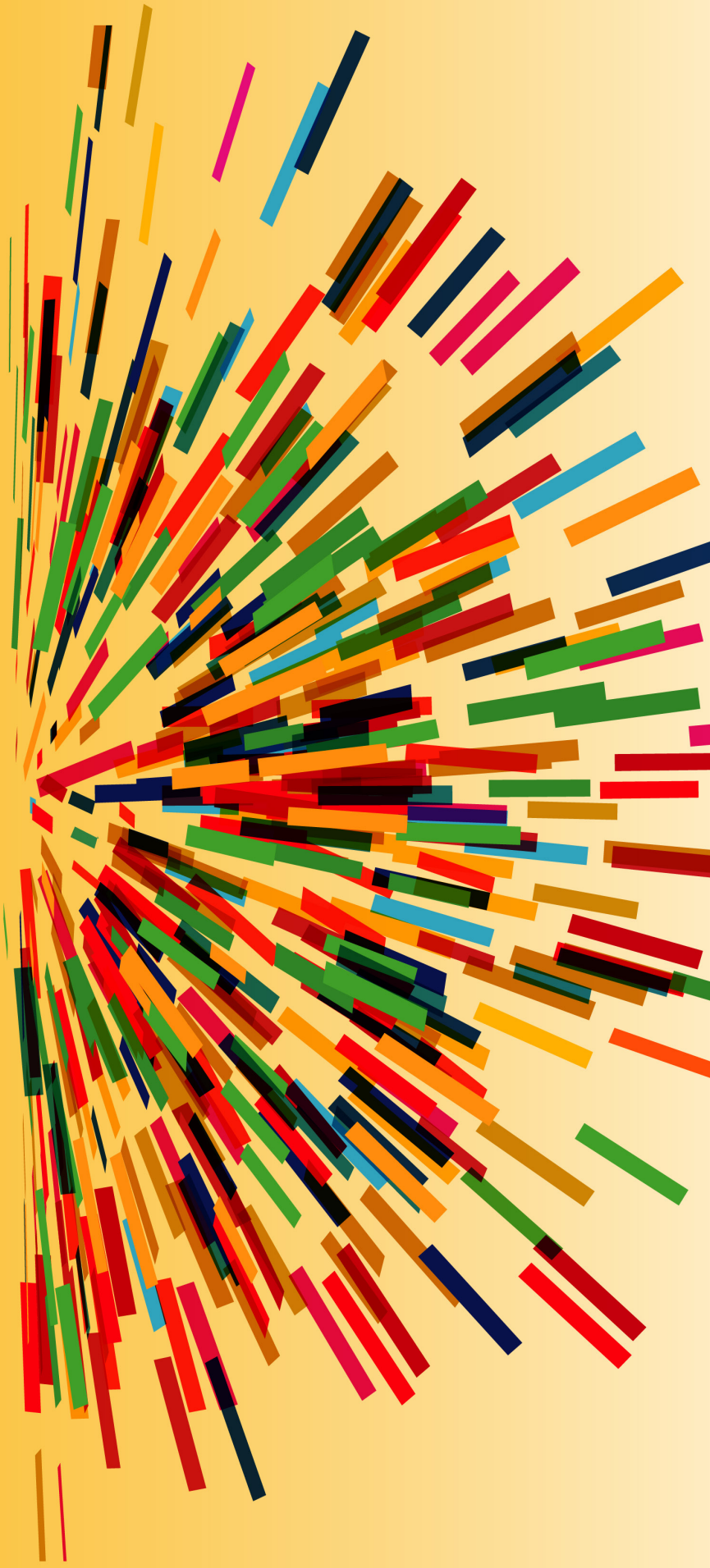
POLICY BRIEFS IN SUPPORT OF
THE HIGH-LEVEL POLITICAL FORUM

LEVERAGING ENERGY ACTION FOR ADVANCING THE SUSTAINABLE DEVELOPMENT GOALS



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- Ministry of Foreign Affairs of the Netherlands
- Ministry of Foreign Affairs, Pakistan
- Ministry of Foreign Affairs, UAE
- African Union Commission (AUC)
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- African Development Bank (AfDB)
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- Global Green Growth Institute (GGGI)
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- International Renewable Energy Agency (IRENA)
- Itaipu Binacional
- PowerForAll

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Clean Cooking Alliance (CCA)

Rocky Mountain Institute (RMI)

SDG7 Youth Constituency

Sustainable Energy and Jobs Platform (SEJP)

United Nations Children's Emergency Fund (UNICEF)

United Nations Development Programme (UNDP)

United Nations Economic and Social Commission for Asia and the Pacific (UN ESCAP)

United Nations Economic and Social Commission for Western Asia (UN ESCWA)

United Nations Economic Commission for Africa (UN ECA)

United Nations Economic Commission for Europe (UN ECE)

Renewable Energy Policy Network for the 21st Century (REN21)

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United Nations Entity for Gender Equality and the Empowerment of Women (UN WOMEN)

United Nations Environment Programme (UNEP)

United Nations Industrial Development Organization (UNIDO)

United Nations Institute for Training and Research (UNITAR)

The World Bank

World Health Organization (WHO)

United Nations Economic Commission for Latin America and the Caribbean (UN ECLAC)

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CONVENED BY:

United Nations Department of Economic and Social Affairs (UN DESA)

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PREFACE

The world has made significant progress toward SDG 7 in some areas. Yet efforts remain well below the scale required to meet the goal by 2030. If we do not accelerate the Global momentum towards universal energy access and a decarbonized, climate resilient energy system, we will fail to deliver on the 2030 Agenda for Sustainable Development. Energy action must be at the heart of the climate action agenda to secure global net zero emissions by mid-century as all countries step up their ambition and Nationally Determined Contributions towards the UNFCCC COP26 in Glasgow in November.

We need to do more, much faster.

That is why the United Nations Secretary-General Antonio Guterres is convening the High-level Dialogue on Energy in September 2021 under the auspices of the General Assembly. The Dialogue represents the first global gathering on energy since the UN Conference on New and Renewable Sources of Energy held in Nairobi in 1981. It presents a historic opportunity to provide transformational action in the first years of the SDG Decade of Action and support the implementation of the Paris Agreement.

This fourth edition of the Policy Briefs, coordinated by the SDG7-TAG, will provide a strong basis for determining what needs to be done to scale up and accelerate progress on SDG 7 between now and 2030, and how energy action can best be leveraged for the achievement of all the other SDGs. The Policy Briefs will inform the discussions at this year's High-level Political Forum on Sustainable Development to be held in July on the theme of "Sustainable and resilient recovery from the COVID-19 pandemic that promotes the economic, social and environmental dimensions of sustainable development: building an inclusive and effective path for the achievement of the 2030 Agenda in the context of the decade of action and delivery for sustainable development".

As the Secretary-General for the High-level Dialogue on Energy, I am encouraged that the SDG 7 Policy Briefs have already provided substantive inputs into the preparatory process for the High-level Dialogue on Energy in September, especially on enabling SDGs through just, inclusive energy transitions, one of the five themes of the Dialogue. I commend the strong engagement of members of the SDG 7 Technical Advisory Group under the able leadership of its co-facilitators Sheila Oparaocha and Hans Olav Ibrekk.

UN DESA will continue to lend its support to the SDG 7 Technical Advisory Group in delivering simultaneously on the 2030 Agenda and the Paris Agreement.

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

FOREWORD

It is our pleasure and honour to present the fourth compilation of SDG 7 Policy Briefs, compiled by the SDG7 Technical Advisory Group.

Sustainable Development Goal 7 – ensuring access to affordable, reliable, sustainable and modern energy for all – holds a unique position in the nexus between the 2030 Agenda and the Paris Agreement. Ensuring universal access is necessary for creating sustainable economic growth and development.

Energy weaves all Sustainable Development Goals together and decisive action on sustainable energy can catalyze progress towards the other SDGs. Indeed, energy is critical to deliver on all other SDGs. Yet while so much depends on SDG7, it may slip out of reach if we do not act immediately.

Meanwhile, the average global temperature has already risen to 1.2 degrees Celsius above pre-industrial levels. Failure to transition to sustainable energy systems will threaten human well-being and economies for decades. We must dramatically step up the pace of implementation to create a more resilient and sustainable world.

With less than a decade left to achieve the Sustainable Development Goals, we are at a make-or-break moment when it comes to delivering on universal access to sustainable energy. We need to take integrated approaches that optimize the effects of energy in other sectors. This includes carefully managing the global energy transformation to ensure equity and inclusiveness. Gender issues need to be taken fully into account, in terms of both driving progress and managing impacts.

We are truly fortunate to have a Technical Advisory Group with an active membership and deep expertise on how to address the SDG goals and the climate crisis and in a synergistic manner. Their collaborative work, involving a broad range of stakeholders, provides a model for strengthened cooperation within and beyond the UN system.

We hope that Member States and all stakeholders will benefit from this report as they deliberate progress on the SDGs at the High-level Political Forum 2021 and look into strengthening their commitments to achieve SDG7 in preparation to the High-level Dialogue on Energy in New York in September 2021 and the 26th UN Climate Change Conference of the Parties (COP26) in Glasgow in November 2021.

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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The development of each policy brief was led by a group of organizations, which served as the lead coordinators to facilitate numerous iterations among themselves and with other contributing organizations and multi-stakeholder contributors. Their excellent efforts, and the quality and timely delivery of the products, are gratefully acknowledged.

The Division for Sustainable Development Goals (DSDG) at UNDESA provided secretariat services to the group, conceptualized the processes and products, mobilized resources, led the drafting of the Summary for Policymakers and the compilation of the policy briefs. The work was spearheaded by the sustainable energy team led by Minoru Takada with support from Bo Fu, Dylan Grant, David Koranyi, Martin Niemetz, Isabel Raya and Nadine Salame and under the overall guidance of Alexander Trepelkov, Office-In-Charge of DSDG and Shantanu Mukherjee, Chief, Integrated Policy Analysis Branch of DSDG at DESA. The Capacity Development Office at UNDESA provided overall support during the process. Special thanks are extended to Gail Karlsson who provided invaluable edits to the policy briefs and the summary for policymakers, ensuring accuracy, consistency and readability, and also to Camilo Salomon for the excellent work on the graphic design and production of the report.

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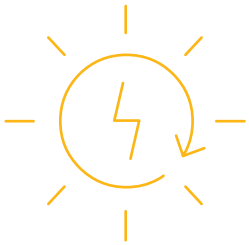
KEY **NUMBERS**

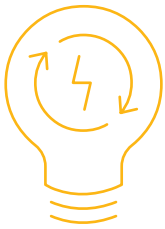
90% OF GLOBAL POPULATION has connected to electricity in 2019.

759 MILLION still remain without electricity access.



2.6 BILLION PEOPLE are still without access to clean cooking solutions.

The share of all renewables is projected to rise only to around **21.5 PER CENT** of total final energy consumption by 2030.



Annual efficiency improvement is projected to reach **ONLY 2 PER CENT** between 2018 and 2030, far short of the 3 per cent needed to achieve our target.

In 2018, international public financial flows to developing countries in support of clean energy amounted to **$14 BILLION**.

Global investment in renewable energy capacity **INCREASED BY 2% TO $303.5 BILLION** in 2020, in spite of the COVID-19 pandemic.

The right energy efficiency policies could deliver **OVER 40%** of the emissions reductions needed to reach the goals of the Paris Agreement.

Renewable-based energy solutions and energy efficiency measures together can potentially achieve **90%** of the energy-related carbon reductions by 2050.

Only **31% OF PRIMARY SCHOOLS** in Sub-Saharan African and 55% in Southern Asia have access to electricity.

Currently, women represent **32% OF WORKERS** across all renewables, compared with 22% in traditional energy industries such as oil and gas.

An estimated **1 BILLION PEOPLE** globally are served by health facilities without electricity

The energy consumption of the **RICHEST 5% EXCEEDS** that of the **POOREST 50%** of the global population.

Thermal power generation is responsible for **50% OF ALL WATER** withdrawals in the United States and several European countries.

Lack of energy often causes cold chain breaks in emerging economies and developing countries, which results in an estimated **20% FOOD LOSS**.

Cities account for **THREE-QUARTERS** of global final energy consumption.

The industry sector accounts for **37%** of global final energy consumption.

The world's first solar farm in a refugee camp currently supports the electricity needs of **20,000 REFUGEES** by providing additional power to the national grid.

SECTION 1

KEY MESSAGES **FOR POLICY MAKERS**

Overarching messages

Decisive action on sustainable energy can catalyse progress towards all the other SDGs, as well as global climate protection targets. Energy is essential to all other SDGs: ending poverty and hunger, running healthcare facilities, providing access to education, improving gender equality, providing access to clean water and sanitation, promoting sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all, reducing inequalities, promoting sustainable production and consumption, building sustainable cities and communities, life below water and on land, creating peace, justice and strong institutions, promoting biodiversity and catalyzing climate action.

We must act very quickly and decisively now. So much of the world's future quality of life depends on reaching the targets for SDG 7 and the Paris Agreement, but there is very little time left to act. We must find new and more effective ways to communicate the urgency of the situation, as there are still large portions of the world's population without modern energy services, and we continue to use polluting energy systems that are leading us towards climate disaster. Making a rapid transition to a clean energy future for all will have enormous impacts on the quality of people's daily lives, as well as the survival of future generations.

Although the world has made progress towards achievement of SDG 7 in some areas, current efforts remain well below what is needed to meet the goal by 2030. As of 2019, 759 million people still had no access to electricity, and significant gaps remain between urban and rural access. About 2.6 billion people are still without access to clean cooking solutions. While global investments in renewable energy capacity increased by 2% to US$ 303.5 billion in 2020, on our current trajectory the share of all renewables is projected to rise only to around 21.5% of total final energy consumption by 2030, from 17.1% in 2018. Non-electricity end use sectors such as heat, cooling and transport are lagging far behind. Annual efficiency improvement is projected to reach only 2% between 2018 and 2030, far short of the 3% needed to achieve the target.

The pandemic presents an unexpected opportunity for both advancing sustainable energy goals and reducing social and economic inequality. The economic and social shock of the COVID-19 pandemic crisis has understandably drawn attention away from long-term sustainability plans and investments, and in some areas even reversed recent gains on energy access. However, with strategic planning and collaboration, governments can use this otherwise tragic time as a catalyst for 'building back better', leveraging their pandemic-related economic stimulus packages to scale up investments in sustainable energy solutions for a 'just transition' that will support new employment opportunities and more equitable societies.

We must capitalise on the global momentum towards net-zero to advance SDG7 action in pursuit of the 1.5°C goal. While a significant number of countries have now committed to net zero emissions by 2050, current levels of ambition related to sustainable energy as reflected in Nationally Determined Contributions (NDCs) are not yet in line with a net-zero emissions trajectory by 2050. Time is now to establish bold policy action facilitating a faster transition to more accessible, affordable and sustainable energy systems.

The September 2021 High-level Dialogue on Energy represents an unparalleled opportunity to mobilize worldwide action on SDG 7 and the Paris Agreement. As the first global gathering on energy under the auspices of the UN General Assembly in 40 years, the High-level Dialogue can serve as a unique vehicle for galvanizing political commitment and focusing global efforts on the collaborative and effective implementation required in the coming years, while also contributing to a successful 26th UN Climate Change Conference of the Parties (COP26) in Glasgow.

INTERLINKAGES WITH OTHER SDGS

SDG 1 – Poverty

The COVID-19 pandemic impedes progress in achieving both SDG7 and eliminating poverty (SDG1). Regions and populations with the most extreme absolute poverty and energy poverty are disproportionately at risk of arrested development and the two are inextricably interlinked. The resource requirements for pandemic response coupled with economic downturn is likely to further constrain the already limited fiscal space of Least Developed Countries (LDCs), Landlocked Developing Countries (LLDCs) and Small Island Developing states (SIDS) and the available finance for energy investments and further heighten the risk of poverty and energy insecurity in these countries. Building resilience requires a broader focus that addresses multiple dimensions of energy poverty and poverty.

SDG 2 – Hunger

Ending hunger will not be possible without access to sustainable energy for all in food system transformation. Greater ambition is required to make appropriate sustainable energy technologies, business models and financing more accessible. While progress has been made on deploying clean energy solutions for irrigation, more rapid advances are needed to address agro-processing, cold storage and access to markets. Effective approaches to avoid competition with food and make bioenergy sustainable exist. Renewable energy and sustainable bioenergy have the potential to become a key component of the whole production chain of food, from harvesting, processing, expanding food life as well as transportation. Scaling renewable energy for small-scale farmers and small and medium agri-businesses, including biogas solutions for clean cooking can lead to significant opportunities for additional employment, in particular of youth and women in emerging economies and LDCs, most of which rely heavily on agriculture.

SDG 3 – Health

Access to energy is essential for healthy homes and effective health care facilities, and lack of modern energy services has been a critical issue facing developing countries dealing with COVID-19. An estimated 1 billion people globally are served by health facilities without electricity, and many other facilities have unreliable electricity supplies. Meanwhile, households relying on traditional biomass fuels, or inefficient stove and fuel combinations, are exposed to high levels of air pollution, and this was linked to almost 3.8 million deaths each year even before the pandemic. Significantly greater public and private investments will be required to transition households completely to clean cooking technologies and fuels, and this can be driven in part by publicly supported technology innovation accelerators. At the same time, particular attention needs to be paid to rural electrification planning, to ensure that relevant programmes prioritize electrification of health facilities through clean and reliable energy sources.

SDG 4 – Education

Access to reliable energy provides better learning environments, enhanced school performance, increased opportunities, and improved staff retention. However, there are still over 200 million children globally who go to primary schools without electricity, mostly in disadvantaged and rural communities, thus compromising the children's education and development. During the pandemic, access to electricity and the internet supported remote education while schools and communities were under lockdown or requiring physical distancing. Adopting enabling policies that incentivize and prioritize emerging business models to scale up decentralized clean energy solutions in currently unserved (or underserved) areas will therefore have significant benefits for students and communities.

SDG 5 – Gender Equality

Gender must be at the heart of promoting SDG7. There is currently insufficient progress towards gender equality in energy access, and efforts to improve women's health, education and economic roles have to some extent been overshadowed by the COVID-19 crisis. However, the pandemic has shed light on the urgency of accelerating women's engagement in the energy sector, as women play important roles in expanding and decentralizing renewable energy supply chains, both for productive and household purposes. New stimulus plans can promote economies and support greater access to energy by increasing investments in women's access to modern energy services, appliances and cooking technologies; ensuring women's participation in decision making at all levels of energy production, supply and consumption; and strengthening data, research and innovation on gender and energy interconnections. Keys to closing the gender gap include: gender action plans and gender responsive policies, investments to support female entrepreneurship, and more mandated positions for women in public and private sector energy management.

SDG 6 – Water and Sanitation

Investments in technologies and processes that improve energy efficiency will substantially reduce energy-related water use. Around 90% of power generation is water-intensive, and three-quarters of all industrial water withdrawals are used for power production. Meanwhile, almost 800 million people are currently without access to clean water and 800 million lack access to electricity. With regard to sanitation, 80% of wastewater is discharged untreated. Demands for clean water are growing in many regions, as a consequence of economic and population growth, as well as climate change. In many countries, subsidies for water were introduced to make it more affordable for all citizens. However, the

subsidies often encourage intensive water extraction, disproportionately benefit the wealthy, and place more pressure on limited water resources. Subsidy reforms are needed, but should ensure adequate safety nets for the poor. Above all, technological improvements are needed for more efficient production to free up water and energy resources. Enhanced regional and international cooperation is also required to ensure the resilience of water and energy systems through free trade, interconnectivity, research and technology transfer, and fund mobilization.

SDG 8 – Decent Work and Economic Growth

A sustainable energy transition will bring significant net employment gains and decent jobs, provided the right policy frameworks are put in place. A green recovery would create 5.5 million more jobs in renewable energy, energy efficiency and system flexibility by 2023. Renewable energy jobs could reach almost 30 million by 2030, with another 40 million jobs in energy efficiency and system flexibility. To drive the wider structural shifts needed in the energy sector and further advance employment opportunities, a just transition and a decent work agenda, economic stimulus packages and recovery plans need to be paired with gender-sensitive holistic policy frameworks. This will need to encompass industrial policies, labour market policies, skills training and retraining, strategies aimed at recruiting more women, and social protection measures for fossil fuel sector workers as they try to find new decent jobs. Gender-inclusive skills and training across all sectors of the economy and social protection systems need to compensate for job losses and retraining should be at the forefront of just transition polices. The potential for increasing productivity and performance of energy entities through more diverse hiring including women, should not neglected.

SDG 9 – Industry, Innovation and Infrastructure

Energy demand from industry is outpacing the research and development and deployment (RD&D) of clean technologies (SDG9). The rapidly decreasing cost of renewable electricity and potentially carbon-free hydrogen could contribute to the decarbonization of the industrial sector. Yet there are weak existing regulatory frameworks for sustainable clean energy for industry, as well as limited coordination between government, regulating agencies, and stakeholders in industries to set and enforce sustainability standards not only for industrial emissions but also in other related spaces like green public procurement. Lack of sufficient infrastructure, financing, and knowledge and information for clean energy in industrial activities also limits RD&D in these areas. Covid-related short-term measures should be leveraged to exert change in hard-to-abate sectors and shift longer term production and mobility patterns.

SDG 10 – Reducing Inequality

Working towards reducing social and economic inequality is a prerequisite for a just and inclusive energy transition. While the energy transition presents huge social and economic opportunities, it is important to consciously address existing inequalities while developing transition policies and financing, and make sure no one is left behind. In some areas, high energy consumption levels by wealthy people, (especially for energy services such as transportation, housing, digital services, and the production of goods and services) actually limit access to energy services by poorer consumers. The energy consumption of the richest 5% exceeds that of the poorest 50% of the global population. Government policies that improve equality in the access, availability, quality and affordability of energy services can lead to a sustained reduction in socio-economic inequality. Adjustments in fuel-related tax subsidy schemes, for example, and subsidies for investments in decentralized energy solutions for low-end consumers, could help promote a transition from fossil fuels to renewable sources, while also increasing social justice.

SDG 11 – Sustainable Cities

Investments in renewable energy, and energy and resource efficiency, are critical for sustainable cities. Although national governments typically are seen as the main bodies responsible for governing energy supply and infrastructure, and for driving the transition to renewables-based energy systems, city governments are uniquely positioned to curb energy use and related greenhouse gas emissions while accelerating the uptake of renewables. Cities account for three-quarters of global final energy consumption and a similar share of global energy-related CO_2 emissions. They are home to 55% of the global population, a share that will grow further. Actions by city governments are essential in the electricity sector, as well as heating and cooling of buildings, and transportation. As target setters, regulators, policy makers, facilitators and advocates for renewables, city governments can implement ambitious action plans to advance renewable energy and energy efficiency. At the national level, governments need to explicitly recognize the roles of cities in the energy transition and in climate action within their NDCs and other energy and development plans.

