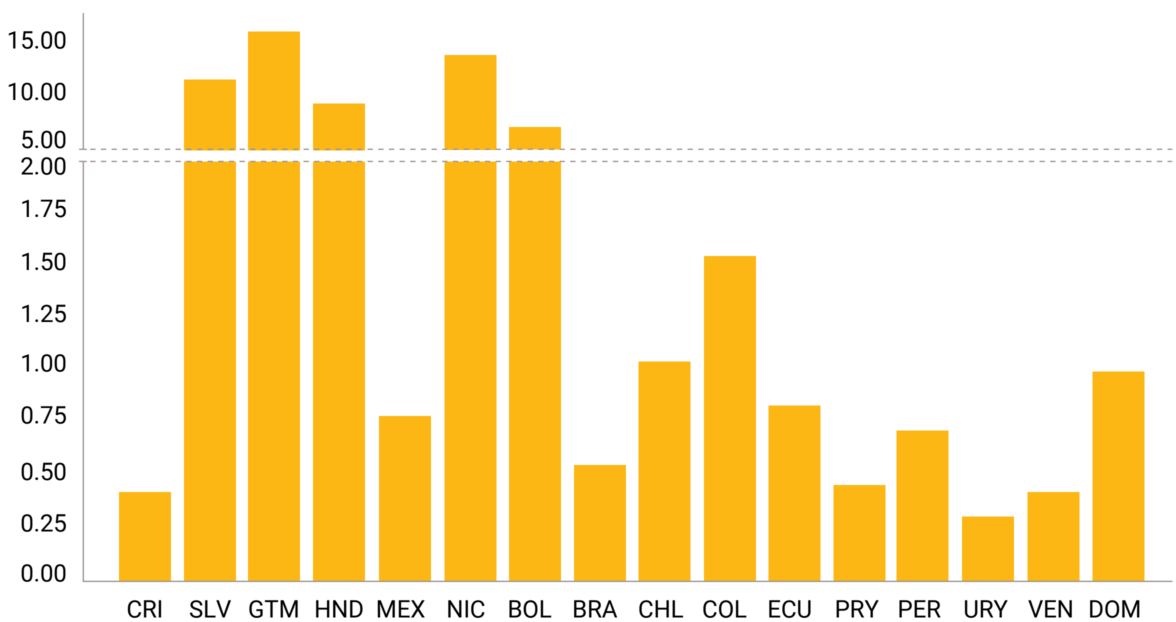
Access to electricity alone, however, is insufficient to overcome household energy poverty. Latin American countries should focus their efforts on improving access to the different services that can be supported by access to affordable, safe, and sustainable energy. In particular, energy poverty must be observed according to the needs of each territory; this requires the following issues to be taken into account: how the territory influences the definition of energy needs and services; how the phenomenon of energy poverty is spatially distributed; and how that spatial distribution can contribute to the propagation of inequalities and territorial vulnerabilities.

In certain Central American countries, the proportion of households lacking the various socioeconomic benefits related to electricity services is higher than in the rest of the region – in Guatemala (11.5%), Panama (5.7%). In the rural areas of Honduras and Nicaragua, which account for an average of about 40% of the national populations, the access gap indicator rises to 17% and 28.6%, respectively.

In South America, the same phenomenon is observed in the case of Bolivia and Peru, with 121% and 7.5%, respectively, of the populations without access to electricity in rural areas. The northeast part of South America also has three countries with low access rates: Guyana (9.8%) and Suriname (4.4%), and French Guiana where 8% of households are without electricity.

Figure 1 provides quantitative information for some countries those without access to electricity in their homes.

FIGURE 1. POPULATION WITHOUT ACCESS TO ELECTRICITY (CEPAL, 2021)



In terms of justness in energy access, there are, according to ECLAC, significant barriers: energy prices; the high cost of high-efficiency technologies; and marked inequality in terms of household energy expenditures. In a region marked by inequality, energy access reflects the socioeconomic conditions of the countries in the region, and this creates a worrying outlook for the prospects of a just energy transition. On the other hand, the complementarity of energy efficiency measures could be positioned as a solution both to lessen the economic pressure on households and to reduce their consumption of fossil fuel-based energy (ECLAC, 2021b). Furthermore, there has been excessive spending to meet household energy needs in the LAC region that impacts the well-being of household members. In other words, to reach the average energy consumption of each country, a household would have to spend more than 10% of the poverty line in the case of Barbados, Brazil, Chile, Guyana, and Uruguay. Likewise, the lowest income quintiles spend between 15% and 19% of their income on energy in Brazil, Chile, Colombia, Dominican Republic, El Salvador, Panama, and Uruguay (ECLAC, 2021b).

Access to Clean Fuels and Technologies for Cooking (CFT)

The countries of the region have advanced steadily in the last decades in terms of access to CFT; the country average increased from 82.1% in 2010 to 85.4% in 2019 (WHO, 2021). However, in Belize, Bolivia, Guatemala, Guyana, Haiti, Honduras, Mexico, Nicaragua, Paraguay, and Peru, the participation rate is below the overall country average of 85.4%, and in some other countries, access is much lower. Guatemala, Honduras, and Nicaragua have rates of access to CFT of around 38.1%, 42.6%, and 44.9%, respectively, while in Haiti access was only 3.5% in 2019 (WHO, 2021).

The common issue for countries with low CFT access is the difficulty of providing alternatives to firewood in rural areas. Low-emission cooking technologies, using, for example, LPG, natural gas, or electricity, require special equipment to be purchased and distribution systems to be set up: both of these may be unavailable to people in rural areas or too costly for them. In the case of Peru, for example, 83.3% of households in rural settlements report using firewood for some energy services. Substantial efforts have, however, been made in Latin America and the Caribbean, and many countries in the region are on the road to transitioning away from inefficient solid fuels for cooking. It is reasonable to expect that by 2030 most of the countries in the region will reach the objectives outlined in SDG 7.1. Countries such as Haiti, however, will have to make radically overhaul its efforts to overcome the continuing lack of access to basic energy services and cooking technologies.