SDG 12 – Responsible Consumption and Production

Aiming for a 'circular economy' offers many opportunities to reduce energy use and carbon emissions. A 'circular economy' is a system designed to continuously reuse resources and reduce waste, as opposed to a 'linear economy' with limited recycling and reuse. Adopting a circular economy would require a large-scale industrial transformation in the ways energy and goods are produced and consumed, and development of new business models, skills, and cross-sectoral collaboration. Improved energy and resource efficiency, waste management, eco-design, and 'reduce, re-use and recycle' practices would clearly contribute to both SDG 7 and 12, and, consequently, to climate change mitigation and environmental sustainability. It is critical to incorporate circular economy into NDCs and COVID-19 responses and recovery strategies, prioritize green investments and promote sustainable lifestyles. Moreover, developing countries require support to improve awareness of the benefits associated with circular economy principles. Capacities must be developed to integrate these principles into bankable business models and projects across value chains.

SDG 13 – Climate Action

Responses to the COVID-19 pandemic have provided the world with opportunities to align short-term recovery objectives with long-term climate and sustainable energy goals, such as the Paris Agreement and SDG 7. Renewable energy and energy efficiency investments undertaken as short-term responses to COVID-19 can support increasingly ambitious longer-term targets and reinforce the enhanced climate pledges reflected in NDCs submitted ahead of COP26. COVID-19 stimulus packages should focus on promoting and financing clean and renewable technologies, phasing out coal, and supporting investments in heating and cooling improvements, as well as research and demonstration projects to support less mature technologies, such as green hydrogen.

SDG 14 – Life Below Water

Oceans contain vast untapped renewable energy potential. Nascent ocean energy technologies could cut emissions from power generation and help to ensure a sustainable, climate-safe energy future. Ocean energy includes wave, tidal, salinity gradient, and thermal energy conversion technologies. These technologies, along with offshore solar and wind energy systems, represent key elements of an emerging blue economy. These developments are especially important for Small Island Developing States, where ocean energy can provide affordable, reliable electricity and end-use energy, as well as boosting potable water supplies via seawater desalination.

SDG 15 – Life On Land

We need to reduce pollution and energy land footprint through increased land productivity, and address conflicts between multiple uses of land Solutions include co-location of different types of energy with other land uses, and, as regards agricultural land, and the use of bioenergy by-products to increase land productivity. Promoting clean cooking solutions is an effective tool in the fight against environmental degradation and biodiversity loss. Adopting a comprehensive planning approach that considers climate, land, energy and water in an integrated way and developing a set of indicators that reflect the possible synergy between renewable energy and sustainable land use are keys to success. Land rights also need to be carefully considered: government action on fair and transparent land titling, with special regard to women and indigenous people, and recognition of indigenous and communal lands, are critical to a just energy transition.

SDG 16 – Peace, Justice and Strong Institutions

Sustainable access to energy can contribute directly and indirectly to peacebuilding efforts by improving well-being, and offering opportunities for community development, while peace, justice and strong institutions can provide the foundations for successful sustainable energy programmes through more inclusive and representative decision making. Framing energy decisions in terms of justice can reduce conflicts between individual and community values, improve the governance of energy projects, and more equitably distribute the benefits they offer. Special attention is required in displacement settings and peacebuilding contexts, where short-term humanitarian aid may not be aligned with governance and investment frameworks that would support sustainable energy access. In those situations, it would make sense for governments to integrate displaced and displacement-affected people into national and local energy planning. Governments, donors and humanitarian agencies should also collaborate more closely to contribute to sustainable energy objectives and support durable solutions.

SDG 17 – Partnerships

Partnerships are essential to achieving SDG 7. Sustainable energy innovation requires a systemic and multistakeholder approach, at all levels, to help bring a broader set of promising technologies to technical and commercial maturity. Partnerships help countries accelerate investment and innovation processes by identifying common priorities and challenges, tackling gaps, sharing best practices to improve performance, reducing costs, and reaching broad deployment of clean and sustainable energy solutions. A much greater level of financial and organizational support for partnership is required, however, within the SDG 7 ecosystem as well as in relation to climate action and other SDGs.

ADDRESSING REGIONAL PRIORITIES AND PROMOTING INNOVATIVE INSTRUMENTS

Regional cooperation is essential for addressing the unique challenges of the Africa, Latin America and the Caribbean, Asia and the Pacific, the Arab region, and the UNECE region. The COVID-19 crisis shed light on the multifaceted vulnerabilities of regional energy systems in terms of sustainability and support for socio-economic growth and development. Building regionally and globally interconnected energy systems will accelerate energy sector decarbonization, optimize the use of resources, ensure energy security, integrate more variable renewable energy into the grid, and improve social equity through improved reliability and affordability of energy.

There is an urgent need for enhanced international collaboration on and increased investments in sustainable energy in all LDCs, LLDCs and SIDS. While most LDCs, LLDCs and SIDS have adopted ambitious energy access, renewable energy and energy efficiency targets on regional and national levels, the implementation progress remains limited and unequally distributed. Their individual energy transition pathways face manifold barriers, which need to be addressed simultaneously and in a cross-sectoral manner. Accelerating access to affordable clean energy can help these countries strengthen their overall development progress.

Innovative tracking instruments and indicators are key to SDG 7 success. Tools such as the Multi-Tier Framework for Energy Access (MTF) and the Regulatory Indicators for Sustainable Energy (RISE) can support evidence-based energy decision making, and promote the right policies and regulations for countries seeking to attract new investments for sustainable energy.

A CALL FOR COLLECTIVE ACTION TO ACCELERATE THE TRANSFORMATION TOWARDS A SUSTAINABLE, INCLUSIVE AND EQUITABLE ENERGY FUTURE

We call on all Member States and other stakeholders to drive the global energy transformation forward by forming transformational partnerships. UN entities, international organizations, and multilateral development banks, as well as businesses, civil society, science, cities and regional governments and other stakeholders, must step up and strengthen their efforts to support the implementation of the SDGs with SDG 7 at the heart.

The High-Level Political Forum, the UN Decade on Sustainable Energy for All, the High-level Dialogue on Energy, and COP26 in 2021 can all inspire actions in support of SDG 7. Energy Compacts in the framework of the High-level Dialogue on Energy offer an inclusive umbrella for Member States and other key stakeholders from the business sector, subnational governments, and civil society to bring together voluntary commitments on all SDG7 targets in support of the goals of the 2030 Agenda and the Paris Agreement. Other intergovernmental platforms should also be leveraged, including the Global Sustainable Transport Conference, the UN Ocean Conference, the Biodiversity Summit, the Food Systems Summit, the UN Framework Convention on Climate Change Conference of Parties, and the Assembly of the International Renewable Energy Agency.

SECTION 2

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

CONTRIBUTING ORGANIZATIONS:
INTERNATIONAL ENERGY AGENCY (IEA),
INTERNATIONAL RENEWABLE ENERGY AGENCY (IRENA),
UNITED NATIONS STATISTICS DIVISION (UNSD),
THE WORLD BANK AND THE WORLD HEALTH ORGANIZATION (WHO)

Summary/Key Messages

The 2021 edition of *Tracking SDG 7: The Energy Progress Report* finds that while the world made significant movement toward achieving SDG 7 in some areas, efforts remain well below the scale required to meet the goal by 2030. The economic crisis caused by the COVID-19 pandemic will undoubtedly have a negative impact on further progress, as investors perceive increased risks in investing in equity, or lending to developing countries. In some countries, the pandemic even threatens to reverse the SDG advances made thus far. However, at the same time, the situation presents significant opportunities to integrate SDG 7-related policies into pandemic recovery packages, and ultimately to scale up sustainable development.

ACCESS TO ELECTRICITY

The worldwide efforts to increase access to electricity over the past decade led to 90% of the global population being connected to electricity by 2019. That leaves 759 million people still with no access. There are also substantial regional disparities. The lowest levels of access to electricity continue to be found in Sub-Saharan Africa, while the Latin American and the Caribbean region, together with Eastern Asia and South-eastern Asia, are now moving towards universal electricity access. After accounting for expected population growth, a total of 940 million people will need to gain access within 9 years to meet the target.

ACCESS TO CLEAN COOKING TECHNOLOGIES

In 2019, 66% of the global population had access to clean cooking fuels and technologies, an increase from 57% in 2010. During the period 2010-2019, progress in access has been led by India, China, Indonesia, Brazil, and Pakistan. Outside of those countries, the global access rate has remained effectively unchanged over the same period. In 2019, the Sub-Saharan African region for the first time had more people without access to clean cooking fuels and technologies than any other region. If current trends continue, almost 30% of the global population (about 2.3 billion people) will still lack access to clean cooking fuels and technologies by 2030.

RENEWABLE ENERGY

In 2018, the share of renewable energy in total final energy consumption (TFEC) amounted to 17.1%. The largest increase in the share of renewables was for power generation, with less progress in the transport and heat sectors. Latin America and the Caribbean have the highest share of modern renewable energy use in TFEC, owing to significant hydropower generation, and to the consumption of bioenergy in industrial processes and biofuels for transport.

ENERGY EFFICIENCY

The rate of global primary energy intensity improvement in 2018 was 1.1%, the lowest average annual rate of improvement since 2010. Between 2010 and 2018, the average annual rate of improvement was 2%; that rate will now need to average 3% until 2030 to meet the target. There has been more progress in reducing energy intensity in Asia than in any other region. In other regions, the rates of improvement were just below the global average in North America and Europe, while the lowest rates of improvement were in Western Asia, Northern Africa, Latin America and the Caribbean, and Sub-Saharan Africa.

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

In 2018, international public financial flows to developing countries in support of clean energy amounted to US$ 14 billion. Overall, the trend of financial flows has been positive over the last decade, representing a three-fold increase during the period 2010-2018 when considering a 5-year moving average. Yet the level of investment remains below what is needed to reach SDG 7, particularly in the case of least developed countries (LDCs).

INSTALLED RENEWABLE ELECTRICITY GENERATING CAPACITY IN DEVELOPING COUNTRIES

Globally, new renewable electricity capacity installations have outpaced installations of conventional/non-renewable power capacity since 2012. In 2018, for the first time, most of the new renewable energy capacity installations were in developing countries. Nevertheless, developed countries had about four times more renewable electricity capacity per capita than developing countries in 2019.

CUSTODIAN TRACKING AND ANALYSIS ON THE ADVANCEMENT OF SDG 7

The *Tracking SDG 7: Energy Progress Report* is jointly produced by the SDG 7 custodian agencies (the International Energy Agency, the International Renewable Energy Agency, the United Nations Statistics Division, The World Bank, and the World Health Organization). The report provides annual tracking and analysis of the most recent progress for each target:

- SDG 7.1 on energy access (with indicators: 7.1.1 on electrification and 7.1.2 on clean cooking technologies and fuels)
- SDG 7.2 on renewable energy
- SDG 7.3 on energy efficiency
- SDG 7.A on promoting access to technology and investments in clean energy (with 7.A.1 focusing on international public financial flows to developing countries in support of clean and renewable energy)
- SDG 7.B on expanding infrastructure and upgrading technology for supplying modern and sustainable energy services for all in developing countries (with 7.B.1 focusing on installed renewable electricity-generating capacity in developing countries).

Using the latest available data for each indicator, and a variety of energy scenarios, the report finds that although the world continues to advance towards SDG 7, efforts remain well below what is required to reach any of the SDG 7 quantified targets by 2030. While innovative policies and technologies continue to emerge and bring positive benefits to the energy sector, the impact of the COVID-19 pandemic has pushed progress on SDG 7 targets backwards in some cases. For example, recent successes on energy access in Africa are being reversed. The number of people without access to electricity increased in 2020 after declining over the previous six years, due to population growth and increased costs for basic electricity services, which are now unaffordable for more than 25 million people who had previously gained electricity access. An additional 85 million people, mainly in developing Asia, could lose the ability to pay for an extended bundle of electricity services and may therefore need to scale back to basic electricity access.

SDG 7.1.1. Access to Electricity

Recent Progress

The share of the global population with access to electricity increased from 83% in 2010 to 90% in 2019, with 1.1 billion people gaining access during this period. After accounting for population growth, the global population without access to electricity fell from about 1.2 billion in 2010 to 759 million in 2019. There was continuous progress from 2017 to 2019 , with 130 million people gaining access to electricity annually, compared to an average of 127 million people per year between 2010 and 2017.

The world's electricity access deficit is primarily concentrated in Sub-Saharan Africa, where three-quarters of the population is without access. The access rate in Sub-Saharan Africa increased from 33% in 2010 to only 46% in 2019, leaving 570 million people still without access to electricity. The three countries with the largest numbers of people lacking access are in Sub-Saharan Africa: Nigeria (90 million people), the Democratic Republic of Congo (70 million people), and Ethiopia (58 million people).

Are we on track to meet the target by 2030?

Despite the recent progress in global electrification growth rates, the world is still falling short of what is needed to achieve the goal of universal access to electricity by 2030. To close the gap, it has been estimated that the annual rate of growth in electrification would have to rise to 0.9% annually until 2030, compared to 0.7% from 2017-2019. Economic disruptions related to the COVID-19 crisis could make it even harder for some countries to reach their targets.

Particularly concentrated efforts are needed to close the access gap in Sub-Saharan Africa. At the current rate of progress, it is estimated that about 555 of the 660 million people without access to electricity in 2030 will be in Sub-Saharan Africa.

The COVID-19 pandemic is placing additional pressure on stakeholders to meet the 2030 target. Although the full impact of the pandemic on electricity access is not yet clear, continued COVID-19 disruptions are expected to slow progress, or even reverse it, as utilities and decentralized energy providers face financial difficulties and governments worldwide find their investment abilities constrained.

SDG 7.1.2 Access to Clean Cooking Solutions

Recent Progress

The share of the global population with access to clean fuels and technologies for cooking increased from 57% in 2010 to 66% in 2019, leaving approximately 2.6 billion people still without access. The Latin America and Caribbean region has remained stable, with 88% access. The regions of Central and Southern Asia, and Eastern and South-eastern Asia, account for the highest access gains for the period 2010-2019, with annualized increases in access to clean cooking of 2.5% and 1.4%, respectively.

The global access rate is led by the five most populous countries: India, China, Indonesia, Brazil, and Pakistan. The global access rate for all other low and middle income countries has remained stagnant.

In Sub-Saharan Africa, the population growth between 2010 and 2019 was higher than the growth in the number of people with access to clean cooking, leaving around 85% of the population in 2019 without access to clean fuels and technologies for cooking. Twenty countries accounted for 81% of the global population without access to clean fuels and technologies in the period 2015 to 2019, and seven of those countries have access levels of 5% or less, including the Democratic Republic of the Congo, Ethiopia, Madagascar, Mozambique, Niger, Uganda, and Tanzania.

Are we on track to meet the target by 2030?

The global access rate has been improving slowly over the past few decades. If current trends continue, only around 70% of the global population will have access to clean cooking fuels and technologies by 2030. That would leave 2.3 billion people, split almost equally between developing Asia and Sub-Saharan Africa, relying on traditional use of biomass, kerosene, or coal as their primary cooking fuel.

To achieve the goal of universal access to clean fuels and technologies for cooking, it is estimated that access gains need to increase by at least 3% annually until 2030, compared to 1% over the 2010-2019 period.

Meanwhile, the COVID-19 pandemic has exacerbated the overall vulnerability of people lacking access to clean fuels and technologies. The economic crisis caused by the pandemic will undoubtedly have an impact on household fuel use, and in some countries threatens to reverse the progress made thus far. Strategic policies and financial incentives will be needed to recover from setbacks caused by COVID-19.

Efforts by national governments to expand targeted policies and subsidy supports will be essential to help accelerate progress towards universal access to clean fuels and technologies for cooking, particularly in the Sub-Saharan African region, where urgent progress is needed.

SDG 7.2 Renewable Energy

Recent Progress

The share of renewable energy in total final energy consumption (TFEC) reached 17.1% in 2018, which is still below the 17.5% level achieved in 1999 (the highest level recorded since 1990).

The largest increase in the share of renewables has been for electricity (+0.7p.p. in 2018, reaching 25.4% total), while the transport and heat sectors have had much slower progress, or none at all.

Heat[1] is the largest of the three end-uses worldwide, accounting for about half of global final energy consumption. Two simultaneous trends have been seen in this sector: traditional uses of biomass have been slowly declining (-1.8% per year in 2018), while the share of modern renewables in TFEC has increased to 9.2% (+1.2% per year in 2018).

The Latin America and Caribbean region reported the largest share of modern renewables due to the extensive use of bioenergy in industrial processes, biofuels for transport, and hydropower electricity generation. Sub-Saharan Africa has the largest share of renewable sources in TFEC, though the renewable energy consumption is 85% traditional uses of biomass.

Are we on track to meet the target by 2030?

SDG target 7.2 requires a substantial increase in the share of renewable energy in the energy mix. Under current and planned policies, the share of all renewables (including traditional uses of biomass) is projected to rise to around 21.5% of TFEC by 2030, from 17.1% in 2018, while the share of modern renewables would increase to 16% in 2030, up from 10.5% in 2018.

The IEA's Sustainable Development Scenario[2] shows that intensified policy support and cost reductions could push the share of modern renewables in TFEC to over 25% by 2030, in which case renewables would supply a little over half of all electricity supply.

IRENA's Transforming Energy Scenario[3] for 2030 shows a pathway under which the rise in the share of modern renewables is slightly higher, reaching 28%, and supplying 57% of global electricity generation.

Heat, despite its large share of final energy consumption, receives limited policy attention globally compared with other end-use sectors. Policy support is also critical for the outlook in transport, particularly in a lower oil and gas price environment.

[1] "Heat" refers here to the amount of energy consumed to produce heat for industry, buildings, and other sectors. All of these will be referred to hereafter simply as "heat." They are not equivalent to heat as a final energy service, which refers to the energy available to end users to satisfy their needs, after taking into account transformation losses.

[2] The IEA's Sustainable Development Scenario lays out a pathway to bridge the gaps and put the world's energy systems on track to achieve the SDG targets most closely related to energy (those in SDG 3.9, SDG 7, and SDG 13).

[3] The IRENA's transforming Energy Scenario 2030 presents a possible way to achieve the goal of substantially increasing renewable energy.

SDG 7.3 Energy Efficiency

Recent Progress

After an upward trend from 2010 to 2015, there has been a steady deceleration in the rates of improvement of global primary energy intensity – i.e., the total energy supply per unit of gross domestic product (GDP). In 2018, global primary energy intensity was 4.75 megajoules (MJ) per US$ (2017 PPP [purchasing power parity]), a 1.1% improvement from 2017.

Between 2010 and 2018, primary energy intensity in Eastern Asia and Southeastern Asia improved by an annual average rate of 3.1%. In Central Asia and Southern Asia and Oceania, the average annual improvement rate of 2.6% between 2010 and 2018 was above the global average of 2%. Rates of improvement were just below the global average in Northern America and Europe (1.9%), with the lowest rates of improvement in Western Asia, Northern Africa, Latin America and the Caribbean (0.8%) and Sub-Saharan Africa (1.4%).

Are we on track to meet the target by 2030?

Achieving SDG target 7.3—doubling the global rate of energy intensity improvement by 2030—is key as it also supports the other targets under SDG 7. Between 2010 and 2018 the average annual rate of improvement[4] in global primary energy intensity was 2%. Although this was better than the rate of 1.2% between 1990 and 2010, it is well below the SDG 7.3 target of 2.6[5]%.

Annual improvement until 2030 will now need to average 3% to meet the target set in SDG 7.3. However, under current and planned policies, and taking into account the COVID-19 crisis, the annual efficiency improvement is projected to reach only 2% between 2018 and 2030. In contrast, the IEA's Sustainable Development Scenario shows that a combination of well-implemented policies and regulations could lead to an annual average rate of 3.4% improvement in energy intensity between 2018 and 2030.

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

Recent Progress

International public financial flows to developing countries in support of clean energy amounted to US$ 14 billion in 2018, a 35% decrease[6] from US$ 21.9 billion in 2017[7]. The decline in 2018, although notable across most regions and technologies, was primarily attributable to a 61% drop in hydropower commitments, following a peak in 2017 due to a large single-project commitment.

Overall, the trend of public financial flows has been positive over the last decade, with a three-fold increase during the period 2010-2018 when considering a 5-year moving average. Between 2010 and 2018, developing countries received US$ 134.8 billion in total, with the biggest yearly average share of commitment going to hydropower (42.2%), followed by solar (22.9%), multiple/other technologies (21.7%) and wind (7.6%). After focusing mainly on hydropower before 2010, a growing share of the public flows have been targeted at supporting solar and so-called 'multiple/other technologies', including through multi-purpose green funds and support for infrastructure.

[4] Calculated as a compound average annual growth rate.

[5] Revisions of underlying statistical data and methodological improvements explain the slight changes in historical growth rates from previous editions. The SDG 7.3 target of improving energy intensity by 2.6% per year in 2010–2030 remains the same, however.

[6] Large fluctuations from year to year – such as between 2017 and 2018 – are primarily due to variations in large hydropower commitments.

[7] All US$ amounts from 2010-2017 have been deflated to constant prices and exchange rates of 2018. For more details see the *Tracking SDG 7: Energy Progress Report.*

Since 2010, financial flows have seen a positive trend across all regions, with the largest relative increase in Central and Southern Asia (a six-fold increase). Sub-Saharan Africa reached a two-fold increase, when considering a 5-year moving average. However, while the positive trend in public financial flows to renewables has been promising, it masks some important distributional discrepancies: only 20% of these flows reaching Least Developed Countries (LDCs) – a total of US$ 2.8 billion in 2018, the same level as in 2017.

Are we on track to meet the target by 2030?

There is no quantitative target for the SDG indicator 7.a.1 on international financial flows to developing countries in support of clean energy. However, financial commitments to developing countries clearly need to increase, given the need to scale up overall renewable energy investments substantially in order to reach the targets for SDG 7. Higher financial flows will surely be needed in the short-term, in light of the COVID-19 crisis, particularly in the LDCs falling furthest behind in reaching SDG 7.

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

Recent Progress

Since 2018, most of the new renewable electricity capacity has been installed in developing countries. In 2019, developing countries had reached 219 watts per capita of renewable electricity installed capacity, up from 205 watts per capita in 2018, and 102 in 2010. The 7% annual growth rate of 2019 was lower than the rate of 8.8% in 2018, signalling a slight slowdown in the uptake of renewables. It was also lower than the compound annual growth rate of 8.9% during the period 2010-2019.

Renewable power capacity installations in 2019 were highly concentrated in the Latin America and the Caribbean region, with 405 watts per capita, closely followed by Eastern and Southastern Asia with 391 watts per capita. Latin America and the Caribbean already had considerable installed renewable electricity capacity in 2010, primarily in hydropower. The large increase, in Eastern and Southeastern Asia (+191%), has been driven primarily by solar and wind energy deployment. Sub-Saharan Africa had 34 watts per capita in 2019, up from 24 in 2010.

Are we on track to meet the target by 2030?

While there is no quantitative target for the SDG indicator 7.b.1 on installed renewable energy-generating capacity in developing countries, the significant potential for developing countries to expand their renewable electricity capacity remains untapped. Although most new capacity installations in the last two years have been made in developing countries, developed countries had around four times more capacity per capita than developing countries in 2019 (with 880 watts per capita in developed countries).

Recommendations on how to Accelerate SDG 7 Implementation

Summary

While innovative policies and technologies continue to emerge and bring positive benefits to the energy sector, the impact of the COVID-19 pandemic has left us in a very different place from that foreseen in early 2020. Not only is the world not on track to meet SDG 7 under current and planned policies, but some elements are even more distant than before. For example, recent successes on energy access in Africa are being reversed – the number of people without access to electricity increased in 2020 after declining over the previous six years, while at the same time, basic electricity services are now unaffordable for more than 25 million people who had previously gained electricity access.

The perceived risk of lending money to most developing countries has increased dramatically, making it more expensive for those countries to raise debt financing for energy technologies and improved energy access. Furthermore, low oil and gas prices could act as a barrier to the uptake of clean energy technologies for some end-uses. The payback period for many energy efficiency retrofits in buildings, for example, is longer if fossil fuel prices are lower. In some sectors, the ongoing decrease in economic activity and lingering economic uncertainty is likely to result in slower turnover of capital stock, meaning that more carbon-intensive and/or inefficient capital stock may operate for longer. However, the pandemic could also have some positive impacts. In many advanced economies, a decline in interest rates and accommodative monetary policy by central banks means that base lending rates will stay lower for longer. Given the capital-intensive nature of many clean energy technologies, this could translate into lower deployment costs. Recovery plans designed to kick-start economic growth, protect workers, and create jobs could provide a substantial boost to the deployment of clean energy technologies – for example, by developing strategies that make use of existing skills in the energy sector to support clean energy transitions. In addition, lower fossil fuel prices could make it easier for governments to reform fossil fuel subsidies.

Part of how we get on track towards meeting SDG 7 depends on how governments respond to the economic crisis and the role of recovery packages in shaping a more sustainable future.

Further insights on necessary measures to accelerate the implementation of SDG 7 targets are highlighted below.

Access to electricity

Continued COVID-19 disruptions are anticipated to impede electrification, by slowing down or even reversing progress as energy providers struggle with financial difficulties, and government investment is limited worldwide. The pace of electricity access progress must accelerate significantly, however, to reach the target by 2030. Sustained efforts and financing across technologies are required to reach people still lacking access, especially targeting low income and fragile countries, as well as the poorest and the most vulnerable.

An integrated approach of electricity access is needed, with decentralized energy development as well as expansion of national grids and improved financial performance of utilities. Policy and regulatory frameworks need to be strengthened in order to support long-term expansion of electricity access, as well as to mitigate the negative impacts of the pandemic on national utilities, and mini-grid and off-grid industries.

To address the affordability gap, demand-side subsidies have emerged as a new instrument for governments to lower the price end-users pay, and to complement supply-side subsidies (concessional financing, results-based financing, and grants) in an integrated manner.

The promotion of productive uses of electricity, and demand stimulation interventions fully integrated into electrification programmes, will leverage the socio-economic benefits of electrification while increasing the viability of business models. Support training and skills building will also be critical, while building opportunities for employment, encouraging women's participation in the sector and engaging with communities to increase awareness.

Access to clean cooking technologies

A commitment to provide clean cooking fuels and technologies is necessary. Given current trends, particular attention must be paid to the Sub-Saharan Africa region, and to countries with small populations, to ensure no one is left behind. Major initiatives and substantial investments, both public and private, will be needed to encourage the uptake of clean cooking fuels and technologies by 2030. This is particularly important after the economic challenges that the COVID-19 pandemic has caused, which threaten to reverse the recent progress made in some regions. Innovative solutions relying on biogas fuel and solar energy should be considered in addition to the more common solution of improved cooking stoves. Countries should take advantage of tools available to help identify the costs and benefits of transitions to cleaner fuels and technologies. As the effect of parallel use of fuels and technologies (fuel stacking) becomes more common in transitioning places, policies should promote cleaner stacking.

Renewable energy

The adoption of renewable energy in the power sector has seen solid progress, in contrast to other end uses, for which much greater effort is needed.

The heating sector accounts for almost half of global energy consumption and there is an urgent need to decarbonize it. Barriers persist – such as high upfront costs, regulatory and institutional frameworks based on fossil fuels, consumer inertia, and technical hurdles – but can be overcome with support policies. Some pathways to decarbonize the heating and cooling sectors include: renewables-based electrification; renewable gases; sustainable use of biomass; and direct use of solar thermal and geothermal heat.

Looking ahead, measures to scale up renewable heating can and must be aligned with broad socio-economic policies and objectives, such as improving conditions for vulnerable segments of the population, developing key economic sectors, setting long-term energy plans, and pursuing international climate and sustainability goals. A coherent, consistent, long-term policy approach to renewable energy and decarbonization of the energy system will inspire confidence in investors and project developers. Importantly, international cooperation can be a key accelerator of energy transition and help address climate change, economic inequality, and social injustice.

Energy efficiency

Recent shortfalls in energy intensity improvements, below the rate necessary to meet the target of SDG 7.3, will require strengthened government policies. Making energy efficiency measures a priority in policy and investment over the coming years can help the world achieve SDG 7.3, improve economic development, and ensure universal access to clean, efficient energy.

Decades of global experience demonstrate that well-designed and implemented energy efficiency policies can deliver a range of benefits beyond energy and emissions savings. Minimum Energy Performance Standards (MEPS), for example, are a proven tool in policy making. The introduction of MEPS is one means to expand mandatory policies and cover more products in more sectors globally.

Government actions to reduce the cost of energy-efficient equipment or building retrofits, including by means of economic incentives such as grants or loans, have proven effective in many countries. Digitalization has also been an emerging trend facilitating progress toward improved energy efficiency. Adopting wide-scale data collection, analysis, and use of digitalization tools can help improve energy efficiency and leverage flexibility opportunities at a systems level.

International Financial Flows to Developing Countries in Support of Renewable Energy

The COVID-19 pandemic has exacerbated the debt pressure of many developing countries, putting a considerable strain on their financial resources. At the same time, market uncertainty and volatility in financial markets due to the crisis have made investors more risk averse, reducing the amount of capital available for renewables in developing countries. Hence, in a post-COVID recovery period, international public finance flows in support of clean energy are key to the development of the sector in these markets.

As public resources are generally limited, they should be used strategically to crowd in additional private capital, especially in sectors and regions that private investors perceive as too risky to invest in. In those markets where the financing of generating capacity can be done by the private sector, donors can increasingly finance supporting infrastructure such as grid integration and energy storage, as well as focusing on de-risking solutions. The predictability and reliability of policies and regulations is a vital consideration for attracting investors, as it reduces risks related to policy reversals or renegotiations. In this regard, governments have a key role to play in the establishment of stable and coherent policy and regulatory frameworks.

SECTION 3

STRENGTHENING **INTERLINKAGES**

SECTION 3.1

INTERLINKAGES BETWEEN **ENERGY AND POVERTY (SDG 1)**

CONTRIBUTING ORGANIZATIONS:
IIASA, MFA NETHERLANDS, IRENA

Summary/Key Messages

THE MOST IMPORTANT INTERLINKAGES BETWEEN SDG 7 AND SDG 1:

- **The pandemic is impeding progress in achieving both SDG 7 and SDG 1.** Regions and populations with the most extreme poverty, and energy poverty, are disproportionately at risk of impeded development, and the two are inherently linked. Progress towards achieving SDG 7 is a prerequisite for poverty alleviation, which is the focus of SDG 1. Affordable and reliable energy services are critical for: health care; education; access to vital goods, services, and information; and opportunities for employment and productive activity.

- **Building resilience requires a broader focus that addresses the multiple dimensions of poverty, including energy poverty**. Expanding the basket of basic needs and essential energy services and tackling the multiple dimensions of poverty and energy poverty are essential elements for building resilience and improving well-being. Simple indicators of extreme poverty (SDG target 1.1) and binary indicators of electricity connections and primary dependence on clean cooking (SDG target 7.1) are easy to track but underestimate the number of those experiencing poverty and energy poverty.

SYNERGIES INCLUDE:

- Improving policy coherence, which remains low because specific SDG targets are still addressed individually within specific ministries and government departments. Coherent cross-sectoral policies are essential for harnessing synergies in addressing SDG 7 and SDG 1.
- Expanding the focus of energy access policies beyond mere connections. The focus on binary access indicators is too narrow; a broader perspective is needed to consider energy services for well-being; service quality, reliability, and affordability; and the role of enabling technologies in addressing poverty for particularly deprived populations.
- Harnessing recovery measures to increase synergies between SDG 7, SDG 1 and other closely related SDGs.

RECOMMENDED TARGETS AND INDICATORS FOR MEASURING THE IMPACTS OF THIS SYNERGY

A new, simpler framework to measure energy poverty is needed, one that is less data-intensive and focuses on energy services for well-being, is aligned to the dimensions of energy poverty specified in the SDG 7 target, and distinguishing energy supply indicators from those that relate to household poverty.

Appliance ownership is used as an indicator of households' access to energy services. The recommended framework defines thresholds for three different tiers of service:

Minimal energy subsistence includes lighting, fans for a minimal level of space cooling, which is required in much of the global south, and cell phone charging.

Decent energy services additionally include refrigerators for food storage, air conditioners and a TV or similar device to access broadcast media, which is important for social well-being.

The *Affluent* tier includes all other appliances.

The affordability indicator is also expanded to include appliance purchase costs.

INTERLINKAGES

The COVID-19 pandemic impedes progress in achieving both SDG 7 and SDG 1 – *Regions and populations with the highest levels of extreme poverty, and energy poverty, are disproportionately at risk of impeded development, and the two are inextricably interlinked.*

For the past two decades, there was consistent progress in eradicating poverty, until 2020 when, for the first time since 1998, about 71 million people were pushed back into extreme poverty due to the impacts of the COVID-19 pandemic (United Nations, 2020). Populations in Southern Asia and Sub-Saharan Africa experienced the largest increases in extreme poverty, and within these regions, certain population groups were disproportionately affected, including self-employed and informal workers, and small and medium-sized enterprises (ILO, 2020). Moreover, recent analysis shows that the people who are newly impoverished are more urban, better educated, and less likely to work in agriculture than those who were

living in extreme poverty before this pandemic (World Bank, 2020). There is an urgent need to address the economic and energy requirements of the growing numbers of urban as well as rural poor people, and to provide them with decent job opportunities.

Progress in achieving SDG 7 was uneven and inadequate even before the pandemic. Now, disruptions caused by COVID-19 are further hampering progress in expanding access to electricity and clean cooking. The flow of financing for renewables and energy efficiency has also been slowed (IEA, IRENA, UNSD, World Bank and WHO, 2020; ESMAP, 2020).

The poorest regions and populations are being disproportionately affected by energy access disruptions. For example, diagnostic reports applying the Multi-Tier Framework (MTF) to assess energy access in Ethiopia and Cambodia have revealed that access to electricity and clean cooking remains very low, especially among rural populations, and that affordability is a key issue. In Ethiopia, 28.4% of households used more than 5% of their monthly spending budget for fuel in 2017 (Gouthami et al., 2018). In Cambodia, 10% of households that used a clean fuel stove as their primary stove allocated on average more than 5% of total spending on fuel, and these households were typically not in the lowest spending quintiles (World Bank, 2018).

If economic recovery from the pandemic remains stalled and fails to specifically target the poorest and most energy-deprived populations, the projected fallout could push close to half a billion people back into poverty by 2030, representing a reversal of approximately a decade of global progress in reducing poverty (Sumner et al., 2020).

A slow economic recovery after the pandemic could also significantly retard progress towards achieving universal access to modern energy services, with affordability becoming an even bigger barrier to access for populations pushed further into poverty. The poorest populations in Sub-Saharan Africa, parts of developing Asia, and Latin America and the Caribbean, will likely be most at risk of not being able to transition to cleaner cooking (Pachauri et al., in review; Shupler et al., 2021). Regular use of clean cooking fuels and devices is currently out of reach for over 4 billion people (ESMAP, 2020). However, the pandemic makes moving away from cooking with polluting fuels and devices even more critical for health reasons, as emerging evidence indicates that exposure to poor air quality increases people's vulnerability to COVID-19 (Afshari, 2020; Baumia and van der Lans, 2020; Conticini et al., 2020; Wu et al., 2020).

Extreme weather events related to climate change can also push people below the poverty line. Hurricanes, for example, often destroy power infrastructure (particularly in Small Island Developing States) and can lead to severe disruptions in fuel supplies. Renewable and decentralized energy systems can help build resilience for people and enterprises that are vulnerable to the effects of weather extremes.

Building resilience requires a broader focus that addresses multiple dimensions of poverty, and energy poverty – *Expanding the basket of basic needs and essential energy services and tackling the multiple dimensions of poverty and energy poverty, are key to building resilience and improving well-being.*

Ending poverty (SDG 1) requires more than raising incomes above the poverty line. Similarly, achieving sufficient access to energy (SDG 7) requires more than just connections to the electricity grid and access to modern fuels. The people who are most at risk from climate-related extreme events, and other economic, social and environmental shocks and disasters, are those that face several simultaneous and overlapping types of deprivations. (The SDG target 1.5 on resilience and vulnerability of the poor highlights this.). In 2020, the estimated 435 million people who lacked access to safe drinking water, facing also indoor air pollution and undernutrition in their households, were highly vulnerable to COVID-19 (Alkire et al., 2020).

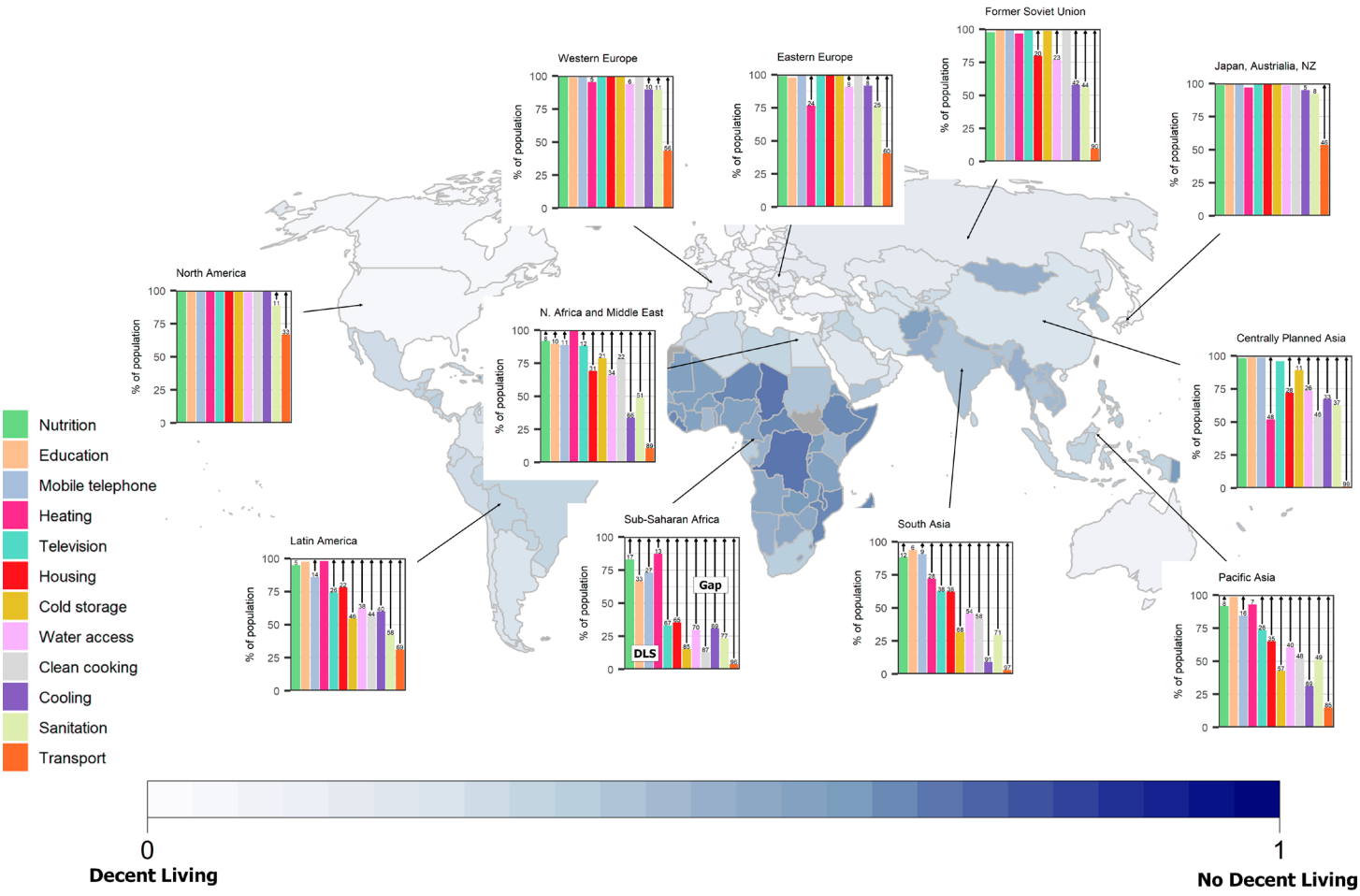
Eradicating poverty in all its manifestations requires inclusive and universal access to basic services, decent work and access to social protection systems, as set out in targets 1.3 and 1.4 for SDG 1. SDG target 7.1 only tracks populations without access to electric connections and clean cooking. It does not account for the estimated 3.2 billion who still lack access to thermal comfort at home and between 3-5 billion who lack access to durable appliances that enable modern energy services critical for decent living (Mastrucci et al., 2019; Poblete-Cazenave et al.). Eliminating poverty and energy poverty requires addressing the multiple dimensions of decent living standards and the energy required for community services (i.e., health care and education) as well as for productive use in agriculture and SMEs. These sectors account for most of the economic activity and employment in most least developed and emerging nations.

The basic needs for well-being at the household and community level, which are reflected in the Decent Living Standards (DLS) proposed by Rao et al., (2019), include:

- Essential services (health, education, sanitation, lighting, mobility, food production)
- Thermal comfort (because heat stress affects livelihoods, labour productivity, and mortality)
- Cold storage (for nutrition and disease prevention)
- Digital and communication services (for social connectivity, education, work opportunities)
- Clean cooking (to avoid air pollution and associated health risks)

The energy services that support basic well-being overlap with elements of multidimensional poverty (Rao et al., 2020). In fact, more people lack access to these services than the number of income poor, as defined by the World Bank's International Poverty Line (2011 PPP $1.90 per day), or as set out in SDG target 1.1. on absolute poverty. In India, a significantly larger percentage of the population lacks these energy services, compared to the 20% identified as income poor. For example, more than 93% (over a billion people) lack access to space cooling to help them avoid heat-induced health effects (Mastrucci et al., 2019) and 70% of households do not own a refrigerator (Mahambare, 2017), while 4% do not have any access to electricity (grid and off-grid) (Bali, 2020).

FIGURE 1. GAPS IN DECENT LIVING STANDARDS.



Source: Kikstra et al. (in review)

Figure 1 provides an assessment of the global gaps in Decent Living Standards.

CHALLENGES FOR CREATING SYNERGIES, AND WAYS TO ADDRESS THEM

Coherent cross-sectoral policies essential for harnessing synergies among SDG 7 and SDG 1

Integrated, coordinated and cross-sectoral policies offer a vast potential to reap multiple benefits for improving well-being with reduced investments. For instance, research from Sub-Saharan Africa shows that integrating energy access, energy efficiency and renewable energy policies has significant benefits (Dagnechew et al., 2020).

Integration stimulates the expansion of energy services while reducing investment requirements and climate impacts. Increased energy efficiency improvements allow for access to a wide range of services through distributed systems. In addition, distributed renewable energy expansion reduces conversion and transmission losses, thus improving service quality and access opportunities.

To implement an expanded and integrated approach requires the cooperation of multiple actors at different governance levels and domains, and from varied stakeholder groups (including public authorities, the private sector, and community organizations).

Supporting appliance purchases could help increase access to energy services at the household level (Pachauri and Rao, 2020). Indirectly, energy access at the community and national level is also needed to support non-energy essential services – such as health care, education, mobility, and food production (Kikstra et al., in review).

In view of long-term sustainability objectives, an integrated and systemic expansion of infrastructure should be designed to supply the basic needs that are beyond the household's decision-making power. Future construction, and associated energy and material demand and lock-ins, could be avoided if slums and poor-quality rural homes were upgraded with energy-saving housing construction practices (Mastrucci and Rao, 2019), and if public transportation could meet future mobility demand. Recent literature regarding the impacts of the pandemic on the urban poor clearly highlights the urgency to improve the energy, digital and housing infrastructure in cities to redress existing inequalities and enhance resilience (Boza-Kiss et al., 2021).

Decentralized, renewable-based energy solutions can also increase resilience to natural and anthropogenic disasters and secure the provision of crucial services, such as health care, in the event of service disruptions. Communities with distributed access to renewables also showed greater livelihood resilience in the face of disruptions caused by COVID-19, as shown in case studies for India by SELCO Foundation[8]. Decentralized energy solutions also enable the participation of local actors, such as communities and SMEs. These actors can create jobs related to the provision of energy services and energy efficiency solutions, and for the maintenance of infrastructure. Thus, they have considerable potential to empower local communities and allow them to capture a range of benefits.

Designing recovery measures to increase synergies between SDG 7, SDG 1 and other SDGs

With the economic downturn and pandemic recovery measures, competition for scarce resources will increase. This could lead to missed opportunities for improvements and further stall progress on expanding access to energy services.

To maximize the benefits of SDG 7 for SDG 1 (and others, such as SDG 8 on sustainable economic growth), cross-sectoral policies and enabling systems are needed, including tailored financing available to end-users and enterprises for technology innovation in order to link energy supply with productive and consumptive end-uses, as well as training and skills development, and facilitation of market linkages. In addition, gender issues need to be mainstreamed within the policies and enabling systems (IRENA, 2020) in order to address gender equality (SDG 5). Innovative and cost-effective policies can deliver immediate progress on many SDGs together and align economic recovery with longer-term developmental goals.

Recovery packages, ongoing reorganization and reorientation of investments, and coordination of the strategic objectives of diverse actors can provide opportunities to simultaneously tackle economic stimulus, sustainability, and affordability of energy services and technologies. For instance, efficient household appliances, and building renovations can help create employment opportunities.

[8] http://www.covid-19.selcofoundation.org/

It is crucial for recovery packages to commit funding at the scale necessary to tackle energy access challenges through coordinated development of centralized and distributed solutions in ways that deliver benefits for other SDGs as well. Targeted efforts to link energy supply with productive uses and basic services – such as health care, water supply and education – will advance general well-being. Such efforts need to catalyse rural economies, strengthen local enterprises, and create jobs that contribute to reducing poverty.

The Washington Consensus on privatization of the energy sector needs to be complemented with pro-poor approaches, such as social safety nets and demand-side subsidies. (See the World Bank's multiyear initiative 'Rethinking Power Sector Reform in the Developing World[9].

TARGETS, INDICATORS AND DATA

Accurately measuring energy poverty requires distinguishing poor energy supply conditions from service deprivations within the home. For instance, availability of power is a necessary condition for electricity supply. However, whether or not a person enjoys a comfortable temperature level at home depends on their ability to afford cooling and heating equipment, and the associated running costs. Tracking energy poverty in this way can help direct policy efforts towards both energy suppliers and households, and thereby accelerate efforts to achieve the targets of SDG 7.