Renewable Energy

The region has continued to make significant progress on renewable energy implementation. Installed capacity of hydro energy increased from 185 GW to 186 GW between 2019 and 2020 (excluding pumped storage) (IRENA, 2022). Its share of the energy mix has, however, decreased due to greater use of wind and solar energy. Wind energy has become the largest source of variable renewable generation, rising from 22.6 GW in 2019 to 26.4 GW in 2020. Solar energy sources are also registering significant progress, increasing from 10.8 GW in 2019 to 15 GW in 2019. Bioenergy sources grew from 20.4 GW in 2019 to 20.8 GW in 2020, and that trend will likely continue as government policies promote greater use of renewable energies.

Capacity expansion rates for installed renewable energy showed significant increases from 2014 onwards, and this trend is expected to continue due to the introduction of mechanisms that facilitate bidding and auctions of renewable energy projects, tax benefits for importing renewable energy technologies, and accelerated depreciation of assets. Electricity generation capacity increased by more than 3% between 2019 and 2020, of which 61% was renewable generation; this reached 952 TWh during 2020. In terms of installed capacity during 2020, 11 GW of renewable electricity capacity was installed (31% wind, 53% solar, and 11% biomass).

Not all countries, however, are following the same pathway. Mexico recently released a new power policy that modifies some of the goals of its 2013 energy reforms, particularly those regarding the reduction of oil consumption and the increase of investment in renewables, technology, and infrastructure. In addition, there is a new nationalistic energy policy push in the country to re-establish state control over energy markets and reduce the deployment of renewables.

The LAC region should move towards diversification of generation capacity in order to shift countries away from imported energy dependency, promote renewables, and protect them against the impacts of climate events such as droughts and floods. Argentina is seeking to increase its generation of renewable energy (such as wind and solar energy) from 2% to 20% by 2025, and in Chile a policy on exclusion of coal-fired generation sources is moving forwards.

Small island countries in the Caribbean rely particularly heavily on diesel power generation for electricity supply. The import of diesel and other fossil fuel not only increases the cost of energy use and risks of energy security, but also causes problems such as environmental pollution and loss of island habitats. By developing clean energy, including solar, wind, wave, and tidal energy, and deploying micro-grids based on environmentally friendly energy storage technology, a reliable and green energy supply can be ensured – one that offers ample power supply for residential sewage treatment, seawater desalination, and solid waste treatment. For example, the "PV + energy storage" micro-grid projects, built in some small island countries as an innovative nature-based solution to promote justness in energy access, have reduced the electricity cost by over 20%.[107]

The averaged levelized cost of solar photovoltaic energy has continued to decrease, reaching 0.11 US$/KWh in South America, and 0.12 US$/KWh in Central America. In 2020, average energy costs from wind reached 0.044 US$/KWh in South America and 0.0.59 US$/KWh in Central America (IRENA, 2021).

Data on foreign direct investment in renewable energies show that from 2010 to 2020 the region saw decreased investments in renewable thermal, geothermal, and hydro energy, while non-conventional renewable projects such as solar and wind energy increased considerably. The latter two types of energy have decreased drastically in cost, which is why there has been significant progress in investment in these projects in recent years.

Hydroelectric energy added 24.8 GW of installed capacity from 2015 to 2020. There is an increasing need to modernize large, ageing hydro infrastructure to extend the life of the assets and to boost electricity generation to meet growing electricity demand. Of the total 251 GW of accumulated renewable installed capacity, 197 GW comes from hydro, representing 78.4% of total renewable capacity. From 2015 to 2020 wind energy made significant progress in terms of installed capacity, adding 18.8 GW of power to reach 32.5 GW installed.

The installed capacity of renewable thermal energy (biomass) is 22.2 GW, while solar is 20 GW and geothermal is 1.7 GW.

[107] GEIDCO, 2021. *Biodiversity and Revolution of Energy and Electric Power.*

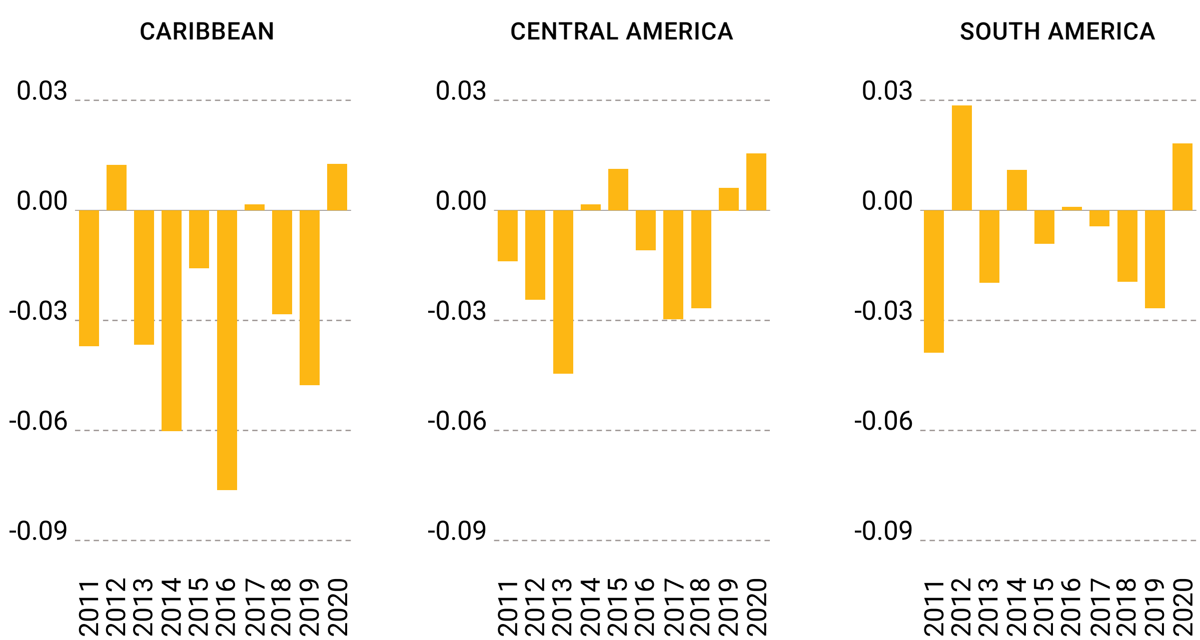
Despite the positive trend observed in recent years, these levels are still far from what is needed to achieve the goal of SDG 7.2. Nevertheless, the great dynamism observed in the development of non-conventional renewable energies, and also hydroelectric capacity, is a cause for great optimism that significant progress can be made in increasing the levels of participation in modern renewable energies.