Currently, two indicators are recommended to track Target 7.1 – Indicator 7.1.1: Proportion of population with access to electricity, and Indicator 7.1.2: Proportion of population with primary reliance on clean fuels and technology. These binary indicators, while easy to communicate and quantify, neglect several service attributes, and provide little granularity on end-uses. They thus tend to underestimate the challenges of eradicating energy poverty.

In a recent paper, Pachauri and Rao (2020), designed a simpler framework (Figure 2) for measuring energy poverty that aims to overcome the prevalent mixing of energy supply characteristics with household characteristics and conditions. They apply this simplified framework to actual country data to test how well it captures energy poverty in comparison to other tools, such as the World Bank's Multi-Tier Framework (MTF). The new framework prunes the dimensions of energy poverty measured to those specified in the SDG 7 target. It defines thresholds to mark fewer tiers than the MTF. It also distinguishes energy supply indicators from those that relate to household poverty. Appliance ownership, in this framework, is used as an indicator of households' access to energy services rather than electricity consumption, which can be misleading if energy is inefficiently used. The affordability indicator is also expanded to include appliance purchase costs in addition to the recurrent electricity costs.

***Minimal* energy services** – defined as the lowest access tier – includes lighting, fans for a minimal level of space cooling, which is required in much of the global south, and cell phone charging.

***Decent* energy service**s additionally include refrigerators for food storage, air conditioning, and a TV or similar device to access broadcast media, which improves social well-being. Although air conditioning is typically a luxury item in practice, it is included in the Decent tier because studies show that AC will be necessary to avoid heat stress-related health impairments in large parts of the world as a consequence of climate change (Ormandy and Ezratty 2021; Mastrucci et al., 2019; SEforALL, 2020).

[9] https://www.worldbank.org/en/topic/energy/publication/rethinking-power-sector-reform

The ***Affluent*** tier includes all other higher-power appliances.

The new framework is an improvement over existing energy access indicators and measurement frameworks, as it reveals greater heterogeneity among the energy poor and the underlying causes of their limited access to energy services. Yet, regularly tracking and monitoring poverty and energy poverty requires adequate data, which may require frequent surveys in the poorest regions and nations. Given the associated effort and cost of these surveys, greater use of Earth Observation data and other big data and open data sources can be an important complement. A recent example of the use of such sources includes an assessment of the progress with electrification in Africa (see also – NASA Earth Observatory, 2021; Falchetta et al., 2020). Efforts to track energy use should also include collecting more gender-disaggregated data so that impacts for men and women can be assessed.

FIGURE 2. A SIMPLIFIED ALTERNATIVE FRAMEWORK COMPARED TO THE MULTI-TIER FRAMEWORK FOR ENERGY ACCESS MEASUREMENT

AF Measurement of Household Access to Electric Services				
	TIER 0	**TIER 1**	**TIER 2**	**TIER 3**
ENERGY SUPPLY POVERTY				
Availability	None	<8hrs	8-16hrs	<16hrs
Cost of supply^	NA	NA	NA	NA
ENERGY SERVICE POVERTY				
Service level	None	Minimal (Lighting/ phone charging)	Decent+ (TV | fridge| cooling)	Affluent+ (other appliances)
Affordability (budget share)	NA	>10%	5-10%	<5%

MTF Measurement of Household Access to Electric Services*						
	TIER 0	**TIER 1**	**TIER 2**	**TIER 3**	**TIER 4**	**TIER 5**
Duration – Day Evening		≥ 4hrs	≥ 4hrs	≥ 8hrs	≥ 16hrs ≥ 4hrs	≥ 23hrs ≥ 4hrs
Quality					Voltage problems do not affect use of desired appliances	
Reliability Disruptions per week				≥ 14hrs	≤ 3 of total duration < 2hrs	
Capacity		≥ 3W	≥ 50W	≥ 200W	≥ 800W	≥ 2kW
Consumption levels, in Wh/day	<12	≥ 12	≥ 200	≥ 1,000	≥ 3,425	≥ 8,219
Affordability				Cost of standard consumption package of 365 kWh per annum is < than 5% of household income		

Note: ^ The cost of supply is context specific.
Source: Pachauri and Rao (2020).

Note: * The MTF also includes dimensions - "Legality" & "Health and Safety".

REFERENCES

Afshari R., 2020. Indoor air quality and severity of COVID-19: where communicable and non-communicable preventive measures meet. Asia Pacific Journal of Medical Toxicology. 2020; 9(1):1–2.

Alkire, S., Dirksen, J., Nogales, R. & Oldiges, C., 2020. Multidimensional poverty and COVID-19 risk factors: A rapid overview of interlinked deprivations across 5.7 Billion People., OPHI Briefing 53, Oxford Poverty and Human Development Initiative, University of Oxford.

Bali, N., Vermani, S. & Mishra V., 2020. Electricity Access and Benchmarking of distribution utilities in India, New Delhi: Smart Power India-powered by The Rockefeller Foundation. Available at: https://smartpowerindia.org/Media/WEB_SPI_Electrification_16.pdf.

Boza-Kiss B, Pachauri S and Zimm C., 2021. Deprivations and Inequities in Cities Viewed Through a Pandemic Lens. Front. Sustain. Cities 3:645914.

Conticini E., Frediani B., Caro D., 2020. Can atmospheric pollution be considered a co- factor in extremely high level of SARS-CoV-2 lethality in Northern Italy? Environ. Pollut. 2020:114465.

ESMAP, 2020. The State of Access to Modern Energy Cooking Services (English). Washington, D.C.: World Bank Group. http://documents.worldbank.org/curated/en/937141600195758792/The-State-of-Access-to-Modern-Energy-Cooking-Services [Accessed 6 April 2021].

Falchetta G, Pachauri S, Byers E, Danylo O, & Parkinson, SC., 2020. Satellite Observations Reveal Inequalities in the Progress and Effectiveness of Recent Electrification in Sub-Saharan Africa. One Earth 2, 364–379.

Gouthami, P; Rysankova, Dana; Portale, Elisa; Koo, Bryan Bonsuk; Keller, Sandra; Fleurantin, Gina., 2018. Ethiopia – Beyond Connections: Energy Access Diagnostic Report Based on the Multi-Tier Framework. World Bank, Washington, DC. https://openknowledge.worldbank.org/handle/10986/30102

Hajia Samira Bawumia, H. S. & D van der Lans., 2020. OPINION: COVID-19, air pollution and cooking: a deadly connectionClean Cooking Alliance. Wednesday, 15 April 2020. Thomson Reuters Foundation. Available at: https://news.trust.org/item/20200415095636-jhr36/

IEA, IRENA, UNSD, World Bank, WHO, 2020. Tracking SDG 7: The Energy Progress Report. World Bank, Washington DC. World Bank.

ILO, 2020. A policy framework for tackling the economic and social impact of the COVID-19 crisis. International Labour Organization. www.ilo.org/wcmsp5/groups/public/@dgreports/@dcomm/documents/briefingnote/wcms_745337.pdf

IRENA, 2020. The post-COVID recovery: An agenda for resilience, development and equality, International Renewable Energy Agency, Abu Dha. www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Jun/IRENA_Post-COVID_Recovery_2020.pdf

Kikstra et al., (in review). Decent living gaps and energy needs around the world. Submitted to Environmental Research Letters.

Mahambare, V., 2017. The hidden truth behind India's low refrigerator ownership. 24 March 2017. Economic Times India 2017. https://economictimes.indiatimes.com/blogs/et-commentary/the-hidden-truth-behind-indias-low-refrigerator-ownership

Mastrucci A, Byers E, Pachauri S & Rao ND, 2019. Improving the SDG Energy Poverty Targets: Residential Cooling Needs in the Global South. *Energy and Buildings* 186: 405-415.

Mastrucci A & Rao ND, 2019. Bridging India's housing gap: lowering costs and CO_2 emissions. *Building Research & Information* 47(1): 8-23.

NASA Earth Observatory, 20 21. Plugging-in Sub-Saharan Africa. Available at: https://earthobservatory.nasa.gov/images/148069/plugging-in-sub-saharan-africa. [Accessed 6 April 2021].

Ormandy D and Ezratty V, 2012. Health and thermal comfort: from WHO guidance to housing strategies *Energy Policy* 49 116–21.

Pachauri S, Poblete-Cazenave M, Aktas A, Gidden M. (In review). Access to Clean Cooking Services in COVID-19 World. Submitted to Nature Energy

Pachauri S & Rao N, 2020. Advancing Energy Poverty Measurement for SDG7. *Progress in Energy* 2(4).

Poblete-Cazenave et al. (accepted). Global Scenarios of Household Access to Modern Energy Services. *Nature Energy*.

Rao ND & Min J, 2018. Decent living standards: Material Prerequisites for human wellbeing. *Social Indicators Research* 138(1): 225-244.

Rao ND, Min J & Mastrucci A, 2019. Energy requirements for decent living in India, Brazil and South Africa. *Nature Energy* 4(12): 1025-1032.

SEforALL, 2020. Chilling Prospects: Tracking Sustainable Cooling for All. Sustainable Energy for All New York. https://seforall.org/system/files/2020-07/CP-2020-SEforALL.pdf.

Shupler, M, Mwitari,J, Gohole, A, Anderson de Cuevas, R, Puzzolo, E, Čukić, I, Nix, E, & D Pope, 2021. COVID-19 impacts on household energy & food security in a Kenyan informal settlement: The need for integrated approaches to the SDGs. *Renewable and Sustainable Energy Review*s, 144: 111018.

Sumner, A, Hoy, C & Eduardo Ortiz-Juarez, 2020. Estimates of the impact of COVID-19 on global poverty. WIDER Working Paper 2020/43. UNU-WIDER. https://www.wider.unu.edu/sites/default/files/Publications/Working-paper/PDF/wp2020-43.pdf

World Bank, 2018. Cambodia - Beyond connections: energy access diagnostic report based on the multi-tier framework (English).Washington, D.C.: World Bank Group. https://openknowledge.worldbank.org/handle/10986/29512 [Accessed 6 April 2021].

World Bank, 2020. "Poverty and Shared Prosperity 2020: Reversals of Fortune." Washington, DC: World Bank.

Wu X., Nethery R.C., Sabath B.M., Braun D., Dominici F, 2020. Exposure to Air Pollution and COVID-19 Mortality in the United States. Science Advances 04 Nov 2020: Vol. 6, no. 45, eabd4049. UN, 2020. Sustainable Development Goals Report, 2020. United Nations. New York.

SECTION 3.2

INTERLINKAGES BETWEEN **ENERGY AND ZERO HUNGER (SDG2)**

CONTRIBUTING ORGANIZATIONS:
FAO, POWER FOR ALL, UNIDO, EC, UAE, ESCWA, PERMANENT MISSION OF UAE TO THE UN, AND CCA

Summary/Key Messages

- Ending hunger will not be possible without adequate, reliable and affordable access to sustainable energy for all to support food system transformation.
- Current patterns of energy use in food systems are unsustainable because they rely heavily on subsidized fossil fuels. On the other hand, inadequate access to energy is a significant problem for food systems, especially in developing countries.
- Affordability is the major barrier for adoption of renewable energy in food systems, and greater ambition is required to make appropriate clean energy technologies, business models and financing more accessible.
- Progress has been made on deploying clean energy solutions for irrigation, but if the 2030 agenda is to be achieved, more rapid advances will be needed to address agricultural processing, cold storage and access to markets.
- Sustainable bioenergy is key to achieving the goals of the Paris Agreement. Existing experience is sufficient to ensure that bioenergy does not hamper food security.
- Sustainable energy can enable significant SDG synergies during and after the COVID-19 recovery, by addressing multiple targets, such as: access to clean drinking water, powering local health centres, increasing incomes, and feeding school children.

- Scaling up renewable energy for small farmers can lead to significant opportunities for additional employment of youth and women in emerging economies that rely heavily on agriculture.
- Investments in energy-smart food must be significantly increased; only 2% of climate finance currently goes to small-scale farmers.
- Investments need to be channelled to energy solutions tailored to specific regions, countries, and food chains. Better data and intelligence will be needed to limit risks and optimize such investments.
- Much greater cooperation is needed between food, energy, climate and water stakeholders at sub-national, national and supra-national levels to successfully achieve SDG 2 and SDG 7.
- A monitoring and evaluation system is needed that better captures the synergies between SGD 7 and SDG 2, as suggested in this brief.

INTERLINKAGES BETWEEN ZERO HUNGER AND ENERGY FOR ALL

Climate-smart energy for food system transformation

Sustainable energy is needed at each stage of the food chain. This is particularly true for digitized modernization and mechanization, and for performing post-harvest operations (storage, processing, and transport) to improve resiliency, enhance livelihoods and reduce food loss. For instance, lack of energy often causes cold chain breaks in emerging economies and developing countries, which results in an estimated 20% food loss. Under current energy systems, there is insufficient access to energy in many parts of the food chain, while at the same time the energy used in food chains represents 30% of global available energy, mostly in the form of fossil fuels, which results in 20-25% GHG emissions from food systems (FAO, 2011).

While transitioning away from fossil fuels and building sustainable energy solutions for food system transformation, it is crucial to guarantee food security and protect the most vulnerable. How to do that differs for mid- to large-scale farming operations compared to smallholders, with energy efficiency being most relevant to the formerwhile small farmer require basic access to affordable and reliable energy. FAO's Energy-Smart Food Programme proposes possible ways to address these challenges.

Harmonization of bioenergy and food production

The International Energy Agency, the Intergovernmental Panel on Climate Change (IPCC), and other organizations, view sustainable bioenergy, particularly through use of waste biomass, as key to achieving the Paris Agreement goals.

As food systems generate many waste residues, they provide significant opportunities to produce bioenergy. Collective knowledge and experience can ensure that sustainable use of bioenergy does not undermine food security. However, due attention should be given to the possible competition between possible uses of residues – in soil management, as animal feed and for other bioproducts besides bioenergy. As wood fuel use by rural households in developing countries often causes forest degradation and respiratory diseases, cleaner cooking options are needed to eliminate the widespread, unsustainable use of wood fuel for cooking.

Integration of other SDGs to ensure energy-food sustainability

Water (SDG 6)

A water-energy-food (WEF) nexus approach (FAO, 2014) is needed to assess trade-offs (e.g., over-pumping because of widespread free solar irrigation) and achieve synergies, – such as use of wastewater to produce biogas, and re-using water for irrigation and for bio-fertilizer in soil management.

Climate change (SDG 13)

Energy use for food production can contribute to climate change problems. Use of wood fuels has deforestation impacts, and use of diesel in food chains contributes to air pollution. However, greater use of renewable energy offers potential benefits, and residues from food chains can be used for bioenergy production. In addition, ensuring adequate access to clean energy for food production increases resilience and climate change adaptation among all stakeholders.

Health (SDG 3)

Clean cooking options can reduce the incidence of respiratory diseases, while sustainable energy provided for food production can also be used to pump good quality water and power health centres. This is particularly relevant for the COVID-19 response (FAO, 2020).

Employment and Livelihoods (SDG 8)

Access to clean energy can generate more income due to increased food sales and related employment. Additional income is also possible through the sale of excess energy.

Transforming food systems in ways that can contribute to the SDGs will require careful consideration of the interactions between climate, energy, food and water. Integration of these systems can simultaneously improve efficiency, reduce environmental impacts and eliminate waste.

Key challenges related to taking action and scaling up

Investments in activities connecting energy use and food can be hindered by lack of data, within both the public and private sectors, about how to best invest inappropriate energy solutions for the food value chain. Data is needed to analyse costs and benefits, as well as social and economic impacts, including job creation, and links with improved health impacts.

Intersectoral coordination on policies, regulations and programming among energy, finance, environment and agricultural ministries is often insufficient. Moreover, actions by stakeholders in government, the private sector, civil society and donors are generally not well coordinated.

In addition, the synergies between SDG 7 and SDG 2, and the possibilities for joint approaches, are insufficiently understood and appreciated. This affects all stages of the food system, including energy for agricultural inputs (fuel for machinery, fertilizers, and pesticides), and energy issues related to food processing (biomass waste used for energy in processing devices) and transportation (fossil fuel use and food loss due to long transportation time).

The business case for investment in renewable energy and energy efficiency for food chains often appears weak from a purely financial point of view due to several factors: insufficient, dispersed and seasonal demand for clean energy by food chain actors; lack of consideration for broader local economic, environmental, and social benefits; and insufficient support to cover investor and end-user risks.

Affordability of energy remains a huge barrier for those involved in small and medium-sized food chains. This is due in part to a supply-side focus among energy service providers that fails to incorporate the needs and challenges of food chain actors in adopting more productive uses of energy.

Women are at the centre of food systems, and energy access challenges. Women produce between 60% and 80% of the food in most developing countries, yet it is much more difficult for them to gain access to resources such as land, credit and productivity-enhancing inputs and services.

The above-mentioned challenges are often compounded by the frequent lack of technical and management capacity to run and maintain renewable energy systems (often exacerbated if energy devices are imported).

Finally, the opportunities to contribute to the circular economy and the decarbonization of food chains through use of food chain residues to produce energy have so far not been adequately considered.

How to address these challenges

The following actions are proposed:

- **Raise awareness about the business case for sustainable energy investments in food system transformation**[10] and the potential mutually beneficial economic outcomes from mainstreaming renewable energy and energy efficiency. Such outcomes may include increased productivity, energy cost savings, income generation and greater gender inclusion.
- **Adopt a food chain-centred approach to energy provision** that puts the needs of food chain actors at the heart of sustainable energy policy and financial support.
- **Enhance mapping of areas where better energy access has the highest positive impact on food chains**, such as the potential for: (a) transforming maize production in Uganda (Rebekah, 2020); (b) comprehensive, gender-disaggregated cost-benefit analyses of national policies and regulations related to energy access investments[11], and use of existing knowledge and experience to ensure that investments in sustainable bioenergy contribute to food security.[12]
- **Include the food-energy nexus in national climate commitments**, which would allow countries to reduce their GHG emissions and achieve their Nationally Declared Commitments to the Paris Agreement, for example through carbon sequestration in tree crops (agro-forestry) and soils.
- **Increase funding to de-risk and scale up innovative business models**, including: pay-as-you-go models; subsidy swaps; preferential credit systems; cost sharing between users and suppliers; crowd-funding for small scale projects; feed-in tariffs; and clustering demand, as was done, for example, by farmer groups such as milk cooperatives in India, farm blocks in Zambia (Middelberg et al., 2020) and integrated agro-industrial parks in Ethiopia (UNIDO, n.d.).
- **Consider linking financial support to integrated approaches** such as the water-energy-food nexus.
- **Promote and support the implementation of sustainable, integrated food-energy systems and operations** – for example, through agro-photovoltaics (Weselek, et al., 2019).

[10] FAO Integrated Food-Energy Systems, http://www.fao.org/energy/bioenergy/ifes/en/
[11] FAO Investing in Sustainable Energy Technologies, INVESTA, http://www.fao.org/energy/agrifood-chains/investa/en/
[12] FAO Sustainable Bioenergy Decision Support Package, http://www.fao.org/energy/bioenergy/en/

- **Develop a stable and supportive enabling environment**, including supportive policies and plans – such as Morocco's Green Plan[13], small power guidelines in Tanzania[14], and rural electrification agencies in Sub-Saharan Africa[15] – while ensuring flexibility and openness of policy frameworks to support varied food-energy schemes. Rural communities should be adequately consulted in these processes.

- **Ensure that intersectoral linkages are reflected in energy transition policies, as well as in water, agriculture, and environment-related policies.** This will help ensure that integrated solutions are sustainable in the long term.

- **Improve intersectoral and multi-stakeholder coordinatio**n that includes members of government, the private sector and civil society, both nationally and sub-nationally, as appropriate.

- I**n the near-term, prioritize low-risk, high-impact actions** – for instance, reduce food losses, strengthen the circular economy and link energy use for food and health as part of the green recovery.

- **Action on energy-food security links should address the needs and capabilities of women and youth**, in particular, considering the important roles women play in food chains and the need to provide opportunities for better livelihoods to women and youth in rural areas.

Case studies on impacts and lessons learned

Integrated approach: The development of the Clean Cooking Systems Strategy (CCSS)[16]

Stakeholders working towards clean cooking systems have highlighted the need for a more coordinated strategy to drive greater collaboration and alignment toward shared goals. In response to this call for action, the CCA is leading a system-wide effort to accelerate universal access to clean cooking solutions. Launched in mid-2020 and expected to continue into early 2021, the CCSS aims to secure commitments and mobilize collective action toward achieving SDG 7. An important goal of the process is to address the needs of relevant stakeholders across the clean cooking ecosystem.

Innovative financing in Ecuador

The Lineas Verdes Programme of the Ecuadorian bank Produbo promotes environment-friendly processes through financing of renewable energy and energy efficiency solutions to productive sectors (El Mercurio, 2020). The programme promotes inclusive and sustainable industrialization to support the transition to clean production, and guides companies on how to maximize efficiency and economic savings. It also contributes to reducing the environmental impact of the activities of these organizations, because one of the conditions to qualify as a beneficiary of the loan is that projects reduce their impact on the environment by 20%, which is a major element of the programme. During the 2016-2018 period, the Lineas Verdes programme made US$ 50.4 million in loans for renewable energy and energy efficiency projects. The combined share of agriculture-related activities constituted more than 23% of the Lineas Verde portfolio. Another key activity was the development of green savings accounts, which have financed about 2% of the programme. In addition, the user-friendly loan request procedures, and the quality of the customer service – including assurances that environmental requirements are enforced, sometimes through certification – explains the increasing success of this programme and its support by important national and international institutions.

[13] Ministry of Agriculture, Fisheries, Rural Development, Water and Forests, The Green Morocco Plan. https://www.agriculture.gov.ma/en/pages/strategy

[14] https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/documents/Tanzania_Approved-Small-Power-Projects-Development-Guidelines-March-2011.pdf

[15] https://esmap.org/sites/default/files/esmap-files/Rpt__AEI14.pdf

[16] https://cleancookingsystemsstrategy.org/

Involving women and youth in energy and food-related actions in the Arab Region[17]

The SIDA-funded and ESCWA-led REGEND project (Regional Initiative for Promoting Small-Scale Renewable Energy Applications in Rural Areas of the Arab Region) operating in Jordan, Lebanon, and Tunisia, aims to improve the livelihoods, local economies, social inclusion and gender equality of rural communities, particularly for marginalized groups, by addressing energy access, vulnerability to drought and water scarcity, climate change, and other natural resource challenges. REGEND is implementing an integrated water-energy-food nexus strategy focused on renewable solar energy and energy efficiency projects, use of modern productive equipment, and training for capacity-building. Recent assessments of achievements have shown particularly positive impacts for women and youth. One important lesson concerns the need to build participants' capacity on technical and business management aspects of such projects, so that local recipients can effectively utilize and benefit from the production equipment they receive.