Energy Efficiency

With regard to energy efficiency, the Latin American and Caribbean region has historically had the lowest energy intensity of any region in the world, and also the lowest rates of improvement (around 0.5% per year). At the sub-regional level, Central America and the Caribbean shows decreasing energy intensity trends, but this situation was reversed in 2020. The Caribbean region has shown sustained improvement in recent years, going from being the most energy-intensive to the least. Central America showed improvements from 2016 to 2018, while in 2019 and 2020 the trend was reversed. The South American region showed almost no significant changes in the last decade, but in 2020 its energy intensity increased. The annual change in Primary Energy Intensity GDP US$ 2011 PPP [kgoe/US$ 2011 PPP] at the subregional level (percentages) can be seen in Figure 2 (CEPAL, 2020).

Despite the efforts made by all the countries in the region during the last decade, there is still much need for improvement. Reducing energy intensity, however, must be focused on strategies that do not compromise economic development or harm people's lives. Economic growth needs to be decoupled from energy consumption, raising people's quality of life and comfort levels with the least possible energy consumption.

FIGURE 2. ANNUAL CHANGE IN PRIMARY ENERGY INTENSITY (CEPAL, 2022)



Source: Data from database provided by World Bank.

Indicator SDG 7.3 proposes doubling the rate of improvement in energy efficiency with respect to indicators that date back to 2015, and this can be achieved only by accelerating the rates of reduction in energy intensity. To achieve the objective, the region will need to make will need to make a greater effort than it has in the past.

II. POLICY IMPLICATIONS/RECOMMENDATIONS

An analysis of indicators to monitor the implementation of SDG 7 clearly establishes the urgent need to intensify efforts. One of the biggest challenges is to commit to bolder policies and to be willing to adopt those policies.

The region is constrained by the need to access increased financing, a challenge that has been impacted by the COVID-19 pandemic. At the same time, the COVID-19 pandemic and the Ukraine crisis have also heightened the urgency of accelerating progress on renewable energy adoption and increasing access to electricity. Achievement of the SDG 7 targets can be seen as an opportunity to support the recovery of the regional economy, for example, by investing in new infrastructure based on renewables that aims to reduce the electricity access gap and the current dependence on fossil fuels. According to the latest studies, investing 1.3% of the regional GDP per decade in the LAC region will be sufficient to transform the regional electricity matrix to 100% renewables (ECLAC, 2020b). This cannot be achieved by governments alone and should be a public–private partnership effort. The question is whether the governments of the region and the private sector are ready for this endeavour.

The Latin America and the Caribbean region has made significant efforts to promote the use of renewable energy in transport but has paid little attention to the heating and cooling sector. When it comes to energy efficiency, there is a greater focus on the electricity sector.

Brazil, Chile, Colombia, Costa Rica, and Uruguay stand out as leaders in the region in terms of policies that seek to advance implementation of SDG 7. Active roles for governments as facilitators of the development of the energy sector should be reinforced, based on each country's comparative advantages and utilizing each country's endowment of natural resources for clean and accessible energy provision.

Given the analyses provided in the previous section, some general guidelines emerge regarding the required focus energy policies in most countries of the region.

- **Access to electricity:** Most of the electricity access gap is witnessed in poorer settlements and remote, hard-to-reach places, where new connections are generally more expensive. To achieve universal access to electricity, particularly after the impacts caused by COVID-19, improving the flow of economic resources from public or private funds, multilateral banking, or international cooperation is urgently needed to close the access gap in the region. Governments must also generate appropriate institutional and regulatory frameworks and develop human and organizational capacities; this will allow an efficient allocation of resources to secure the basic energy needs of the poorest. The inclusion of renewable energy technologies in energy policies, programmes, and projects, particularly in rural areas, plays an important role in expanding electricity coverage. This path should be deepened, using an approach that combines development of rural electrification with general provision of educational and health services within the framework of an integrated SDG agenda.

- **Subsidies:** For proper allocation of resources, a move towards convergence between energy prices and production costs is essential. Subsidies as public policy instruments should be implemented through mechanisms that guarantee that subsidies are specifically targeted. Their potential impact on poor households depends on such targeting; so too does the possibility of reasonably limiting distortions in consumption decisions that originate in subsidies, and of redirecting resources to other priority uses.

- **Renewable energy:** Government policies have contributed to the formation of more renewable electricity generation through the development of important hydroelectric ventures and the incorporation of non-conventional renewable energies, such as wind and solar. To achieve the desired outcomes on SDG 7, it is imperative for these policies to be sustained over time. Furthermore, to achieve the large investments (public and private) needed to increase the share of renewable energies, it is important to establish stable institutional and regulatory frameworks, clear rules, and transparent procedures. Transport is one of the sectors where there are great opportunities to increase the share of renewable energies. An integrated approach to the problem could have excellent results for fostering sustainable development.

- **Cooking and heating:** In several countries of the region, traditional biomass will continue to occupy a prominent place in cooking and heating. Within this framework, and in parallel with efforts to continue improving access to modern sources of energy for cooking, the implementation of national programmes to promote the use of efficient and clean wood-burning stoves should be deepened, with emphasis on care for the environment, protection of people’s health, and attention to the socio-cultural context in which families live. Programmes that have the greatest probability of success are those that promote the direct and conscious participation of the beneficiaries, rely on the technical skills of the communities, stimulate the innovative capacity of community organizations, and incorporate gender considerations into the elaboration, design, and implementation of technology improvements.

- **Energy efficiency:** For energy efficiency to improve, countries must have consolidated regulatory and organizational schemes, trained technical teams, and robust financing mechanisms that allow them to ensure the continuity of their activities over time. Only in such a context can energy efficiency become a permanent component of energy policies and a substantial part of sector planning.