Large-scale programmes for water-energy-food challenges in India

Through its Kusum programme, India has become the world leader in deploying solar water pumps, with more than 300,000 installed to date (Rural Marketing, 2020). Its ambitious plan calls for the deployment by 2022 of more than 2.5 million solar water pumps for irrigation, worth US$ 18 billion. The carbon emission reductions and financial savings potential are enormous. Using grid-tied electricity and diesel for groundwater irrigation produced an estimated 26 million tonnes of carbon emissions annually, about 5% of India's total. At its peak, India had over 15 million grid-connected irrigation pumps, accounting for an estimated 700 billion rupees (roughly US$ 10 billion) of power subsidies. India now seeks to leverage its manufacturing and bulk procurement capacity to make solar irrigation more affordable in Sub-Saharan Africa through the International Solar Alliance (ISA). ISA has tasked Energy Efficiency Services Limited (EESL), a joint venture of public sector undertakings under India's Power Ministry, to procure 500,000 solar pumps based on the aggregated demand of 13 ISA member countries. Despite the success of the Kusum programme, questions remain about sustainable groundwater management and the longer-term financial sustainability of the programme, given the role of state subsidies. Because the pumped water is essentially free, issues remain around water overuse and lack of revenue for power utilities. India also has collaborated with Israel, through the Indo-Israel Agricultural Project, to take a more holistic approach to scaling the entire food value chain by creating about 30 centres of excellence across the country, using solar energy to increase resource efficiency and productivity.

Aggregation of food chain demand - The Zambia Farm Block programme[18]

The Zambia Farm Block programme was launched in 2002 on about 900,000 hectares, establishing at least one farm block per province, each of which includes an area for farming and an adjacent area ceded by customary authorities to the state to implement infrastructure needed for agribusiness. The plan aimed to attract national and international investors to support the costs of infrastructure development, including on energy, as public investment in this area has been challenging, mainly due to state budget limitations. In 2015, it was determined that investors themselves should cover the costs of infrastructure. In that line, a company based in South Africa has invested in containerized solar power micro-grid plants with the aim of supplying solar energy to off-grid farm blocks. Nearby rural households, as well as government institutions – such as schools and clinics that form part of the blocks – also benefit from the project as they are supplied with power at affordable fees with no or little up-front costs, and pay for power under a pay-as-you-go model. The project underscored the need to ensure adequate tenure security as a precondition for investments in aggregated food chains. Another lesson is that tax

[17] https://www.unescwa.org/sub-site/renewable-energy-rural-arab-region-regend
[18] http://www.firmfactoryafrica.com/zambia-renewableenergy-solarplant.html

incentives for private infrastructure development should be considered as a way to ensure adequate supply of energy to aggregated food chains moving forward, especially given frequent shortages of national funding for such projects.

TARGETS, INDICATORS AND DATA

National targets on energy-food chain links can be linked to SDG targets (see Table below) hereafter.

Target	Indicators	Data source + comments
RE: Significant increase (maybe 25%) by 2030) in number of food chains with RE – Ref SDG 7.2. links to SDGs 2.3 & 2.4.	Adapted SDG 7.2 indicator on RE share in food chain energy consumption	Survey or selected samples + number of new RE projects from Ministries of Agriculture or Energy + Maybe a trend indication indirectly through FAOSTATS
Energy Efficiency: Significant increase (maybe by 25%) of food chains with double energy efficiency – Ref SDG 7.3. links to SDGs 2.3 & 2.4	Adapted from SDG 7.3. indicator: share of food chains with energy efficiency	Same as above but more difficult to find information than for RE + Maybe a trend indication indirectly through FAO Stats
Energy efficiency: Improved efficiency of wood fuel use for cooking	Change in number of improved cookstoves	Information on relevant projects from the Ministry of Energy, Forestry, or Cooperation
RE and Energy Efficiency	Indirectly though share of energy in reduction of GHG emissions from food chains	Likely difficult - maybe sampling. Moreover, FAO statistics only give information regarding land use - hence energy for machinery used in production stage

Note: FAO statistics at the country level give some information on the current use of energy in food chains and related GHG emissions. However, data are limited to fossil fuels during the production and on-farm phases of food chains. However, if food chains use less fossil fuels and are more energy efficient, these changes might possibly be noted through these data.
Another proposal would concern the development of indicators that capture the possible synergy between energy and food (e.g., integrated food energy systems, links between energy and yield increase/food loss reduction, and WEF nexus (these already exist).

REFERENCES

Clean Cooking Alliance. Clean Cooking Systems Strategy. https://cleancookingsystemsstrategy.org/

El Mercurio, 2020. Evolution of credit and green accounts in the Ecuadorian market. https://ww2.elmercurio.com.ec/2020/02/21/evolucion-del-credito-y-cuentas-verdes-en-el-mercado-ecuatoriano/

ESMAP. Session 4: Rural Agency and Rural Electrification Fund https://esmap.org/sites/default/files/esmap-files/Rpt__AEI14.pdf

ESCWA. Regional Initiative to Promote Small–Scale Renewable Energy Applications in Rural Areas of the Arab Region "REGEND". https://www.unescwa.org/sub-site/renewable-energy-rural-arab-region-regendEWURA, 2011. Guidelines for development of small power projects. https://ppp.worldbank.org/public-private-partnership/sites/ppp.worldbank.org/files/documents/Tanzania_Approved-Small-Power-Projects-Development-Guidelines-March-2011.pdf

FAO. Energy-Smart Food Programme. Home | Energy | Food and Agriculture Organization of the United Nations (fao.org)

FAO. FAOSTAT/Energy, http://www.fao.org/faostat/en/#search/Energy

FAO. Integrated Food-Energy Systems. http://www.fao.org/energy/bioenergy/ifes/en/

FAO. Investing in Sustainable Energy Technologies in the Agrifood Sector (INVESTA) http://www.fao.org/energy/agrifood-chains/investa/en/

FAO. Sustainable Bioenergy Decision Support Package. http://www.fao.org/energy/bioenergy/en/

FAO, 2011. Energy-Smart Food for People and Climate – Issue Paper. http://www.fao.org/3/i2454e/i2454e00.pdf

FAO, 2014. The Water-Energy-Food Nexus A new approach in support of food security and sustainable agriculture. http://www.fao.org/3/bl496e/bl496e.pdf

FAO, 2020. Linking energy, food security and health can help face COVID-19 – OPED 26 May 2020. http://www.fao.org/energy/news/news-details/en/c/1277470/

Firm Factory Africa. (http://www.firmfactoryafrica.com/zambia-renewableenergy-solarplant.html

Middelberg, S., van der Zwan, P. and Oberholster, C., 2020. Zambian farm blocks: A vehicle for increased private sector investments. De Gruyter Open Agriculture 2020; 5: 817–825. https://www.degruyter.com/document/doi/10.1515/opag-2020-0079/html

Ministry of Agriculture, Fisheries, Rural Development, Water and Forests. The Green Morocco Plan. https://www.agriculture.gov.ma/en/pages/strategy

Rebekah, S., 2020. Powering Agriculture: Unlocking Africa's Next Green Revolution. https://media.africaportal.org/documents/Policy_Briefing_207_shirley.pdf

Rural Marketing, 2020. Energy Conservation: Everything You Need to Know about PM Kusum Scheme. https://ruralmarketing.in/stories/energy-conservation-everything-you-need-to-know-about-pm-kusum-scheme/

UNIDO. Ethiopia: Integrated Agro-Industrial Parks. https://www.unido.org/news/ethiopia-integrated-agro-industrial-parks

Weselek, A. et al., 2019. Agro-photovoltaic systems: applications, challenges, and opportunities. A review. Agronomy for Sustainable Development volume 39, Article number: 35 - https://link.springer.com/article/10.1007/s13593-019-0581-3

SECTION 3.3

INTERLINKAGES BETWEEN **ENERGY AND GOOD HEALTH AND WELL-BEING (SDG 3)**

CONTRIBUTING ORGANIZATIONS:
WHO, ESCWA, IRENA, CCA, UNICEF

Summary/Key Messages

THE MOST IMPORTANT INTERLINKAGES

Energy access is central to meeting the targets for achievement of widespread health and well-being, as called for in both the 2030 Agenda for Sustainable Development and the Paris Agreement on climate change. At the same time, good health is essential to overall sustainable development.

These relationships reflect the complexity and interconnectedness of energy and health in the 2030 Agenda. The agenda considers the widening economic and social inequalities, rapid urbanization, increased threats to the climate and the environment, and the continuing burden of infectious diseases, as well as emerging challenges such as noncommunicable diseases. Progress in these areas requires increased access to clean and sustainable energy to support, among other things, disease prevention, diagnosis and treatment. In this way energy directly contributes to universal health coverage, which will be integral to achieving SDG 3, ending poverty and reducing inequalities.

But the world is not on track to achieve the health-related SDGs. Progress has been uneven, both within and among countries. There is a 31-year gap between the shortest and the longest life expectancies in countries worldwide.

Those that are the most vulnerable and the furthest behind in energy access stand to gain the most from energy-related actions that will produce results in terms of eradication of poverty (SDG 1) and hunger (SDG 2), advancements in health (SDG 3), education (SDG 4), clean water (SDG 6), gender equality (SDG 5), jobs (SDG 8), and combating climate change (SDG 13).

The following priority actions are drawn from a working group discussion on health and well-being led by WHO:

- **Make clean cooking solutions a top funding priority**, putting in place specific funding provisions, cross-sectoral plans and public investments, while also building support from private investments as well.

- **Promote integrated energy planning** that addresses the full suite of household energy needs, including clean cooking and electrification. Support increased engagement between clean cooking stakeholders and the power sector – including mini-grid developers, utilities and regulators – as a way to implement and scale up energy access programme.

- **Invest in clean and sustainable energy for health care facilitie**s as a requirement for safely carrying out most medical procedures, and provide occupational protection for health workers.

- **Invest in resilient energy systems in households and institutions**. The COVID-19 pandemic, and the recent extreme weather and climate events that damaged energy systems, demonstrate the vulnerability of energy systems. Investments are needed to improve energy system resilience for the delivery of health care services, which are often disrupted at the very times they are most critical. Investments to prevent loss of funding or logistical and operational disruptions in the clean cooking sector are crucial as well.

- **Support targeted energy subsidies for adequate and reliable energy to protect health**, including incentives to facilitate the transition of households and health systems to cleaner and more sustainable energy solutions. Fossil fuel subsidy reform is needed to ensure that such subsidies are truly social investments. Poorer populations need to be supported until greener and more renewable solutions are widely available and affordable. Ultimately, use of inefficient fossil fuel subsidies should be phased out, but it must be done in a way that ensures no household is left behind, or asked to bear an unreasonable health burden if healthier renewable solutions are out of reach in the medium term. Special attention needs to be given to those countries, regions, communities and people that are being left behind, including in the advancement of decentralized energy systems and clean cooking solutions.

- **Promote a 'green and healthy recovery**' through the use of clean and sustainable energy sources. Factoring in economic and social consequences, and taking decisions in the overall public health interest, will tend to favour clean and sustainable energy sources, which lead to cleaner environments and healthier people.

THE INTERLINKAGES BETWEEN ENERGY ACCESS (SDG 7) AND HEALTH AND WELL-BEING (SDG 3)

Access to clean, modern, reliable and affordable energy is critical for social and economic development and contributes directly to achieving good health and well-being. At the same time, ensuring healthy lives and promoting well-being at all ages is essential to sustainable development. Failing to achieve the energy target set forward by SDG 7 will threaten development progress generally and more specifically SDG 3 – advancing good health and well-being. This brief highlights the interlinkages between SDG 7 and SDG 3, and key challenges in creating synergies between the two goals. It also suggests ways of addressing these challenges, and provides a summary of the status of targets, indicators, and data at the intersection of SDG 7 and SDG 3 in two key settings: households, and health care facilities.

Households

People require clean and sustainable energy for lighting, cooking, heating, and, in many climates, cooling. Lack of access to clean cooking options forces households to rely on inefficient stove and fuel combinations, which expose them to indoor air pollution, a source of some 3.8 million deaths each year (WHO, 2018). Most deaths from household air pollution are related to non-communicable diseases, including heart disease, stroke, lung cancer and chronic obstructive pulmonary disease. Over half of these deaths are among women and children, who often have the greatest exposure to household air pollution, which can also lead to an increased risk of pneumonia, low birth weights in new-borns, and still-births. Beyond direct disease outcomes, the negative impacts extend to the general well-being of household members. Fuel collection puts people at risk for injury and violence, and requires considerable time and effort. The time savings gained from the use of clean household energy can provide further opportunities for schooling or training, income-generation, and socializing. Clean, modern and affordable energy is essential for breaking the cycle of poverty and inequality that is reinforced by the lack of energy services.

Health care facilities

Challenges in energy access are not unique to households, and extend also to public institutions. Sustainable and modern energy services in schools and public institutions, support the availability of social services and greater community engagement, which are important to well-being, and modern energy services are particularly important in health care settings. Without adequate electricity, it is impossible to achieve universal health care, and other major development goals, including reduced child mortality, improved maternal health, and disease treatment and prevention. Electricity in health care facilities is essential for lighting and powering vital life-saving medical devices. This has been particularly important in the treatment of COVID-19, which has required ventilators, lab operations for immunological tests, vaccine refrigeration, emergency services, and surgical, laboratory and diagnostic equipment. Electricity is key to ensuring continuity of quality services for maternity and reproductive health as well as for basic amenities like cooling, ventilation, digital connectivity, and provision of clean and hot water. Many life-saving interventions cannot be undertaken safely – or at all – in the absence of reliable power. Electricity also supports health worker retention and enables the wider use of “telemedicine” and “e-health” strategies, which have become increasingly pertinent during the COVID-19 pandemic. Despite the importance of electricity in health care, an estimated 1 billion people globally are served by health facilities without electricity, including 255 million people in Sub-Saharan Africa (Practical Action, 2013). While most large hospitals have access to electricity, access rates drop dramatically for rural clinics. Those clinics that do have access to electricity often have an unreliable supply (WHO and World Bank, 2014), which contributes to the immense health care challenges that developing countries face.

KEY CHALLENGES HAMPERING CLEAN AND SUSTAINABLE ENERGY FOR GOOD HEALTH AND WELL-BEING

While the world has made substantial advancements in human health and well-being in recent decades, it is not, at the current rate of progress, on track to achieve the health-related targets called for by SDG 7. Even greater efforts will be needed to meet the energy-related targets of SDG 7 in a post COVID-19 world.

The many challenges hampering progress in access to clean cooking and electrification fall into five categories:

1. Challenges related to **means of implementation** include lack of integrated approaches –even a common language – among sectors, as well as tensions related to trade-offs, and differing energy efficiency perspectives that undermine integrated approaches. For example, the clean cooking community must address the tensions and trade-offs involved in pursuing universal access to clean cooking by 2030, as well as Net Zero Emissions by 2050, and ensuring pathways for a just energy transition that leaves no one behind. Where governments see the potential for transition cooking fuels (that are not 'zero emission') as part of the solution mix to achieve universal access, we must honour and support this.

2. **Finance-related challenges** are often associated with investments in the health sector being directed to address short-term problems instead of long-term, sustainable solutions. In addition, clean cooking has historically been listed last in conversations and reports within the energy access dialogue, tagged on as an afterthought behind electricity and cooling. Funding for clean cooking has lagged accordingly. Given the scale and implications of the challenges related to clean cooking and electrification of health facilities, this is the time to prioritize these issues in both energy and health dialogues.

3. Strengthening the **capacity** of key people in the health sector to understand energy needs and solutions, and acquire the knowledge, tools and resources necessary to more actively engage with the energy sector, can improve the planning, financing, policies, procurement, and management of energy systems for both households and health facilities. Similar capacity building is needed to address planning for clean cooking.

4. Challenges associated with **technology** include the choices and availability of appropriate equipment for low and middle-income countries. For example, design and procurement of cooking technologies and medical equipment is often undertaken without consideration of ISO cookstove standards, WHO Guidelines for indoor air quality, or the incorporation of energy efficiency. This is certainly the case in regions where energy prices are subsidized, as well in the high-income countries – where electricity is abundant (and where much of the relevant equipment is produced).

5. Other challenges are associated with the lack of **coordination** between the health and energy sectors in terms of responsibility for energy system improvements. Good coordination can result in the adoption of air quality guidelines, implementation of clean cooking guidelines, and improved operation and management of energy systems in health facilities. Similarly, more active engagement and coordination with the health sector in the design, selection and promotion of clean cooking solutions and health care facility electrification can advance overall progress toward the SDG target.

HOW TO ADDRESS THESE CHALLENGES

Below are proposed actions to address these challenges.

Acknowledge the impacts of the COVID-19 pandemic on progress towards universal clean cooking. Early findings on the impacts of COVID-19 on clean cooking companies show that there were moderate to severe disruptions in operations, and lower sales volumes (CCA, 2020). Household energy challenges require a multifaceted approach. Investing in timely data and evidence would help us better understand progress towards SDG attainment, evaluate the impacts of the COVID-19 pandemic and estimate how much funding is required to achieve universal access to clean cooking.

Maintain momentum on increased investments for clean cooking, and strengthen the case for continuing such investments, particularly during shocks. Recent research by IEA shows the average annual investment required from 2020 to 2030 to reach universal energy access in emerging markets and developing economies is around US$ 35 billion for electricity access and US$ 6 billion for clean cooking. This is more than six times higher than the present level of investment, with more than half of the total for new investments being required in Sub-Saharan Africa (IEA, 2020). To secure the greatest health and well-being benefits from clean cooking, even greater investment will be required to transition households completely to clean cooking technologies and fuels.

Continue support for technology innovation through accelerators that drive more rapid, evidence-based, market-ready research and development. Several new product and business model innovations have emerged over the last few years that have the potential to create a commercially viable clean cooking industry and health sector – including renewable energy delivery models and energy efficient medical devices. These innovations will continue to require public-financing support for several years in order to come to scale, but they have the potential to attract significant commercial capital, and to increase affordability of, and access to, clean solutions.

Reform fossil fuel subsidies and reallocate that funding to deliver smart and equitable strategies for boosting sustainable energy access. This could include development of a 'Subsidy Toolkit' profiling the benefits of various programmes and structures and providing guidance on how to effectively subsidize energy. For example, the Smart Subsidies Lab proposed by the World Bank's Lighting Global programme (GOGLA) and Africa Clean Energy, aims to support current end-user subsidy activities and to share lessons about smart, holistic, end-user subsidy designs. At the same time, the lab would support interested governments, development partners and other key stakeholders to create effective subsidy strategies and projects.

Use the 'health argument' to build political support for energy transitions. Advocating for scaling up clean cooking solutions, and increasing access to clean and sustainable energy that enables health facilities to protect health and provide quality services, will encourage leaders in both the public and private sector to prioritize clean and sustainable energy. Likewise, related health benefits can complement a broad behaviour change campaign for clean cooking within communities.

Strengthen health systems through better access to electricity. Strengthening health systems through suitable, targeted, resilient and clean energy solutions is essential. This should start with integrating energy and health system plans with appropriate budgetary allocations, including for the operation and maintenance of energy systems. Particular attention needs to be paid to rural electrification planning, to ensure that relevant programmes prioritize electrification of health facilities through reliable, adequate energy.

Engage the private sector with several clear entry points of collaboration. Key entry points to jointly accelerate investments, access and stewardship can be established by encouraging a sense of ownership with regard to health facility energy systems. This can be done by first working with the energy sector to identify managerial, planning, procurement and logistical responsibilities for energy systems, and then working with the health sector to build capacity for improved operations and management. It would also be helpful to establish intergovernmental clean cooking 'delivery teams' to work across agencies.

CASE STUDIES

Maximizing the Health Benefits of Clean Household Energy in Peri-Urban Nepal

Recently, the Clean Cooking Alliance completed a demonstration project in Nepal that followed 772 households for over a year. During that time period, the households purchased a variety of clean cooking solutions, including induction stoves, along with LPG, biogas digesters and rice cookers. Primary cooks living in communities affected by intervention activities experienced a sizable 3.34 mmHg (95% CI: -0.81 to -5.19) reduction in systolic blood pressure, after adjusting for changes among cooks measured outside of the study group. Based on the findings, the project provided recommendations for next steps toward long-term transitions to clean cooking in Nepal: 1) addressing knowledge gaps affecting household perceptions of energy consumption, costs, and choice, particularly with respect to electricity; 2) scaling up community-based outreach programmes; 3) assessing and upgrading the electricity grid's infrastructure and household wiring; and 4) undertaking market-strengthening strategies to ensure consistent supply.

Clean Cooking Alliance, Moving Towards Clean Cooking in Nepal

Powering Primary Healthcare Facilities through Solar Energy in the Indian State of Chhatisgarh

The Indian state of Chhattisgarh faced serious difficulties in ensuring reliable electricity supply to primary health facilities, particularly in the remote and rural part of the state, and this electricity challenge greatly hampered the quality of health care services available to the communities. In response, the Chhattisgarh Renewable Energy Development Agency (CREDA), in cooperation with the Chhattisgarh Ministry for Health, initiated an extensive state-wide programme to electrify primary health facilities in 2012-2013. Substantial improvements were observed in key health service parameters, including hours of operation. Positive trends were also observed in successful childbirths, emergency health care services, and refrigeration to support administration of vaccines. This initiative has received recognition for improving the quality of primary health care services through better access to electricity. It is also a very good example of intersectoral and interdepartmental cooperation.

CEEW and Oxfam, 2017

TARGETS, INDICATORS AND DATA

Targets

Energy targets are clearly defined in the SDG Agenda. However, most baseline targets within the SDGs do not convey the extent of interlinkages. While current energy or health targets do not explicitly reflect interlinkages, there is opportunity to consider these interlinkages through targets that are complementary to the 2030 Agenda.

Indicators

Various measures can be used to track the synergies between energy and health SDGs. One example of a SDG indicator that demonstrates interconnectedness between health and energy is a comparison of mortality rates associated with ambient and household air pollution (SDG 3.9.1) The data used to monitor clean cooking access (SDG 7.1.2) can also be used for estimating household air pollution exposure. Below are suggestions for expanding the use of tested indicators to track health and energy in global mechanisms and newly proposed indicators that are currently under revision.

Status	Targets and Indicators	Available data
In use by selected Institutions	**Access to any electricity in health care facilities**: Universal access to electricity in health care facilities should be a sustainable development priority to ensure the good health and well-being for all.	WHO, World Bank and others
In use by selected Institutions	**Access to reliable electricity in health care facilities:** Improved reliability of the electricity supply (e.g., with no service outages greater than 2hr in the last 7 days before the survey) is an important measure for tracking the availability of energy and related health services. All health facilities should be powered with a reliable electricity supply.	World Bank's MTF; WHO's SARA; and USAID's SPA
In use Not tracked by global mechanism	**Access to clean household energy for all major end uses:** To reduce the risk of diseases related to household air pollution, all fuels and technologies — such as for lighting, and space heating and supplementing the main cooking stove — should be clean and sustainable.	WHO Household Energy Database
In use Not tracked by global mechanism	**Time spent on fuel collection:** The reduced time spent for fuel collection related to the use of clean household energy compared to traditional practices can serve as an important quantitative measure of well-being that can help drive policy change.	Data on this indicator is being collected on surveys & recently included in a database by WHO.
In use Not tracked by global mechanism	**Household expenditure on energy:** Affordability is a key factor in clean cooking adoption. Setting targets for reducing household expenditures on cooking and other end uses is an important proxy for monitoring the impacts on well-being of SDG 7 achievements.	World Bank's MTF
Newly proposed indicator	**Access to sufficient power supply:** Increase access to power that is available to cover all the needs of the essential medical devices and appliances.	Under consideration in USAID's SPA
Newly proposed indicator	**Access to a stable supply of electricity:** Increase access to a stable supply of electricity in health care to reduce fluctuations in power supply that can impact the functionality and utility of some medical devices.	Under consideration in USAID's SPA

Data sources referenced above: World Bank's Multi-Tier Tracking Framework, 2) WHO's Service Availability and Readiness Assessment (SARA) and 3) USAID's Service Provision Assessment (SPA).