- **Thermal insulation:** The quality of housing plays a crucial role in understanding energy poverty and the challenges of improving energy efficiency in terms of how well housing protects people from external environmental conditions and what basic energy level is needed to maintain healthy and comfortable temperatures. Regulations or quality standards for thermal insulation can support minimum performance and encourage users to choose energy-efficient housing.

Given the lack of information regarding the quality of thermal insulation in the region’s housing, the existence of regulations related to thermal insulation can be considered as a good proxy for assessing the state of the housing stock. Energy-efficient housing has very high initial costs, which makes it difficult to afford for the majority of the population. Moreover, due to the high cost of land in Latin American cities, construction companies have little incentive to improve the existing minimums in each country’s building regulations, especially in the context of social housing construction. However, 20 countries in the region have some type of regulatory instrument regarding the energy efficiency of the thermal insulation of housing. Of these, seven countries define these instruments as mandatory standards (Bahamas, Bolivia, Brazil, Cayman Islands, Chile, Ecuador, and Mexico, while in the other 13 countries they are referential.

Mexico and Chile introduced mandatory standards in 1997 and 2000, respectively, followed by Brazil and the Bahamas in 2003, and Bolivia in 2005. Argentina was the first of the region to install a referential standard in 1996, followed by Uruguay in 2004, and a group of 11 Caribbean countries in 2016. Due to this late incorporation of norms or standards in the region, thermal insulation in houses in a number of countries has remained low. For example, in Chile, at least 66% of the housing was built without any thermal regulation, resulting in minimal thermal comfort conditions in those homes.

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SECTION 4.6

ADVANCING SDG 7 IN LEAST DEVELOPED COUNTRIES

CONTRIBUTING ORGANIZATION:
UNITED NATIONS OFFICE OF THE HIGH REPRESENTATIVE FOR THE LEAST DEVELOPED COUNTRIES, LANDLOCKED DEVELOPING COUNTRIES AND SMALL ISLAND DEVELOPING STATES (UN OHRLLS), INTERNATIONAL RENEWABLE ENERGY AGENCY (IRENA)

Key Messages/Summary

In the Least Developed Countries (LDCs) access to energy is occurring only slowly, falling short of the requirement to achieve structural transformation in the LDCs as a driver of progress – a central pillar of the Doha Programme for Action for the Least Developed Countries for the Decade 2022–2031 (DPoA) and critical to achieving all other SDGs.

A transformative change is needed in the LDC energy sector to bring SDG 7 within the reach of these countries. To help LDCs achieve rapid progress towards 2030, an enabling environment is needed. This must be underpinned by policies and regulations to adopt least-cost pathways to electrification, enhance the socioeconomic inclusiveness of energy access, and catalyse both public- and private-sector finance.

The redirection of energy policies and finance towards clean energy investments and improving energy efficiency will further help LDCs take full advantage of, and benefit from, falling renewable prices; it will help them access larger pools of capital to build energy resilience and become part of the global energy transition that is currently under way.

Energy Access

Between 2010 and 2020, electricity access in the LDCs improved steadily from 33% to 55%. Nevertheless, as of 2020, 478 million people in these countries still had no access to electricity, and over 860 million people were reliant on harmful fuels for cooking. Progress is uneven across regions and between rural and urban areas. The global deficit in access to electricity is increasingly concentrated in the African LDCs, while Asia–Pacific LDCs have made huge strides in electrification, resulting in the reduction of the number of people without electricity by over 100 million from 2010 to 2020.

To provide universal access, LDCs need to nearly triple the pace of electrification, from 23 million new customers each year in 2000–2018 to 63 million in 2019–2030 (RMI/OHRLLS, 2021).

Closing the financing gap will require annual financial flows to be dramatically increased by 2025: for access to electricity to USD$ 35 billion and for access to clean cooking to US$ 25 billion, of which 50 percent is directed to LDCs (UN 2021a).

Renewable capacity

Excluding traditional uses of biomass, the share of renewables in total final energy consumption reached 10.3% in 2019, down slightly from 10.7% in 2010. The data reveal hydropower power to be the dominant renewable technology in LDCs. Non-renewable capacity continues to expand faster than renewables to meet growing energy demands in LDCs. These countries may lose out on the opportunity to leapfrog to renewables and new technologies unless they introduce comprehensive energy-sector planning at the national level, identifying least-cost pathways, relying on the mix of technologies combined with appropriate financing solutions.

Energy Efficiency

Energy intensity needs – the ratio of total energy supply per unit of gross domestic product – fell in LDCs from 5.59 Megajoules/United States dollar (MJ/US$) to 4.84 MJ/US$ between 2010 and 2019, using 2017 purchasing power parity (PPP). This compared with a global average of 4.69 MJ/US$. Achieving large-scale energy efficiency can help LDCs move towards achieving energy resilience while at the same time lowering emissions. There is a crucial role for governments to play in implementing energy efficiency regulations and standards. Governments need to address market failures related to the adoption of energy efficient appliances and technologies, including ones involved in the productive use of energy, such as cooking, cooling, and transportation.

Access to finance and technology

LDCs received 25% of the international financial flows to developing countries in support of clean energy in 2019. While this shows an increase from 21% in 2018, it hides a 9% decrease from $3 billion to $2.7 billion.

Public finance will continue to play an important role in bridging the energy investment gap in LDCs. The rising debt burden further limits their fiscal space and ability to finance infrastructure investments or to introduce stimulus packages focusing on green economies, as seen in developed countries. Debt relief measures, fresh financing by donors, including meeting their commitment to climate financing, is especially important for LDCs.

The UN Energy Pledge to implement the Global Roadmap for Accelerated SDG 7 action in support of the 2030 Agenda and Paris Agreement sets deliverables for 2025; it also commits to scaling up collective action for raising annual access investment to $40 billion, of which 50% is directed to the least developed countries.

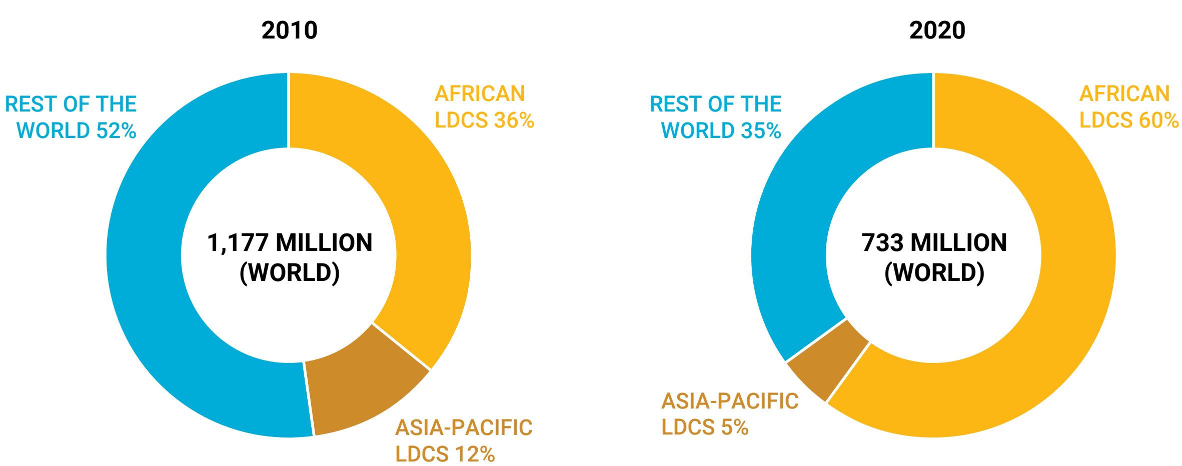
I. PROGRESS TOWARDS ACHIEVING SDG 7

LDCs are low-income countries that are confronting severe structural impediments to sustainable development. They are highly vulnerable to economic and environmental shocks and have low levels of human capital. There are currently 46 countries in the list of LDCs. They have a combined population of 1.1 billion people and the vast majority of them (65%) live in rural areas.

In the LDCs, the COVID-19 pandemic is impeding progress towards achieving SDG 7 and the economic recovery they experienced in 2021 is slowing. Initial evidence and studies suggest that the LDCs will take several years longer than developed economies to return to pre-pandemic GDP levels. As of 28 February 2022, only 19% of the population in LDCs were fully vaccinated, as compared to 73% of the population in developed countries (United Nations General Assembly 2022). The total external debt service of LDCs for 2021 and 2022 is expected to increase by $20 billion compared to the pre-pandemic average, jeopardizing recovery efforts.[108]

Against this backdrop, the Doha Programme of Action for Least Developed Countries for the decade 2022–2031 (DPoA) was adopted at the first part of the Fifth UN Conference on the Least Developed Countries in New York on 17 March 2022 and endorsed by the General Assembly on 1 April 2022 (A/RES/76/258). DPoA recognizes that bold and transformative action is needed to support LDCs get on track to achieving SDG 7 by 2030.

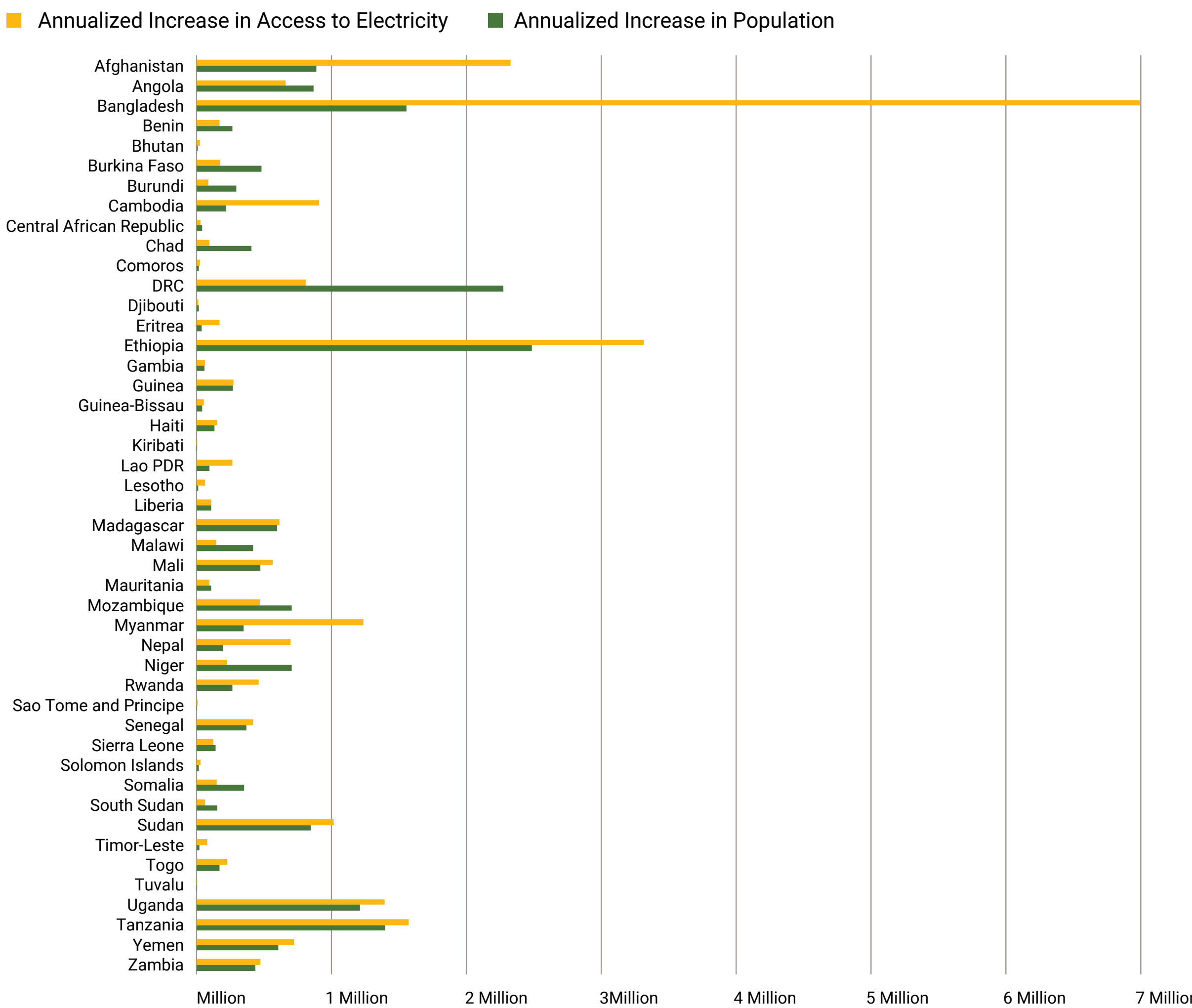
FIGURE 1. SHARE OF PEOPLE WITHOUT ACCESS TO ELECTRICITY: LDCS VS THE WORLD IN 2010 AND 2020