Data

Households

Further data allowing better estimates of the impacts on health and well-being from household energy use, particularly those related to simultaneous use of different types of stoves for different purposes ('stacking'), are needed to better understand progress toward achieving SDG 7. WHO tracks data on multiple aspects of health-related impacts as a result of household air pollution, including exposure, disease burdens, and the joint effects of air pollution (combining death rates from both ambient and household air pollution).It also tracks access to electricity in health care facilities. For both electrification and cooking, the World Bank has developed a Multi-Tier Framework methodology, a detailed diagnostic measure of energy access covering seven quality dimensions (including affordability and reliability) that places households in one of five tiers of energy access. Lack of high-quality data and, more precisely, lack of sex-disaggregated data and gender statistics, is a major impediment to projects in the gender and energy nexus. Gender statistics on energy access are not available at the national or sub-national level, and are often available only at the project level.

Health care facilities

WHO and USAID (the United States Agency for International Development) have led collaborative initiatives to make more reliable data available (WHO and World Bank, 2014). One example is the Service Availability and Readiness Assessment (SARA), a collaboration among WHO, USAID and the International Health Facility Assessment Network (IHFAN) that measures and tracks progress in health systems through support for planning and management. The USAID's Service Provision Assessment (SPA), provides a comprehensive overview of a country's health service delivery. While these efforts are under way, reliable data on energy access in health care facilities are sparse, and more commitments and resources will be required to get better estimates on the status of energy in health care and its impacts on health and health service delivery.

REFERENCES

Clean Cooking Alliance, 2020. COVID-19 Impacts on Clean Cooking https://www.cleancookingalliance.org/binary-data/RESOURCE/file/000/000/590-1.pdf CEEW and Oxfam, 2017. Powering Primary Healthcare through Solar in in India: Lessons from Chhatissgarh

IEA, 2020. World Energy Investment 2020, IEA, Paris
https://www.iea.org/reports/world-energy-investment-2020

Practical Action, 2013. Poor people's Energy Outlook. Energy for community services. Rugby: Practical Action Publishing.

World Health Organization, 2018. Burden of disease from household air pollution for 2016. 2018. https://www.who.int/airpollution/data/HAP_BoD_results_May2018_final.pdf

World Health Organization, 2014. Access to modern energy services for health facilities in resource-constrained settings: a review of status, significance, challenges and measurement

SECTION 3.4

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

CONTRIBUTING ORGANIZATIONS:
UNICEF, SDG 7 YOUTH CONSTITUENCY

Summary/Key Messages

Access to reliable energy enables and improves the quality of education for children, young people and their families. It has been associated with a better learning environment, enhanced school performance, increased opportunities, and improved staff retention. Advancing access to energy can therefore play a crucial role in improving schooling and educational attainment by complementing other educational investments.

During the COVID-19 pandemic, improved access to electricity and the Internet has been instrumental in providing technology-based education, with schools and communities under lockdown or subject to physical distancing requirements. Access to sustainable energy protects students and staff from exposure to the indoor air pollution associated with use of traditional fuels for lighting and cooking. It also has broader implications for communities, especially in remote areas where schools serve as integrated service platforms for skills training and social activities. Access to high-quality education is vital for an informed population, and a new generation of informed problem-solvers coming up will be better able to accelerate access to affordable and clean energy, which is crucial for a sustainable future.

Despite its importance, electricity access is often an overlooked building block for quality educational services. Only 31% of primary schools in Sub-Saharan African have access to electricity. This is also the region with the lowest levels of learning, and lowest scores on the Human Capital Index. Globally, over 200 million children go to primary schools without electricity access, mostly in disadvantaged and rural communities, and this compromises their educational and development outcomes.

PRIORITY ACTIONS:

- Gather sufficient quantitative and qualitative data and information to accurately reflect the magnitude of the challenges and drive evidence-based decision making.
- Adopt enabling policies that incentivize and prioritize emerging business models to scale up decentralized clean energy solutions in the education sector. Address operations and maintenance challenges for long-term sustainability and create opportunities for youth and local communities by providing training on repair and maintenance.
- Initiate urgent and ambitious collaboration among stakeholders – policy makers, the private sector, development partners, and civil society. Private sector investment is needed to complement limited public resources, and help address the huge energy access gaps in schools and other public institutions that need to be addresses in order to drive the energy transformation.
- Build support for these policies through stakeholder engagement, public education, and outreach to influence decision makers. Advocate for air quality action plans in schools that are exposed to unsafe air quality levels, to ensure that all children have access to a clean, safe, and healthy school environment.
- Incorporate energy education in curricula in order to build a necessary technical skill base from early on, creating a younger generation whose members can act as change agents Facilitate necessary knowledge, attitude, and behavioural changes among children, young people and adults on the benefits of sustainable energy.

THE INTERLINKAGES BETWEEN SDG 7 AND SDG 4

Access to energy enhances the quality, accessibility and reliability of social services (including education, health, water and sanitation) for children, young people and their families, while also making public systems more resilient to the impacts of climate change. Without access to energy, it is impossible to achieve inclusive and quality education for all, as called for in SDG 4 , or other development goals. Access to quality education is vital to an informed population, and through access to information, the next generation will have the potential to accelerate access to affordable and clean energy, which is crucial for a sustainable future.

Educational facilities require energy for lighting, cooking, heating and cooling, water supply and purification, and emergency and medical services, as well as for digital connectivity and remote learning. During the COVID-19 pandemic, adequate access to electricity and the Internet has facilitated technology-based education while schools and communities have been under lockdown or requiring physical distancing.

Access to reliable electricity has been associated with improved educational outcomes, a better learning environment, and increased opportunities for children and young people. For example, rural electrification in Bhutan has resulted in an increase of 0.65 additional years of schooling for girls and 0.41 additional years for boys. Similarly, rural villages in Madagascar have reported an increased ability of children to keep up with school, and have reduced gender inequality by providing girls, who are traditionally more engaged in housework than boys, opportunities to study after sunset (UNICEF, 2015). School attendance reportedly increased with better electrification and lighting, especially in regions with poor sunlight penetration.

In Bangladesh and the Philippines, teachers have reported cancelling schools in rainy weather owing to poor lighting conditions (Practical Action, 2013, Valerio, 2014 and UNICEF, 2020). Improper lighting affects the way teachers teach, and can also strain children's eyes and limit their ability to focus on what is being taught.

Electricity also allows educational facilities to maintain and extend operating hours, improving lesson preparation and teacher training, and providing electricity for staff quarters, which contributes to staff retention. For example, in rural areas of Kenya, 75% of head teachers reported that recruiting and retaining teachers was a problem and 60% said better lighting would encourage teachers to work in remote regions. Over a third of teachers said that they use a solar light for marking, lesson planning, and extra classes (Smart Villages, 2017).

Lack of access to sustainable energy forces schools, dormitories, kitchens, and staff facilities to rely on unsustainable sources such as candle light, biomass, charcoal, or kerosene for lighting and cooking purposes. This exposes students and staff to indoor air pollution, and creates health risks ranging from headaches to respiratory disease that compromise health and learning abilities.

Ensuring energy access to educational facilities can bring overall benefits to the communities as these public institutions can be used as integrated service platforms for children, where clean water, nutritious meals and primary health care services can be provided in a safe environment.

Despite its importance, electricity access is often an overlooked building block of quality educational services. In addition, schools' access to energy has broader implications for the community, especially in remote areas where schools serve as centres for community events, including skills training and social and cultural activities.

KEY CHALLENGES FOR CREATING SYNERGY

Only 31% of primary schools in Sub-Saharan African, and 55% in Southern Asia, have access to electricity (UNESCO, 2018). Over 200 million children attend primary schools without electricity access (UNESCO, 2019), and 89% of those children live in the two regions mentioned above (UNESCO, 2018). It is worth noting that Sub-Saharan Africa has the lowest overall level of electricity access, as well as education, and also has low scores the Human Capital Index (World Bank, 2019).

Recent trends in the education sector indicate that basic literacy skills have improved tremendously, but more efforts are needed to achieve universal education goals; 103 million youth worldwide still lack basic literacy skills, of whom 60% are young women (UNDP, 2019). Secondary education also remains a huge challenge and, according to projections, by 2035 only 63% of the world's 20 to 24-year-olds will have completed upper secondary school (Smart Villages, 2017). Dropouts present a continuing issue, mostly in Sub-Saharan Africa, where at least 20% of children enrolled in school are not expected to reach the last grade (Smart Villages, 2017).

Barriers that limit access to sustainable energy in educational facilities pertain broadly to:

- Weak policy complementarities and lack of coordination across the energy and education sectors.
- Issues of affordability, high upfront capital costs and the lack of market signals to encourage private investment and local capacity, especially related to emerging technological advancements, such as solar PV systems.
- Technical barriers, including unreliability of power supply, lack of incentives or capability for longer-term system maintenance, and insufficient after-sales services and sustainability.
- Lack of information and awareness about the multiple benefits of energy, and its implications for educational outcomes. As it stands, lack of data is often a key difficulty, and challenges remain in trying to obtain data on energy access in the education sector, which in turn undermines evidence-based decision making.

Innovative tools for engaging children and young people in Education on Energy

Drawing from existing tools, children and young people can be encouraged and supported to become part of the sustainable energy solution.

A **toolkit for young climate activists** has been created by young advocates to share concise, easily understandable information on global, regional and national climate actions, in order to prepare for full and informed participation.

UNICEF is exploring developing a similar toolkit for young people on sustainable energy. Similarly, **Voices of Youth (VOY)** is UNICEF's global community for young people to learn about development issues, including environmental education, and where interlinkages with sustainable energy can be emphasized.

The **World's Largest Lesson (WLL)** produces creative tools for educators and action-focused learning experiences for children and young people that build skills and motivation to achieve the SDGs. In 2019, free WLL resources, available in over 30 languages, reached 17.9 million children located in over 160 countries. WLL can provide a concrete platform to keep student learning on SDG 7 engaged and relevant.

Electricity access does not always equate to having electricity services at night. Households that obtain electricity access through off-grid renewable equipment tend to still experience darkness at night. Examining only electricity access may fail to capture the additional beneficial impacts on education of having electricity at night so children can read and study. This an important issue for policy makers determining the best ways to increase educational attainment.

HOW TO ADDRESS THESE CHALLENGES

Sufficient quantitative and qualitative information is needed to accurately reflect the magnitude of the challenge and drive evidence-based decision making. Gaining better insight requires an increased effort to generate and analyse data.

Some of the solutions to increase energy access in educational facilities include extending the electrical grid or connecting to decentralized solutions such as mini-grids or stand-alone solar PV systems, to ensure adequate service delivery. Innovations in technology, emerging business models and dramatic cost reductions now make it possible to help address some of these challenges.

Increasingly, solar energy is cost competitive – even with the cheapest coal generation – and can be deployed in a fraction of time it would take the centralized grid to arrive (IRENA, 2020). This, coupled with innovative business models, such as long-term, performance-based contracts for solar system installations and after-sales services, may give public institutions the electricity service they need at an affordable cost (IEA, 2014).

The challenges related to maintenance of decentralized solar PV systems still remain, but solar solutions can be turned into employment opportunities for local communities by providing training for repair and maintenance. Such activities could be included in vocational training programmes for local high schools or technical colleges, which could include educational modules on distributed energy systems, along with practical activities on installation, repair and maintenance, using the actual electrification systems of the schools as training spaces. (For example, electrification of an energy kiosk at the Semara University, Ethiopia was undertaken by an international team of universities, NGOs and renewable energy practitioners: https://rurerg.net/projects/electrification/ethiopia/semara/)

Urgent and ambitious collaboration among stakeholders – policy makers, the private sector, development partners and civil society – is required to scale up emerging business and financing models. The public sector has a critical role in affirming conducive enabling environments, such as through ambitious long-term solar energy targets and other government, regulatory and institutional structures, and public finance instruments to minimize investment risks and prioritize the education sector for financing of electrification.

Limited quantitative data makes it challenging to authoritatively estimate the financing needed to electrify the education sector. But the scale of renewable energy investment required to achieve energy security, and meet the Paris Climate agreement goals and wider social and economic benefits, is estimated at around US$ 3.2 trillion per year until 2050 (IRENA, 2020), and approximately US$ 11 billion to electrify all public institutions. This offers a broad signal of the magnitude of investment required to adequately reach out to the education sector.

Priority actions should focus on identifying factors that have enabled positive progress in school electrification to date, and selecting the most appropriate examples to build the investment case for providing electricity in schools with no access. Private sector investment is needed to complement limited public resources to address the huge energy access gaps in public institutions. The private sector role is also important for innovations in service and delivery models.

Policy advocacy, stakeholder engagement, public awareness, and education are important for decision makers, in facilitating the necessary knowledge, attitudes, and behavioural changes among children and adults on the benefits of sustainable energy. For example, advocacy for schools to institute energy management policies or strategies, and energy management systems based on nationally appropriate standards (with monthly updates of energy performance indicators for management) can support long-term investment decision-making on facility power planning.

Advocacy for air quality action plans for schools that are exposed to unsafe air quality is another area of recommended focus. Such an action plan would minimize children's exposure to air pollution through better waste management systems, improved ventilation, and design and construction that reduces exposure to both indoor and outdoor pollutants, thus ensuring access for all children to a clean, safe, and healthy school environment.

Separately, the incorporation of energy education in curricula has been demonstrated to build a necessary technical skill base for a young generation whose members can act as change agents to advance sustainable energy solutions. There are several educational programmes on locally manufactured small wind turbines for rural electrification that are examples of such an approach. Engaging the next generation through education is important for maintaining and growing the 'green energy' work force, especially as the world works towards a Net Zero energy transition.

CASE STUDIES

A compendium of case studies illustrates several blended approaches among public-private partners for energy service delivery in the education sector. The Government of Uganda, with World Bank support, electrified 560 schools and 522 health care facilities through the Energy for Rural Transformation – II (ERT-II) project. The Ministry of Education and Sports spearheaded the programme in schools and promoted an approach whereby the private sector was responsible for supply, installation and maintenance of the PV systems. After five years the operations and management responsibility was transferred to local governments, which typically have limited human and financial resources (UN Foundation and SE4All, 2019).

Similarly, the Government of India, with UNDP-GEF support, promoted investments in solar concentrators for cooking and hot water in public institutions, including academic institutions and student hostels. Supported through government subsidies a typical system catering to a single hostel of about 600 students created annual reductions of greenhouse gas emissions by over 1.08 tCO_2 p.a (Sun Focus, July-Sept15).

Likewise, joint programmes between ministries of energy and education can benefit from leveraging funding towards common goals and sharing on-the-ground knowledge and expertise. Under Argentina's Project for Renewable Energy in Rural Markets, led by the Ministry of Energy in partnership with the Ministry of Education's complementary Project for Improving Rural Education, provided an additional source of funding to support school electrification and the installation of energy-efficient appliances. The programme also leveraged local relationships and knowledge to support community engagement and successful outcomes (Best, 2011).

TARGETS, INDICATORS AND DATA

Component	Indicator	Current or potential source
Impacts of energy access on education	Proportion of schools offering basic services, by type of service necessary to ensure a safe and effective learning environment for all students. Proportion of schools (primary/secondary) with access to electricity	UIS Statistics (unesco.org)
	Proportion of educational institutions with access to renewable energy and energy efficient solutions	
	Proportion of primary/secondary school completion rate with access to electricity	
	Access to electricity in educational facilities	World Bank MTF Survey

REFERENCES

Barnes D, et al. (2014) "The Development Impact of Energy Access", www.researchgate.net/publication/299883395_The_Development_Impact_of_Energy_Access

Benjamin K. Sovacool, Sarah E. Ryan (2016) "The geography of Energy Education". www.sciencedirect.com/science/article/pii/S1364032115016020

Best, Sara. 2011, Expanding Energy Provision in Rural Argentina through PublicPrivate Partnerships and Renewable Energy. A Case Study of the PERMER Programme. London: International Institute for Environment. http://pubs.iied.org/16025IIED.html

European Commission (2006) Action Plan for Energy Efficiency: Realising the Potential. COM (2006) 545 Final, https://www.researchgate.net/publication/260137969_Action_Plan_for_Energy_Efficiency_Realising_the_Potential

GIZ, (2016) Public Investment in Energy Efficiency (PIE Project), Project Brief.

Goodman, J. et al., (2018) Heat and Learning. Working Paper 24630. NBER Working Paper Series.

Hansen, N., Koudenburg, N., Hiersemann, R., Tellegen, P. J., Kocsev, M., & Postmes, T. (2012) Laptop usage affects abstract reasoning of children in the developing world. Computers & Education, 59(3), 989-1000. https://doi.org/(...).compedu.2012.04.013

International Energy Agency (IEA) 2014 Innovative Business Models and Financing Mechanisms for PV Deployment in Emerging Regions

International Energy Agency (IEA) (2017) "Energy Access Outlook: World Energy Outlook Special Report, OECD/IEA, Paris" www.iea.org/bookshop/750-World_Energy_Outlook_2017

International Energy Agency (IEA) (2017a) Population without access to electricity, 2017 dataset https://www.iea.org/sdg/electricity/

IRENA, 2020 Global Renewables Outlook

IRENA, 2020. Renewables Increasingly Beat Even Cheapest Coal Competitors on Cost (irena.org)

International Book Bank (IBB) (2018) "Mobile Learning in low resource countries" http://internationalbookbank.org/wp-content/uploads/2018/03/Mobile-Learning-in-Low-Resource-Countries-1.pdf

Kampala Capital City Authority, Kampala Capital City Authority

(KCCA) and French development agency (2019) Empowering children in Uganda for a sustainable future – http://www.simoshi.org/projects/

Kanagawa, Makoto and Toshihiko Nakata (2008) Assessment of access to electricity and the social and economic impacts in rural areas of developing countries, Energy Policy 36 (2008) https://www.sciencedirect.com/science/article/pii/S0301421508000608

Practical Action (2013) Poor people's energy outlook 2013: Energy for community services, Rugby, UK: Practical Action Publishing. https://policy.practicalaction.org/policy-themes/energy/poor-peoples-energy-outlook/poor-peoples-energy-outlook-2013

Smart Villages (2017) "Education and the Electrification of Rural Schools, Technical Report 13", http://e4sv.org/wp-content/uploads/2017/05/TR13-Education-and-the-Electrification-of-Rural-Schools_web-1.pdf,

UN Foundation and SE4All, 2019 Lasting Impact: Sustainable Off-Grid Solar Delivery Models to Power Health and Education | Sustainable Energy for All (seforall.org)

United Nations Development Programme (UNDP) (2019) https://www.undp.org/content/undp/en/home/sustainable-development-goals/goal-4-quality-education.html

United Nations Educational, Scientific and Cultural Organization (UNESCO) (2021) Institute for Statistics (UIS), SDG database, February 2021. UIS Statistics (unesco.org)

United Nations Children's Fund (UNICEF) (2015) "Sustainable Energy for Children" www.unicef.org/environment/files/UNICEF_Sustainable_Energy_for_Children_2015.pdf

Valerio, Ana Patricia, "The link between Electricity and Education" Devex, 30 June 2014, www.devex.com/news/the-link-between-electricity-and-education-83789

World Bank, 2019: Kenya - Multi-Tier Energy Access Tracking Framework Global Survey 2016-2018 (worldbank.org)

SECTION 3.5

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

CONTRIBUTING ORGANIZATIONS:
ENERGIA, UNIDO, CLEAN COOKING ALLIANCE, GWNET, MINISTRY OF ENERGY OF KENYA, UN WOMEN

Summary/Key Messages

PROGRESS TOWARDS ACHIEVING SDG 7 AND GENDER EQUALITY

Progress in implementing SDG 7 is too slow and uneven to ensure its attainment by 2030. The number of women gaining access to sustainable energy is low, and women are still underrepresented in decision-making, employment and entrepreneurship in the energy sector. Insufficient progress towards SDG 7 and other interlinked SDGs has been further jeopardized by the COVID-19 pandemic, which has rolled back the limited advances made towards realizing gender equality and sustainable energy. Yet the political commitment to "build back better" in the aftermath of the pandemic presents a unique opportunity to address gender disparities in the energy sector, by increasing and sustaining investments in women's access to modern energy services, appliances and cooking technologies, ensuring women's participation in decision making at all levels of energy production, supply and consumption, and strengthening data, research and innovation on gender and SDG 7.

Access to energy

While progress in increasing access to modern energy has been significant in most countries, women are being left behind in some countries, particularly in Sub-Saharan Africa (IRENA, 2019). Female-headed households are less likely to have access to electricity (EFEWEE, 2018) and when access is available, it is less likely to address their

needs. Energy access remains inadequate for services especially critical to women's health, education, agricultural production, water supply, food processing and businesses. The high costs of electricity and cooking fuels, coupled with unreliable supplies in many countries, have significant impacts on women in rural areas, slums, and settlements for the displaced, as well as disabled women. Nevertheless, women can and do play a transformative role in improving energy access when conditions are conducive.

Energy Efficiency

Improving energy efficiency can make a huge difference in women's lives and livelihoods by alleviating both economic need and time poverty. Time freed up through the use of efficient energy technologies enables women to increase their participation in productive and educational/self-development activities, or to secure much-needed leisure and rest. Efficient appliances can help women save money, therefore making significant contributions to women's and household budgets. Women can play a critical role in achieving energy efficiency goals, so opportunities to do so should be opened up at all levels across the energy sector.

Renewable Energy

Women have been played important roles in expanding and decentralizing access to renewable energy, and in participating in renewable energy supply chains, both for productive and household purposes. Women have been active in numerous projects, including as cookstove producers in Malawi, Barefoot Solar Engineers in Afghanistan, and Solar Sisters in Tanzania and elsewhere. Their share of renewable energy jobs increased from 22% in 2010 to 32% in 2018 (IRENA, 2019). However, they remain largely in lower-paid and non-technical positions. Women lag behind men in acquiring and deploying the technical knowledge to take up jobs in renewable energy, and also face discriminatory social norms and gender stereotypes as inhibiting factors. Significant efforts must be made to increase women's skills and educational attainments, particularly in science, technology, engineering and mathematics (STEM) fields, and also actively recruit, retain, and promote women in renewable energy and across the energy sector.

Priority actions

Reduce gender gaps in energy access by significantly increasing financing for both grid and non-grid development, including clean and efficient cooking.

Support women's energy entrepreneurship to ensure their inclusion in transforming the sector and in gaining incomes from energy entrepreneurship.

Increase women's inclusion in supply chains, decision making and policy making in the energy sector to ensure that their expertise and voices are adequately utilized and represented in the energy transition.

Support electrification of public services that address women's needs.

Ensure all policy and regulatory reforms take into account women's needs and priorities.

Support the tracking of gender gaps at all levels across the sector.

PROGRESS TOWARDS ACHIEVING SDG 7 AND GENDER EQUALITY

Energy Access

Electrification – Some progress has been made in increasing access to electricity – between 2018 and 2019 almost 90 million people gained access to electricity (IEA, 2019). However, global tracking data is largely not sex disaggregated. Emerging evidence suggests that women – specifically in female-headed households – lag behind in access to electricity, regardless of type of supply (EFEWEE, 2018).

When access is available, women tend to occupy lower tiers of access due to higher levels of poverty compared to men. It is therefore important to avoid a gender watt-gap where men have access to high-capacity electricity, which enables a wider range of activities, while women are relegated to only the most basic of services.

Clean and efficient cooking is vital for improving women's health, reducing their unpaid care and domestic work, and freeing their time for productive and leisure pursuits. Global access to clean cooking increased by a meagre 4% between 2015 and 2018. About 2.9 billion people remain without access to clean cooking (IEA, IRENA, UNSD, WB, WHO, 2019) with the adverse impacts of this disproportionately affecting women's health and well-being. While investments made in 2018 – amounting to US$ 131.5 million (IRENA, 2020) – represented an improvement over the previous five years, they fell short of the required US$ 4.5 billion per year needed to achieve universal access to clean cooking by 2030.

Energy services for health care — Women make up 70% of the health workforce worldwide (Boniol et al., 2019). Only 41% of low and middle-income country health care facilities have reliable electricity, based on an analysis of 78 countries (Cronk and Bartram, 2018).

Lack of reliable energy services compromises health care delivery, increases risks of infection, affects the quality of medical products, and restricts sterilization of equipment and medical waste management, while also posing challenges affecting meal preparation for patients and staff. In some Sub-Saharan African countries, patient guardians – who are overwhelmingly female – must collect and provide cooking fuels for health facility kitchens, adding to the burden of care.

Women also take on the bulk of health care at home. Without modern energy services, women spend much time and labour provisioning water, and cleaning and sterilizing spaces and equipment – or must forego this, putting themselves and their households at risk.

Energy services for education — An estimated 69% of schools globally have access to electricity, but only 37% of primary schools in Sub-Saharan Africa (UNESCO, 2018). Reliable electricity supplies at home and in schools can improve educational outcomes for girls, by reducing their unpaid care and domestic workloads and freeing up time for study and school attendance, which results in increased enrolment and years of schooling completed (Khandker, 2014).

School closures and lockdowns during the COVID-19 pandemic have added to the unpaid care and domestic work responsibilities of women and girls everywhere. However, in low-income countries without modern energy services, home schooling is difficult, and girls' education has been particularly affected.

Productive use of energy — Women's productive activities and businesses have different energy needs and capacities to pay for energy services than those of men, which tend to be larger and more energy-intensive (EFEWEE, 2018; Mestre and Pueyo, 2019). Gender-responsive approaches to women's productive use of energy and energy entrepreneurship should support their access to financing, and address constraints in energy supply and technologies.

Energy in conflict settings, and disaster and emergency situations — Globally, there were 71 million people in 2018 who were forcibly displaced, of which 25.9 million were refugees (UNHCR, 2018). An estimated 9 out of 10 refugees in camps have no access to modern lighting (NORCAP and BCG, 2020). It is common for refugees to exchange much-needed food rations for cooking fuels, and to face physical and sexual violence while searching for fuels (Lahn and Grafham, 2015).[19] Inadequate lighting in night markets, communal hygiene/sanitation facilities, or public spaces in general, can increase women's vulnerability to violence (Lahn and Grafham, 2015). Restrictions on movements and gatherings can disrupt women's access to energy technologies, finance and information, and this has been seen during the COVID-19 pandemic (Emili, Milano, Matinga, Bwalya, and Nyasulu, 2021; ENERGIA, 2020).

Women's employment in the energy sector — In 2019, women made up 32% of the renewable energy sector workforce compared to 22% in the energy sector overall. However, women's participation in STEM jobs is far lower than in administrative jobs (IRENA, 2019). Women are also not equally represented within energy leadership: women represent 5% of board executives and 16% of board members in power and utility companies (Ernst and Young, 2017), which shows the need for policies to address structural barriers and discriminatory social norms that impede progress in these areas.

POLICY RECOMMENDATIONS

Significantly increase financing for both grid and non-grid development, and focus on innovations in renewable energy supply and energy-efficient household and productive technologies that meet women's needs and priorities and reduce their unpaid care and domestic work.

Support women's energy entrepreneurship by increasing financing for women-led energy businesses, and promoting financial institution arrangements to provide products and services tailored to women's energy enterprises, including women-specific investment windows.

Support girls in STEM recruitment, retention, re-entry, and career advancement in gender-responsive workplaces, and mandate more positions for women in energy management in the public and private sectors in order to significantly increase women's inclusion in supply chains, decision making and policy making in the energy sector.

Prioritize public financing for electrification of health and education facilities, and community water supply and lighting.

Implement gender-responsive policy and regulatory reforms to address women's needs and priorities, and close gender gaps and inequalities in the energy sector.

Monitor and report gender gaps in energy access, renewable energy, energy efficiency and financing, including mandatory consideration of the number of women in energy management in the public and private sectors, and the proportion of funding for gender-responsive energy investments and initiatives – and assess their impacts on women's lives and livelihoods.

[19] Exposure to sexual violence during fuel collection is not exclusive to conflict situations and is prevalent in many different contexts.

REFERENCES

Boniol, M., M. McIsaac, L. Xu et al., 2019. "Gender Equity in the Health Workforce: Analysis of 104 Countries." Health Workforce Working Paper 1. World Health Organization, Geneva, March.

Emili, Milano, Matinga, Bwalya, and Nyasulu, 2020. The impact of financing business models on access to SHS and women's financial inclusion: Insights from FINCOOP Savings and Credit Cooperative in Malawi and MoneyMart Finance in Zimbabwe. AECF. Nairobi

ENERGIA, 2020. Gender and energy at center stage in COVID-19 battle: Powering a more gender-equal recovery COVID-19, energy and gender.

Ernst and Young, 2017. Index of Women in Power and Utilities.

IEA, IRENA, UNSD, WB, WHO, 2019. Tracking SDG 7: The Energy Progress Report 2019, Washington DC

IRENA, 2019. Renewable Energy: A Gender Perspective. IRENA, Abu Dhabi

IRENA, 2020. Global Landscape of Renewable Energy Finance 2020. Available at: https://irena.org/publications/2020/Nov/Global-Landscape-of-Renewable-Energy-Finance-2020

Khandker, S. R., Samad, H. A., Ali, R., & Barnes, D. F., 2014. Who Benefits Most from Rural Electrification? Evidence in India. The Energy Journal, 35 (2), 75–96. doi:10.5547/ISSN0195-6574-EJ

Lahn, G., and Grafham, O., 2015. Heat, Light and Power for Refugees: Saving Lives, Reducing Costs. Chatham House Report for the Moving Energy Initiative. London: Royal Institute of International Affairs.

NORCAP/Norwegian Refugee Council and Boston Consulting Group, 2020). EmPowering Africa's Most Vulnerable – Access to Solar Energy in Complex Crises. https://www.nrc.no/resources/reports/empowering-africas-most-vulnerable/

REN21, 2020. Renewables 2020 Global Status Report (Paris: REN21 Secretariat)

Sustainable Energy for All and Climate Policy Initiative, 2020. Energizing Finance: Understanding the Landscape

UNHCR, 2018. Global Trends: Forced Displacement in 2018. https://www.unhcr.org/5d08d7ee7.pdf

SECTION 3.6

INTERLINKAGES BETWEEN **ENERGY AND WATER AND SANITATION (SDG 6)**

CONTRIBUTING ORGANIZATIONS:
ESCWA, UNICEF, DESA, THE EUROPEAN COMMISSION, AND ITAIPU

Summary/Key Messages

INTERLINKAGES AND CHALLENGES

Achieving Sustainable Development Goal 6 and 7 remains a challenge globally, amplifying the need for synergy. Progress will also affect a range of other SDGs, including health, food, poverty eradication, gender equality, economic productivity, and climate change. A transformative, integrated approach to water and energy lies at the heart of the success of these interconnected agendas – and of harness the international momentum set in motion by the UN 2030 Agenda for Sustainable Development and the Paris Agreement.[20]

Water is widely used in the production of energy, whilst energy is required to treat and supply water, this is referred to as the water energy nexus. Populations that lack access to water often lack access to electricity and are amongst the most vulnerable to disease and food insecurities. Economic and population growths and the rise in consumer wealth, have prompted producers to focus on capacity additions at the expense of environmental degradation. Thus, impeding the progress of other SDGs, affecting health, expediting climate change, and widening inequality mostly among children, women and marginalized populations.

[20] https://sustainabledevelopment.un.org/content/documents/24078ab6_cover.pdf

Key impediments include the lack of communication, policy coherence, institutional coordination and awareness and understanding of the water energy interlinkages from both policies, planning and operational perspectives. Other challenges include the availability of appropriate technologies and access to finance in order to improve the equitable management of these resources.

PRIORITY ACTIONS TOWARDS 2030

Promote and operationalize technologies and processes that improve efficiency and free up water and energy resources.

Accelerate the deployment of renewable energy investments at scale, and ensure that energy policies are vetted to effectively tackle intersectoral synergies and trade-offs.

Strengthen evidence base, information quality, data collection and insights by putting in place data management plans and protocols, with monitoring and accountability measures and clear performance indicators to increase confidence between parties.

Address market distortion and price subsidies through the gradual and appropriate removal of subsidies and put in place adequate business models to increase the role of the private sector.

Establish a regional and/or international nexus knowledge hub, supported by specialized agencies working on the nexus, and build bridges between sectors and institutions to share best practices and experiences, and strengthen institutional and technical capacity.

Enhance regional and international cooperation in ensuring the resilience of water and energy systems through free trade, interconnectivity, research and technology transfer, and fund mobilization.

INDICATORS AND TARGETS

Energy access for water supply – to increase amount and enhance the quality of water supply using modern, sustainable and reliable form of energy.

Water requirements of the energy sector – to reduce the amount of water consumed during the energy production process.

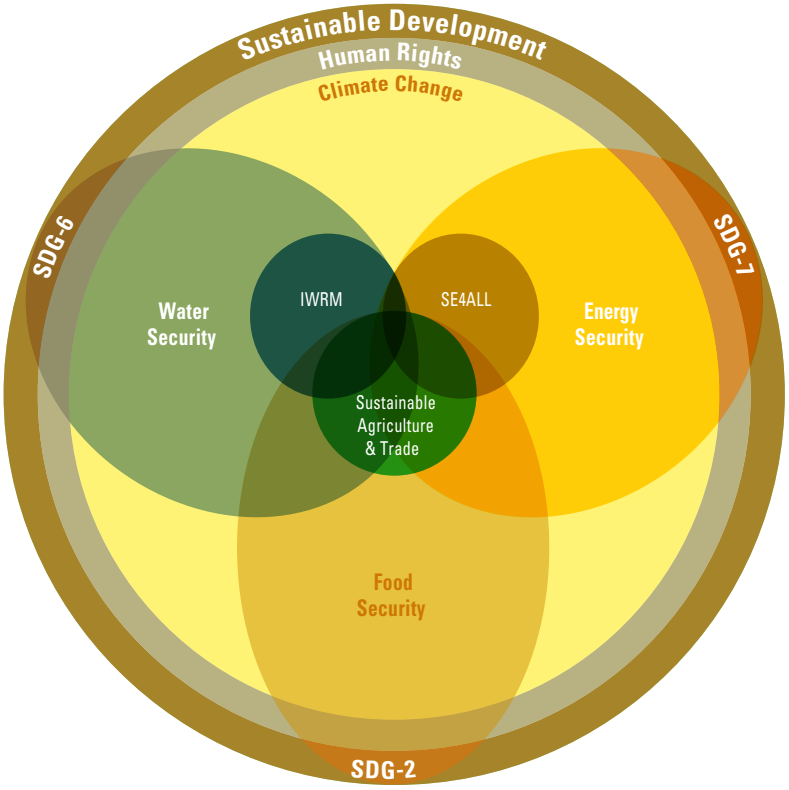
Energy requirements of the water sector – to reduce energy intensity and unit cost by source or technology of water (drinking, treated wastewater and desalinated)

SDG 6 AND SDG 7 ARE STRONGLY INTERLINKED, AND ALSO IMPACT OTHER SDGS

The United Nations General Assembly reaffirmed the international community's commitment to the human rights to clean drinking water and adequate sanitation, and to sufficient, safe, affordable and nutritious food. It also envisioned a world of access to affordable, reliable and sustainable energy.

Increasingly, the interlinkages between SDGs 6, 7 and 2 cannot be ignored, and synergies across SDGs are needed to meet these goals. Within the water-energy nexus, balancing inputs and uses of water and energy resources are needed to achieve mutually acceptable and sustainable management policies.

THE WATER-ENERGY-FOOD SECURITY NEXUS



Source: ESCWA Framework: https://www.unescwa.org/publications/water-energy-nexus-regional-policy-toolkit

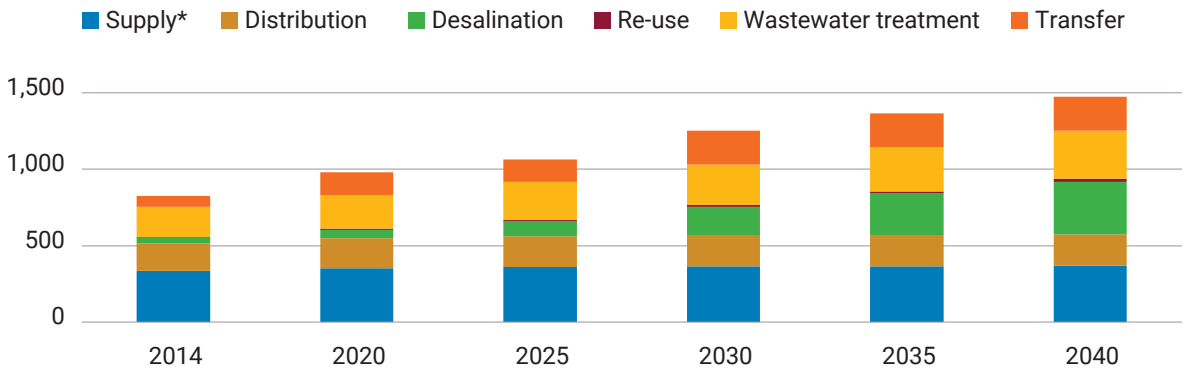
CHALLENGES FOR CREATING SYNERGIES

Population growth and competition for water and thus energy. At present, almost 800 million people are without access to electricity, 800 million people without access to clean water[21] and 80% of the wastewater is discharged untreated.[22] Each resource faces rising demands and constraints in many regions as a consequence of economic and population growth and climate change. By 2050, it is estimated that global demand for energy will nearly double, while water demand is set to increase by over 50%.[23] Similarly, water needs for agriculture, industrial and domestic purposes will increasingly rely on resources that are harder to reach and more energy intensive to exploit.

Conflict and instability have negatively impacted energy security and water availability and complicate the implementation of nexus solutions. In Iraq, Libya, the Syrian Arab Republic, Yemen and the occupied Palestinian territory (specifically Gaza), damage to, and destruction of, national infrastructure have included power-generation plants and transmission infrastructure and this has contributed to the collapse of essential public services such as water access and sanitation.

[21] JMP (washdata.org)
[22] https://www.iea.org/articles/introduction-to-the-water-energy-nexus
[23] IRENA 2015

ELECTRICITY CONSUMPTION IN THE WATER SECTOR BY PROCESS, 2014-2040



Source: IEA: https://www.iea.org/data-and-statistics/charts/electricity-consumption-in-the-water-sector-by-process-2014-2040

Climate variations and extreme weather events, could cause damage to electrical systems and water infrastructure. Climate change is projected to reduce water resources in most dry subtropical regions, intensifying competition for water among sectors, including for electricity generation.[24] Shifting precipitation patterns are impacting hydropower reserves and electricity generation.

Diminished freshwater resources can lead to a greater reliance on energy-intensive sources of water supply. 90% of power generation is water-intensive and three quarters of all industrial water withdrawals are used for power production. Additionally, 80% of global energy is produced by thermal power generation, which is responsible for 50% of all water withdrawals in the United States and several European countries. In the Middle East, desalination's share of total final energy consumption is expected to increase from 5% today to almost 15% by 2040.[25]

Evidence on the role of renewable energy within the water-energy nexus remains dispersed and limited, as does quantitative and qualitative knowledge on the impact of expanding renewables. Some renewable energy technologies such as wind and solar PV are less water intensive whilst providing the power needed. Whilst others such as biofuels, concentrated solar power (CSP) and even nuclear power, if not managed properly, may increase water stress and/or be limited by it.

Market distortion for energy and water prices. In many countries, subsidies for water and energy were introduced to make the resource more affordable for all citizens. But this encourages energy intensive water extraction activities placing more pressure on limited water resources, promotes overconsumption of energy and disproportionately benefits the wealthy. However, in absence of subsidies, the poor could be at risk of access to affordable energy and water.

Limited access to finance and private sector engagement to build necessary infrastructure and implement the technologies needed. Investment in renewable is still lagging funding requirements, especially when considering the costs of energy efficient technologies from a nexus approach. Engaging the private sector is problem due to subsidized energy and water, hindering effective cost recovery and discouraging private investments especially in water services provision.

[24] 3 — Freshwater Resources (ipcc.ch)
[25] https://www.unescwa.org/publications/water-energy-nexus-sustainable-development-goals5

Lack of participatory intersectoral approach to policy formulation and implementation results in water and energy investments competing for public funds.[26] Matters are complicated in instances where special allocations of water resources and prices are provisioned in the agricultural sector as well as energy for industry, hindering the implementation of uniform policies that are aimed at improving consumption patterns.

Insufficient awareness, institutional capacity and absence of coherent communication strategies between government entities and key stakeholders on resources allocation leads to fragmented thinking, clouds the element of responsibility, and encourages departments to work in silo, focusing on their own priorities and neglecting the opportunity to set common targets.

Data required for water energy nexus are difficult to obtain and are not fully linked to SDGs indicators to inform evidence-based policy decisions. Data availability on energy and water becomes more challenging when looking at it from a water-energy nexus perspective, predominantly in developing countries. The challenge is relevant for specific sectors (e.g., data on water use or energy production) as well as from a water-energy nexus (e.g., data on water use for energy production). Hydropower and bioenergy are especially challenging because the relation of water use to energy production (instead of other services) is unclear.

ADDRESSING THE CHALLENGES

Promote and operationalize technologies and processes that improve efficiency and free up water for energy production and energy for water production in turn – Energy savings can be realized if all the economically available energy efficiency and energy recovery potentials in the water sector are exploited. Wastewater contains significant amounts of embedded energy that, if harnessed, could cover more than half of the electricity needs of municipal wastewater utilities. There is also a major opportunity to reduce water losses along the supply chainfrom leaks, bursts and theft which would save water and energy. Use of low-flow, smart fixtures and technologies can increase water efficiency and thus decrease energy demand. Application of nature-basedservices to maximize water supplies and reduce water demand, for example in agriculture, can further improve the water balance.

Accelerate the uptake of renewable energy investments and ensure that energy policies are vetted to effectively tackle intersectoral synergies and trade-offs – Policymakers should ensure that intersectoral linkages are adequately reflected in renewable energy policy- as well as water, agriculture, and environment-related policies- in order to support sustainability. Incorporation of alternative energy generation at water- wastewater facilities and sites (biogas, solar, wind) can reduce energy demand from the water sector (Case study: providing clean water to children in the state of Palestine).[27]

Address market distortion and price subsidies through the gradual and appropriate removal of subsidies – Price reforms need to ensure adequate safety nets for the poor, proper communication strategies aimed at educating the public about responsible use, and above all, technological improvements and diversification, that allow for more efficient production. Savings from reforms can be channelled towards technology gaps and improving productivity and efficiency to achieve a resilient sector and ensure sustainable resource management. Overall, investments, which increase access to water - sanitation and energy, will in turn foster economic development and introduce a 'virtuous cycle': customer affordability will increase and the need for subsidies will decrease.

[26] IRENA, 2015

[27] Source: https://www.unicef.org/sop/what-we-do/wash-water-sanitation-and-hygiene

Strengthen institutional and technical capacity building programs through continuous awareness raising of the sectoral linkages to build common standards, coherent national agenda, understanding of priorities. This includes designing, implementing and monitoring of policies, business models, and investment to better manage the water-energy interlinkages and their implications on other SDGs.

Establishing or strengthening basin-wide management bodies can foster a multisectoral approach to resources stewardship, security and sustainable use. International organizations and specialized agencies working on the water-energy nexus should continue advocacy, communications and outreach to help countries through their government institutions, education sector and private sector, in order to conduct evidence-based dialogues and facilitate broad-based implementation of SDG 6 and 7. Development of joint tools, such as green specifications for application of alternative energy facilities at water-wastewater sites, can promote cross-sector capacities and cooperation.

Build bridges between sectors and institutions by establishing clear dialogue between sectors through a participatory approach. Increase the level of coordination and collaboration between the water and energy sectors in all stages of planning and implementation by mobilizing and scaling-up multi-stakeholder actions aimed at stimulating integrated water-energy responses and addressing cross-sectoral barriers in other development sectors. Promoting effective dialogue, team building with strong negotiation skills, knowledge sharing and transparency across different sectors and at all stages help identify the synergies and management of trade-offs within an agreed nexus framework.

Strengthen information quality, data collection, and insights. At national level, it is necessary to establish and/or enhance the data management plans and protocols to increase confidence between parties and put in place a monitoring and accountability measures with clear performance indicators. Establishing a regional nexus knowledge hub, supported by specialized agencies working on the nexus, would help to support sharing best practices, experiences, and quality data on the water-energy interlinkages and their contributions to other SDGs.

Enhance regional and international cooperation in ensuring the resilience of water and energy systems through free trade, interconnectivity, research and technology transfer, and mobilization of funds to support developing and vulnerable communities to jointly face any global, regional and national disasters, such as the COVID-19 pandemic, and the long-term global threat of climate crisis.