Source: World Bank (2022a), World Bank (2022b)

[108] https://unctad.org/topic/least-developed-countries/chart-march-2022

FIGURE 2. ANNUAL INCREASE IN ELECTRIFICATION AND POPULATION IN LDCS (2010 TO 2020)



Source: World Bank (2022a), World Bank (2022b)

Access to electricity

The share of the population of the LDCs with access to electricity rose from 33% in 2010 to 55% in 2020; it remains, however, 36 percentage points below the world average (91%). The global access deficit shrank significantly between 2010 and 2020 (Figure 1) but the number of people without access to energy actually increased in the 33 African LDCs over the last decade, from 420 million in 2010 to 442 million in 2020. As a result, the global access deficit is increasingly concentrated in these countries. Asia–Pacific LDCs showed a substantial drop (over 100 million) in the number of people without access over the same period.

The progress in electrification in LDCs resulted primarily from advances in the Asia–Pacific LDCs, where, for instance, in Bangladesh, an average of 7 million new customers were connected to electricity every year compared with a population increase of just over 1.5 million per year over the last decade (see Figure 2).

Unfortunately, this has not been the case in the majority of the African LDCs, where population growth rate has outpaced electrification rates, resulting in a growing number of people without access to electricity across these countries, although exceptions to this trend can be seen.

Rural–urban divide: The access rate increased faster in rural areas than in urban settings across the two regional groups. Nevertheless, access remains low in rural areas in LDCs, where just 44% of the population has access compared with 78% in urban areas in 2020. Decentralized energy systems, based on renewables, offer smaller-scale, localized production, storage, and distribution benefits which are particularly relevant for accelerating energy access to rural and remote communities.

Promising examples in scaling up off-grid systems in LDCs, using mini-grids and solar home systems, are helping to expand access to previously hard-to-reach locations. Burkina Faso, Ethiopia, Mali, and Togo have started to use result-based financing (RBF) tenders in which a result-based grant is provided for each proven electricity connection, as well as loans for productive use and support for construction of the renewable energy infrastructure. This approach has attracted greater international support from international donors and investors. Burkina Faso has open data which allows online platforms such as the Global Electrification Platform or the Off-Grid Market Opportunity Tool to calculate future projections and scenarios of the costs of mini-grid projects. Niger is changing its regulations to support private mini-grid development through a clearer regulatory system and business model (Antonanzas et al., 2021).

Bangladesh, under the long-term impact of COVID-19, has prioritized mini-grids; it has also mobilized increased funding sources through various local non-governmental organizations (NGOs) and the government-owned Infrastructure Development Company Limited (IDCOL). The funding includes subsidy packages and capital grants for mini-grid developers (Ali et al., 2022).

Sufficient and reliable access: A connection alone is not enough to meet the goal of a sufficient and reliable power supply necessary for productive use and conducive to economic growth. LDCs face severe reliability challenges, for instance in Sierra Leone and Uganda, where more than 30% of people report never having had electricity despite being connected to the grid (Blimpo and Cosgrove-Davies, 2019). Sufficient supply also drives demand for energy which is vital not just to give providers a path to profitability but also for energy access to unlock opportunities for economic development. In a scenario, where the minimum consumption threshold to drive rural development is set at 300 kilowatt hours (kWh) per person per year, the demand for electricity is expected to increase by 8% annually. This compares with a 2% growth rate in demand if new customers are just provided with the minimum supply that meets the definition of energy access (50 KWh) (RMI/OHRLLS, 2021). According to this report by the Rocky Mountain Institute/Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States (RMI/OHRLLS), the increase in demand jumps to 18%, if the consumption threshold is set at 1000 kWh, a level considered to be the minimum required for the modernization of economies.

There is evidence that the pandemic has increased people's concerns about the affordability of electricity to the extent that even if an increasing number of people were provided with a connection, they could not afford an extended bundle of services (IEA 2021). The impact of rising global energy prices and food prices is likely to further heighten this problem in the LDCs.

[108] https://unctad.org/topic/least-developed-countries/chart-march-2022

Access to clean cooking: In 2020, 17% of the population had access to clean cooking, unchanged from 2019, and leaving more than 860 million people in LDCs without access (WHO 2022). Progress on this indicator has been slow, with incremental increases from 11–17 % in the decade 2010–2020. To promote efficient electrification and achieve the energy transition, clean cooking should be treated as an integral part of electrification planning. As of 2019, only 22 LDCs had enacted any officially approved national electrification plans and even fewer had enacted plans for clean cooking.[109]

Renewable Capacity

Across the LDCs, the average share of renewable energy in total final energy consumption (TFEC) reached 69.4% in 2019, a decrease from 76.2% in 2010. This overall share of renewables is high compared to the global average, given that a large part of the population relies on traditional uses of biomass – wood fuel, crops, and animal residues – for cooking and heating. Excluding traditional uses of biomass, the share of renewables in total final energy consumption reached 10.3% in 2019, down slightly from 10.7% in 2010.

Of the 40.2 gigawatts (GW) of installed renewable capacity in LDCs in 2020, hydropower (excluding pumped storage) dominated at 36.4 GW, followed by 2.1 GW of solar energy, 1.1 GW of bioenergy, and 0.5 GW of wind energy). In 2020, off-grid solutions in the LDCs reached a total installed capacity of 1.5 GW, up from 0.4 GW in 2010.

In 2020, the Lao People's Democratic Republic (Lao PDR) (where much of the capacity was built to enable power exports) had the highest rate of hydropower capacity at over 8300 MW, nearly double that of Ethiopia, the country with the second-highest capacity.

The share of renewables in TFEC, while still over 50%, fell between 2010 and 2019 in LDCs. This indicates that investment in non-renewable energy sources has outpaced investment in renewables, heightening the exposure of LDCs to external shocks, including their vulnerability to rising gas and oil prices. The share of traditional uses of biomass in TFEC remains high in LDCs.

The energy transition requires the use of renewables to expand at a faster rate than the growth in energy demand. LDCs have a long way to go to reach that point, although they have significant potential for renewables using hydropower, solar, and wind for electricity generation. The Doha Programme of Action emphasizes the need for the international community to commit to supporting scaling up the deployment of renewables in LDCs.

There are several reasons why LDCs have not been able to deploy renewables at a faster pace – from low levels of technical capacity to lack of finance. Lack of choice of financial investors as well as competition from fossil fuels and fewer subsidies for renewables compared to traditional fuels also result in high prices for renewables in LDCs. Technology-neutral auctions with all-source procurements for system services are emerging as best practice. LDCs, especially smaller countries, could also explore cross-country auctions to make projects more attractive for bidders (RMI/OHRLLS, 2021). In April 2021, Namibia and Botswana signed a 5GW solar complex partnership led by the US government's Power Africa initiative and supported by other development partners.[110]

[110] https://taiyangnews.info/markets/botswana-namibia-sign-moi-for-5-gw-solar-project

In Asia-Pacific, Bangladesh and Lao Peoples' Democratic Republic among other developing countries have introduced Renewable Portfolio Standards (RPS), an (enforceable) public policy tool requiring renewable targets in the overall electricity supply. Backed by enabling policy frameworks, such tools can signal strong commitment and thus spur investor confidence.

Increased collection and availability of data, including through digitalization of mini-grid projects, could offer a multitude of benefits: it would help to develop dynamic electrification policies and standards that allow for greater transparency and accuracy as well as optimization of project design. This, in turn, could address bottlenecks to energy availability, reliability, and affordability in LDCs.

Greater engagement of local communities, especially encouraging participation by youth, women, and marginalized groups in the decision-making processes, together with adequate long-term operations and maintenance funding, can help achieve the sustainability of off-grid projects and maximize their benefits to local communities.

Energy Efficiency

A positive trend in LDCs is the drop in primary energy intensity needs (to generate a given GDP output) from 5.59 MJ/US$ (2017 PPP) in 2010 to 4.84 MJ/US$ in 2019, compared with a global average of 4.69 MJ/US$.

Accelerating the implementation of energy efficiency can help LDCs towards a low-carbon development path and result in savings on energy expenditure. Governments must step up efforts to create building blocks for transformation of the large-scale energy efficiency market towards building energy resilience in alignment with socioeconomic and environmental goals. There is an opportunity for LDCs to leapfrog to state-of-the-art technologies in energy efficiency, especially in high-growth sectors.

Energy efficiency is an issue that LDCs have committed to at the political level through the establishment of the Least Developed Countries Renewable Energy and Energy Efficiency Initiative for Sustainable Development (LDC REEEI).[111] Under the mandate of LDC ministers, the LDC REEEI aims to support LDCs towards achieving 100% utilization of energy efficiency potentials along the value chain through the full implementation of best practice measures and planning by 2040.

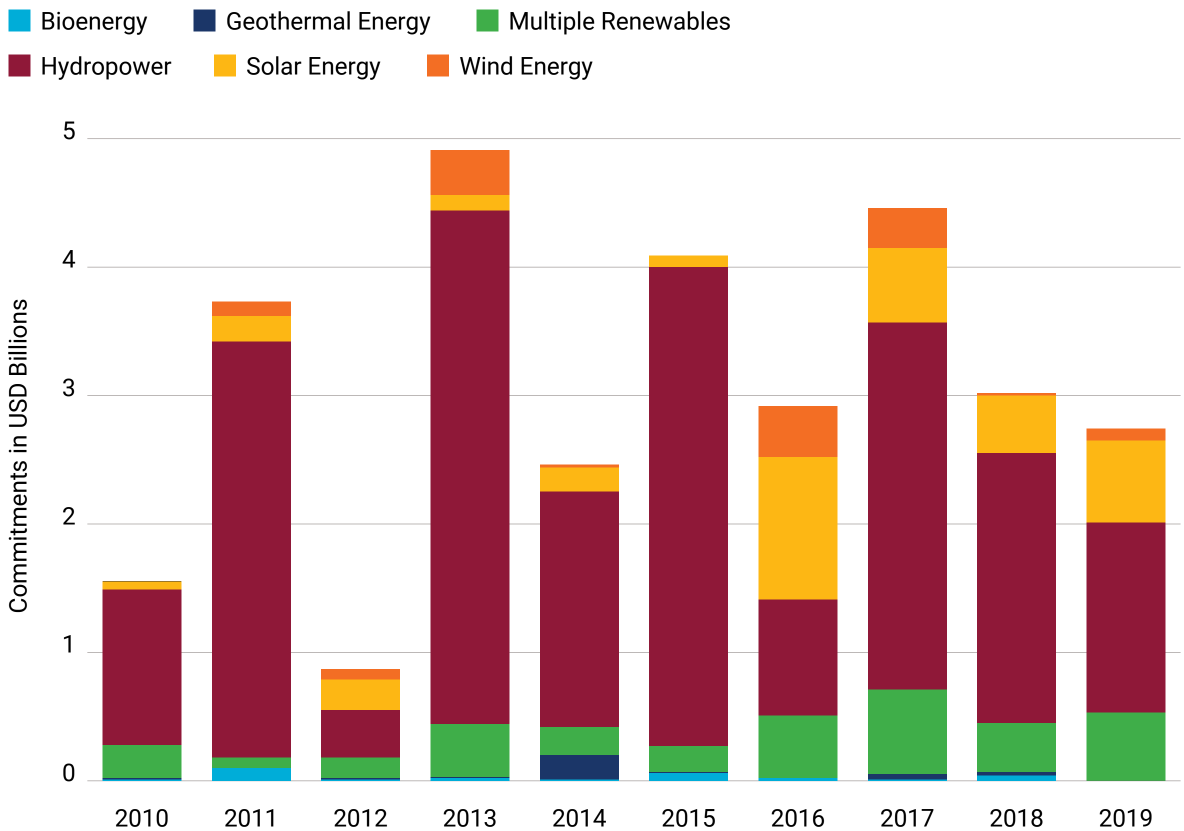
International financial flows in support of clean energy

LDCs received $2.7 billion in international financial flows in support of clean energy in 2019 (Figure 3). This represents an overall decline in commitments by $0.3 billion, on trend with the decline in global flows.[112] On a positive note, the share of flows received by LDCs increased from 21% to 25% over the same period, even though this share falls far short of the 2025 milestone set in the Energy Access Thematic Report, namely to allocate 50% of annual financial flows for energy access and for clean cooking (both public and private) to the LDCs.

International financial flows to hydropower have dominated investments in renewables in LDCs, mirroring global trends. Notably, typical hydropower investment per commitment is almost three times larger than for any other technology (IEA, IRENA, UNSD, World Bank, WHO, 2022) Commitments to solar energy show encouraging growth from $445 million in 2008 to $643 million in 2019.

[111] For more information on implementation action see: http://ldcreeei.org/
[112] Impact of COVID-19 on financial flows to LDCs will not show until 2020 data.

FIGURE 3. INTERNATIONAL FINANCIAL FLOWS IN SUPPORT OF CLEAN ENERGY BY TECHNOLOGY TO LDCS (2010–2019)



Source: World Bank (2022c)

Existing models show a significant gap between current investment levels and those needed to achieve the energy transition in line with climate and sustainable development imperatives (IEA, IRENA, UNSD, World Bank, WHO, 2022). The Outcome of the Ministerial Meeting of the LDCs in preparation for the 26th Conference of the Parties (COP) calls for streamlining and simplifying the application, review, approval, and disbursement procedures[113] of the financial mechanisms of the Convention and other climate funds and financial institutions.

Without adequate policy, planning, and fiscal support measures, LDCs will not be able to benefit from the global energy transition that is currently under way as part of green recovery efforts. Donors should seek at a minimum to meet their Official Development Assistance (ODA) and climate finance commitments as well as provide further fresh financing for developing countries that enable inclusive growth and sustainable development, especially LDCs and small island developing states (SIDS) (IEA, IRENA, UNSD, World Bank, WHO, 2022).

[113] www.ldc-climate.org/wp-content/uploads/2021/10/Thimphu-Call-for-Ambition-and-Action.docx.pdf

As the UN High-level Dialogue thematic report on Finance and Investment emphasized, reaching SDG 7 and net-zero emissions requires an urgent and steep rise in clean energy investment and finance, with a priority focus on the LDCs. The report further notes that it is essential to increase financial flows to the least developed countries, and to find ways in which public funding can leverage the private sector to invest in clean energy – for example, through relevant regulatory improvements that enhance private-sector participation and foster the greater openness, attractiveness, and readiness of electricity markets, so that millions can benefit from new electricity access (UN, 2021b).

Promising examples of how LDCs are integrating energy access and pandemic recovery efforts are emerging. Since the beginning of the pandemic, the World Bank has approved several projects combining electrification with recovery efforts, including increasing access for healthcare facilities and schools in LDCs. Approved in January 2021, the Enhancing Sierra Leone Energy Project will provide a $50 million grant from the International Development Association (IDA) to improve access to electricity in Sierra Leone and enhance institutional capacity and commercial management of the sector.[114] This project will provide electricity to approximately 276,000 people and about 700 health facilities and schools and help cut an average of 15,135 tons of greenhouse gas (GHG) emissions per year.

The Somalia Electricity Recovery project ($150 million) is set to increase access and lower the cost of electricity for 7 million people. The project aims to enhance health and education services by providing electricity access to 205 health facilities and 380 schools.[115]

II. PRIORITIES FOR ACCELERATING PROGRESS TOWARDS SDG7 IN ALIGNMENT WITH THE DOHA PROGRAMME OF ACTION FOR LDCS

- Accelerate the **delivery of public finance and mobilization of resources from all sources** to meet the energy-access investment needs in the LDCs in alignment with climate goals; ensure resources are anchored in a strong commitment to increasing renewables in the energy mix and achieving energy efficiency.

- Increase commitment to promoting public and private investment to ensure that households make **the transition to cleaner, more efficient, and sustainable cooking technologies** and fuels with a focus on remote, poor, and vulnerable households.[116]

- **Redirect policies and regulations in LDCs** and make **finance available to help them regain the momentum on expanding renewable capacity**. Redirect resources, including from fossil fuel subsidies, where applicable, towards renewable generation.

- **Promote transparency and accountability of public–private partnerships** to build business confidence and attract private investments at scale so that existing energy systems can be overhauled through improved market design and flexibility.

- **Promote effective engagement and participation of local communities**, especially **youth**, **women**, and other marginalized groups both in decision-making processes and in the implementation of energy policies and programmes; this is to ensure the sustainability of electrification projects, as well as an efficient uptake of energy services for employment and other income-generating opportunities.

[114] www.worldbank.org/en/news/press-release/2021/01/28/more-than-270000-sierra-leoneans-to-get-better-access-to-electricity
[115] www.theeastafrican.co.ke/tea/business/world-bank-to-boost-electrification-in-somalia-3651028
[116] The Doha Programme of Action for the Least Developed Countries: available at: https://digitallibrary.un.org/record/3959499?ln=en

- Increase **international cooperation to promote least-cost pathways to energy access in LDCs**, including through **cross-border cooperation** and **collection and publication of data**; **digitalization** can play an important role in shaping future policies and investments towards an energy secure future for all.

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