Component	Indicator	Current or potential source
Impacts of energy on water access	Water (m3) pumped/treated/distributed/desalinated by energy source/ technology (if off grid)	
	Shutdown time (hours) and operational losses ($) due to energy-related issues (at the water utility level)	
Energy requirements of the water sector	Energy intensity (GJ/m3) and unit cost ($/m3) by energy source/ technology (if off grid) of drinkable water/treated wastewater/ desalinated water	World Water Development Report 2014
	Energy intensity (GJ/m3) and unit cost ($/m3) of water heating by energy source/technology (if off grid)	

Component	Indicator	Current or potential source
Water requirements of the energy sector	Water (m3) withdrawn/consumed/discharged by energy source (and cooling technology) at the energy production facility level	IEA 2012/ Carbon Disclosure Program (CDP)
	Number of operating power plants by energy source and cooling technology	IEA 2012/CDP
	Cost of water withdrawn ($/litre) for the energy sector (by energy facility)	
Integrated policy and planning	Perceived change over the past 20 years in the importance of water for energy by country governments (percentage scale, from significant decrease to significant increase)	UNEP 2012
Technology	The number of patents filed by a country	
	R&D expenditure (% of GDP)	
RE effectiveness indicators	Installed renewable capacity (MW) and share of total capacity	
	Electricity generated (MWh)	

Sources: www.unescwa.org/publications/water-energy-nexus-sustainable-development-goals, www.unescwa.org/publications/water-energy-nexus-renewable-energy-module

REFERENCES

IEA, 2020 https://www.iea.org/data-and-statistics/charts/electricity-consumption-in-the-water-sector-by-process-2014-2040

IRENA, 2015. Renewable Energy in the Water, Energy & Food Nexus: https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2015/IRENA_Water_Energy_Food_Nexus_2015.pdf

UN, 2019. Accelerating SDG 7 Achievement, Action Brief 6, Sustainable Water and Energy Solutions Network, https://sustainabledevelopment.un.org/content/documents/24078ab6_cover.pdfUNESCWA. Developing the Capacity of ESCWA Member Countries to Address the Water and Energy Nexus for Achieving Sustainable Development Goals – Resource Efficiency Module https://www.unescwa.org/publications/water-energy-nexus-sustainable-development-goals

UNESCWAb. Developing the Capacity of ESCWA Member Countries to Address the Water and Energy Nexus for Achieving Sustainable Development Goals https://www.unescwa.org/publications/water-energy-nexus-regional-policy-toolkit

UNESCWAc. Moving towards Water Security in the Arab Region :https://www.unescwa.org/sites/www.unescwa.org/files/publications/files/moving-towards-achieving-water-security-arab-region-english.pdf

UNESCWAd. Tracking SDG 7: Energy Progress Report Arab Region: https://www.unescwa.org/publications/energy-progress-report-arab-region

UNESCWAe. Water-Energy Nexus Operational Toolkit: Renewable Energy https://www.unescwa.org/publications/water-energy-nexus-renewable-energy-module

UNESCWAf. Water-Energy Nexus Operational Toolkit: Technology Transfer Module https://www.unescwa.org/publications/water-energy-nexus-technology-transfer-module

UNICEFb. Solar-powered water systems https://www.unicef.org/wash/solar-powered-water-systems

SECTION 3.7

INTERLINKAGES BETWEEN **ENERGY AND ECONOMIC GROWTH AND EMPLOYMENT (SDG 8)**

CONTRIBUTING ORGANIZATIONS:
INTERNATIONAL RENEWABLE ENERGY AGENCY (IRENA), INTERNATIONAL LABOUR ORGANIZATION (ILO) AND GLOBAL GREEN GROWTH INSTITUTE (GGGI), CLEAN COOKING ALLIANCE (CCA), AND MEMBERS OF THE SUSTAINABLE ENERGY AND JOBS PLATFORM (SEJP) INCLUDING THE ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAM (ESMAP) OF THE WORLD BANK, GLOBAL WOMEN'S NETWORK FOR THE ENERGY TRANSITION (GWNET), GOGLA, IASS POTSDAM, POWER FOR ALL, SELCO FOUNDATION.

Summary/Key Messages

SUSTAINABLE ENERGY CAN DRIVE A GREEN COVID-19 RECOVERY AND CREATE ADDITIONAL AND DECENT JOBS

The strong interlinkages between SDG 7 and SDG 8 are well recognized, and there is clear evidence that the sustainable energy transition would bring net employment gains and decent jobs, provided the right policy frameworks are put in place. The benefits of an energy transition based on accelerated renewables and energy efficiency has gained greater relevance in the context of pursuing a green and inclusive recovery from the COVID-19 pandemic.

The energy transition, which was underway well before the COVID-19 pandemic, has already been reflected in a growing workforce. IRENA estimates that employment in the renewable energy sector reached 11.5 million in 2019, up from 7.3 million in 2012. Solar photovoltaic (PV) jobs represent the single largest segment, at about 3.7 million.

A green recovery in line with the IRENA Transforming Energy Scenario would create 5.5 million more jobs in renewable energy, energy efficiency and system flexibility by 2023 than there would be under the business-as-usual Planned Energy Scenario. Medium-term, renewable energy jobs could reach almost 30 million by 2030, with another 40 million jobs related to energy efficiency and system flexibility.

Projections for a Green Recovery Plan modelled by PAGE and Cambridge Econometrics similarly show additional jobs by 2030 – about 20.5 million across economies globally – compared to around 3 million additional jobs in a business-as-usual recovery scenario.

An inclusive energy transition model will be incomplete without consideration of access and gender issues. Data from Power for All shows that in an energy access context, decentralized renewable energy (DRE) is a large contributor to employment. In 2019, DRE companies directly employed 95,000 workers in India, 10,000 workers in Kenya, and 4,000 workers in Nigeria. The Government of Nigeria is also targeting the creation of 250,000 jobs from its new Solar Power Naija programme. Informal employment in the sector is more than double these numbers, and additional jobs are also created in productive use applications catalysed by improved energy access.

Women represent 32% of the workforce in the overall renewable energy sector, and measures are necessary to ensure equal access to opportunities, jobs and capital for women-led enterprises, according to a global survey conducted by IRENA in 2019.

To drive the wider structural shifts needed in the energy sector to further advance employment opportunities within a just transition and a decent work agenda, it is important for economic stimulus packages and recovery plans to be paired with gender-sensitive holistic policy frameworks. These frameworks will need to address industrial policies, labour market policies, skills training and retraining, strategies aimed at recruiting more women, and social protection measures for fossil fuel sector workers as they try to find new decent jobs.

In the processes for designing such policies, it is important for all voices to be heard, including members of community groups and unions, women's representatives, gender mainstreaming advocates, youth, and many others. Reconciling many different perspectives requires strong public policy guidance, because exclusively market-led development planning cannot be expected to accomplish this critical task.

The four pillars of the Decent Work Agenda – social dialogue, social protection, rights at work and employment – are indispensable building blocks of sustainable development and must be at the centre of policies for strong, sustainable and inclusive growth and development.

INTERLINKAGES BETWEEN SDG 7 AND SDG 8

SDG 7 on universal access to sustainable energy and SDG 8 on decent work and economic growth go hand in hand, as earlier editions of the SDG Policy Briefs series have shown. It is today well documented that any energy transition aimed at reaching SDG 7, as well as global climate objectives, will generate a significant number of new job opportunities and economic growth – not just in the energy industry itself but across many other sectors in the economy.

The COVID-19 pandemic has had a devastating impact not only on people, health, and livelihoods but also on our economies. Significant job losses have disproportionally affected low-skilled workers and minority groups, as well as women, who are 1.8 times more likely than men to have lost their jobs or livelihoods (ILO, 2020; Ojiambo, 2021). By directing gender-sensitive stimulus packages and investments towards renewables, energy efficiency and other enabling technologies and infrastructure, governments can generate immediate gains and set the course for a climate-safe and inclusive economic recovery in line with the objectives of the Paris Agreement and the 2030 Agenda for Sustainable Development.

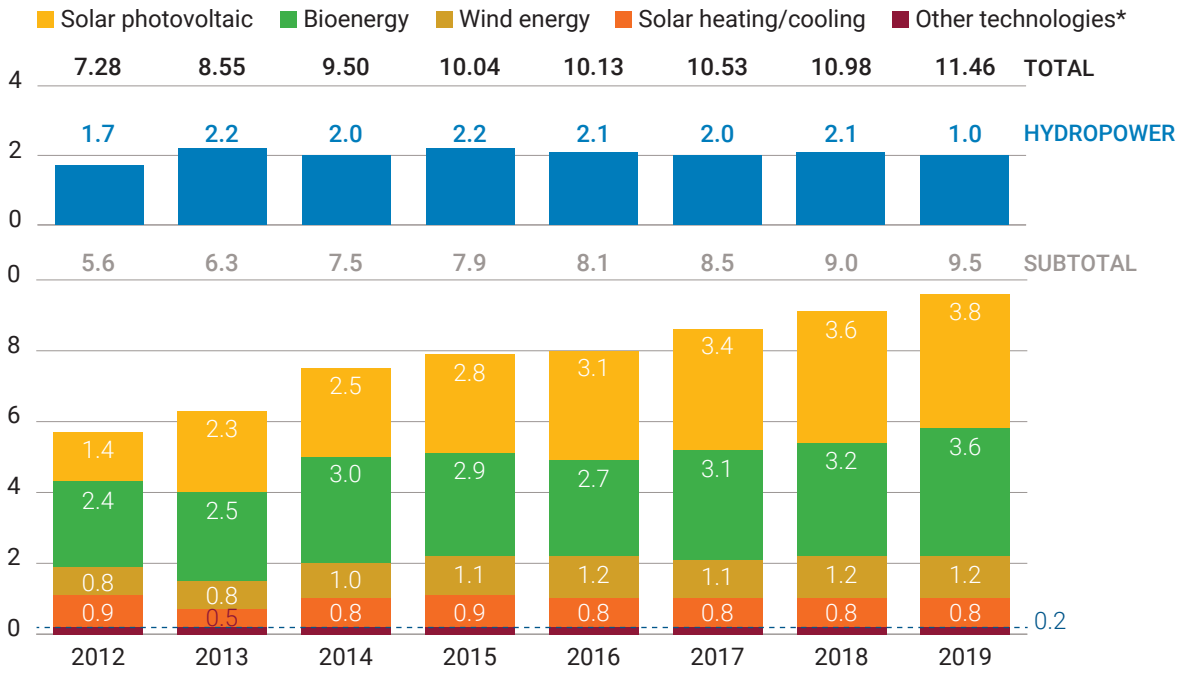
While many countries have put forward measures to further support the energy transition, and even announced more ambitious climate and energy commitments in response to the impacts of COVID-19, many others have yet to take decisive action to drive a post-COVID green recovery, one that is just and ensures additional and decent jobs in a broad range of energy contexts.

SUSTAINABLE ENERGY AND EMPLOYMENT CREATION

Driven by maturing technologies and policy frameworks, as well as rapidly falling costs, renewable energy capacity installations doubled between 2010 and 2019 (IRENA, 2020a). Hydropower still accounts for half of all renewable capacity installed, but solar PV (expanding 13-fold) and wind (expanding 2.4-fold) have seen the largest growth.

The ongoing expansion of installed renewable energy capacity is already translating into a growing workforce. According to IRENA estimates, employment in the renewable energy sector reached 11.5 million in 2019, up from 7.3 million in 2012 (IRENA, 2020b). Solar PV jobs represent the single largest segment, at about 3.7 million (see Figure 1). Currently, women represent 32% of workers

FIGURE 2. GLOBAL RENEWABLE ENERGY EMPLOYMENT BY TECHNOLOGY (2012-2019)



Source: IRENA, 2020b.

across all renewables, compared with 22% in traditional energy industries, such as oil and gas (IRENA, 2019). But progress is uneven; the representation of women in wind energy is only 21% (IRENA, 2020c).

Renewable energy offers employment for people coming from a range of backgrounds, both in terms of qualifications and occupational experience, thereby creating the possibility of levelling the playing field for women and men. In fact, the greatest demand (over 60%) is for low-skilled employees, including construction and factory workers. This is followed by STEM-educated workers (30% in solar PV).

The energy transition can create large numbers of new job opportunities along the value chain. Per dollar invested, the renewable energy sector employs more people than fossil fuels. An input-output analysis estimate showed 7.49 full-time-equivalent (FTE) jobs created in renewables per US$ 1 million spent, compared with 2.65 FTE jobs in fossil fuels (Garrett-Peltier, 2017). An analysis of renewable energy investment scenarios by the Global Green Growth Institute (GGGI) found renewable energy created 18 more job-years per US$ million invested compared to non-renewables (Grafakos, et al., 2020). There were similar findings in the middle-income countries represented in the study – Mexico and Indonesia. Furthermore, a study by IASS Potsdam on renewable energy job creation in Vietnam demonstrated that replacing coal power plants with solar or wind would more than double the number of jobs per average MW capacity (IASS Potsdam, 2019).

The transition to a renewables-based energy system would thus bring overall net job gains. According to IRENA's Transforming Energy Scenario (IRENA, 2020d), jobs in renewable energy alone could almost triple, to about 30 million by 2030, with another 40 million jobs in energy efficiency and system flexibility. By 2050, jobs in these fields would expand to a combined 78 million, far outpacing the 6.4 million fossil fuel jobs that could be lost between now and 2050. Nonetheless, potentially significant misalignments are likely to occur between where or how jobs are gained and lost. Such misalignments can be of a temporal, spatial, sectoral, or skills-related nature.

In the energy access context, tailored country-level strategies to expand electricity access and clean cooking solutions can help maximize socio-economic and environmental benefits, leveraging increasingly cost-competitive renewable energy options. Data from Power for All and GOGLA show that DRE is already a large contributor to employment. For every 100 solar home systems installed in East Africa, GOGLA estimated that 21 full time jobs were created in the informal sector (GOGLA, 2019). Power for All findings showed that DRE companies directly employed 95,000 workers in India (as many as the traditional utility-scale power sector); 10,000 workers in Kenya (about the same as the national utility KPLC); and 4,000 workers in Nigeria. Informal employment in the sector added 210,000 jobs in India, 15,000 in Kenya and 9,000 in Nigeria, with far larger numbers in productive use applications such as agro-food chains and other sectors (Power for All, 2019). The Nigerian 'Solar Power Naija' programme, launched in December 2020 to expand energy access to 25 million individuals through solar home systems (SHS) and mini-grids, is expected to further incentivize the creation of 250,000 jobs (Bungane, 2020).

Targeted efforts are needed to link electricity access with income-generating activities in order to catalyse rural economies, create local jobs and maximize the socio-economic benefits of energy access. This requires: holistic policies; tailored energy-efficient technology solutions, business and financing models for end-users and enterprises; market linkages and training; and skills development (IRENA, 2020e).

THE DECENT WORK AGENDA

While jobs prospects in the energy transition look promising, as outlined above, it is important to ensure that existing and new jobs are 'decent'. The four pillars of the Decent Work Agenda – social dialogue, social protection, rights at work and employment – are indispensable building blocks of sustainable development and must be at the centre of policies for strong, sustainable and inclusive growth and development (ILO, 2015).

The degree to which international standards and norms are required by government policy and fulfilled by companies will vary by country and region, and by industry. Without doubt, labour rights are much harder to ensure in the informal economy, which is particularly significant in the agricultural supply chain for biofuels and biomass.

Decent jobs are about fundamental fairness for workers. But it is important to understand that decent jobs are desirable from an industry and broader societal perspective as well. Arguably, workers who are well-trained, well-paid, and respected will also do a good job in manufacturing, installing and operating renewable energy equipment. The quality of the work environment translates into higher quality deployment, fewer malfunctions, and less need for repairs. Just as critical as the number of megawatts and gigawatts installed is how well and reliably facilities perform.

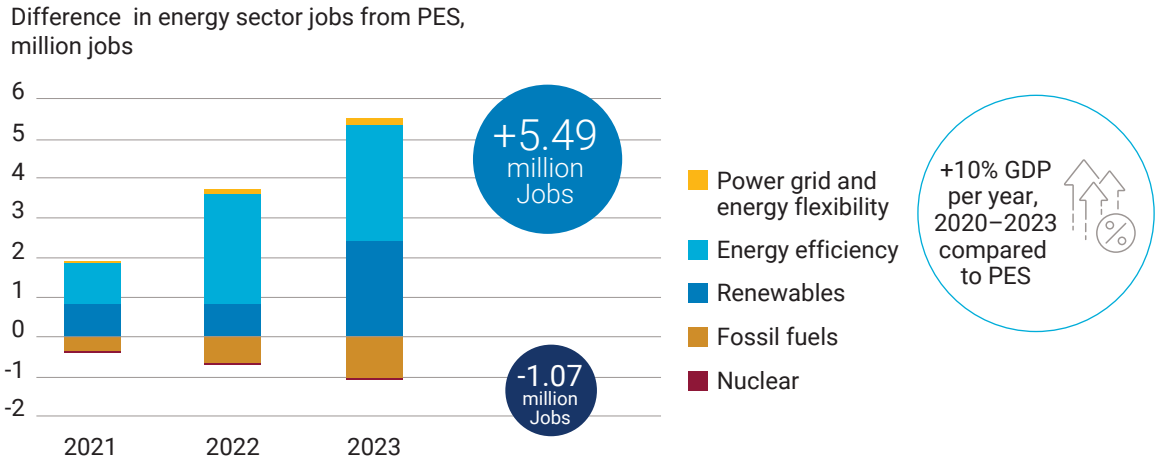
COVID-19 EMPLOYMENT IMPACTS AND SCENARIOS FOR A GREEN RECOVERY

Among the industries most impacted by COVID-19 are tourism, hotels and leisure, and also the energy industry. As global energy demand declined by an estimated 6% in 2020, jobs were lost and existing energy poverty exacerbated, notably in developing countries. Altogether, the renewables sector has fared better than the fossil fuel sector, though with sectoral and regional variations. In Europe, the solar sector grew by 11% in 2020; the 18.2 GW installed was the most since 2011 (Hemetsberger, 2020). In the United States, demand for electricity from wind, solar and hydropower grew nearly 7% in 2020 (compared with nearly 4% worldwide), while overall energy demand declined by 5% (Reed, 2020). More than 100,000 U.S. oil industry workers were laid off (Krauss, 2021).

Short-term measures for recovery to protect vulnerable communities and laid off workers must be linked to the medium and long-term need for decarbonized economies and more inclusive societies. As various studies indicate, the unprecedented stimulus packages mobilized to overcome the COVID-19 pandemic and its socio-economic impacts provide an opportunity to accelerate the energy transition and the creation of much-needed jobs and economic benefits (IRENA, 2020b; Cambridge Econometrics and UN PAGE, 2021; IASS, 2020).

A modelling exercise undertaken by IRENA for its post-COVID recovery agenda indicates substantial job gains in the energy sector, assuming that some of the stimulus investments are directed towards a green recovery in line with global climate objectives under the Paris Agreement. Under this agenda, annual investments in technologies related to the energy transition would more than double, from the 2019 level of US$ 824 billion to nearly US$ 2 trillion in the 2021-2023 recovery period, before reaching an annual average of US$ 4.5 trillion in the decade leading up to 2030 (IRENA, 2020b).

FIGURE 2. CHANGES IN ENERGY SECTOR JOBS RESULTING FROM TRANSITION-RELATED INVESTMENT (TRANSFORMING ENERGY SCENARIO COMPARED TO PLANNED ENERGY SCENARIO, 2021-2023)



Source: IRENA, 2020e.

This added investment stimulus under IRENA's 'Transforming Energy Scenario' would add 5.5 million more jobs in energy transition-related technologies by 2023 than would be possible under the less ambitious 'Planned Energy Scenario' (see Figure 2), while boosting GDP by an additional 1% on average. In the medium-term, by 2030, 19 million more jobs would be created compared to the Planned Energy Scenario, and GDP boosted by an additional 1.3% per year over the next decade.

In an upcoming report (Cambridge Econometrics and UN PAGE, 2021) which looks more broadly at several sectors of the economy, two alternative recovery packages of equal size are being modelled: one in which economic recovery was stimulated 'colourlessly' by cutting consumption sales taxes temporarily by 5 percentage points - the VAT Recovery Scenario. The other, a Green Recovery Plan, involves a package of measures that target green energy and CO_2 reductions, with capital subsidies for new renewable power installations, energy grid investments, energy efficiency measures, replacement of polluting vehicles, and adoption of battery electric vehicles.

In 2023, the Green Recovery Plan would add 2.3% to global GDP while the VAT Recovery Scenario would increase global GDP by 1.7%, compared with a projection with no recovery measures. Because of the additional private investment that the programmes would stimulate, by 2030 there would still be GDP gains of 1.8% for the Green Recovery Plan, and 0.4% for the VAT scenario. Global job numbers would increase by 0.8% in 2023 under the Green Recovery Plan, and by 0.3% in the VAT Recovery Scenario, falling to 0.5% and 0.1% respectively by 2030. The Green Recovery Plan would add some 20.5 million jobs over the baseline in 2030, compared to around 3 million additional jobs in the VAT Recovery Scenario (see Figures 3 and 4).

FIGURE 3. IMPACTS ON GLOBAL EMPLOYMENT – % DIFFERENCE FROM BASELINE.

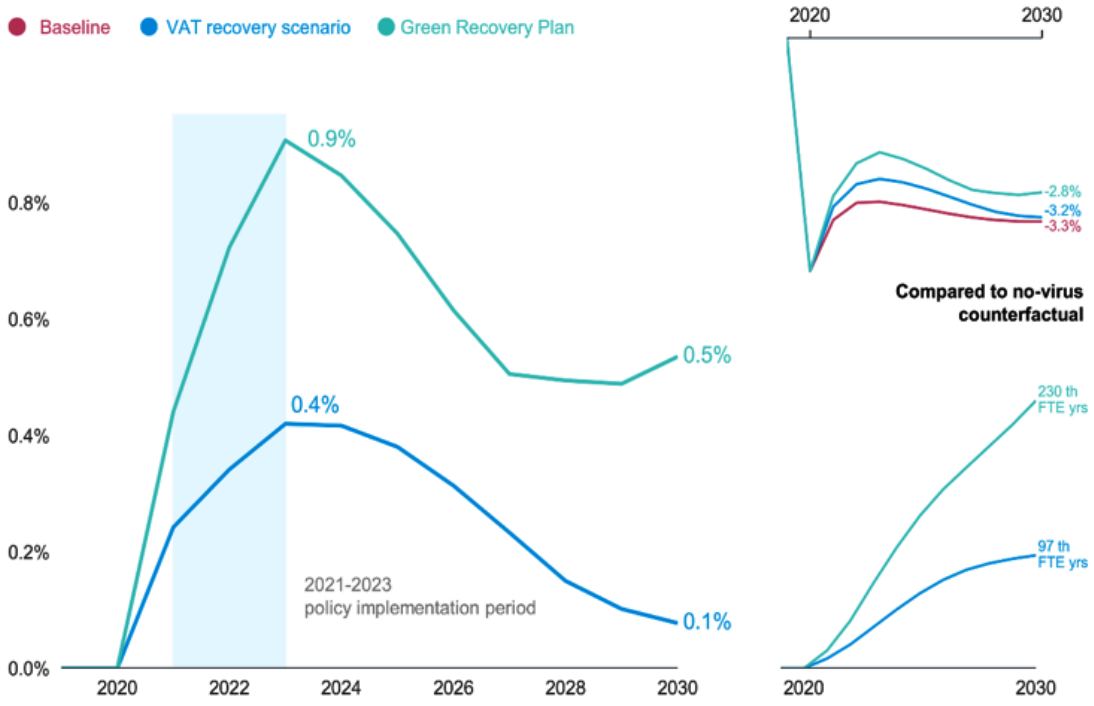
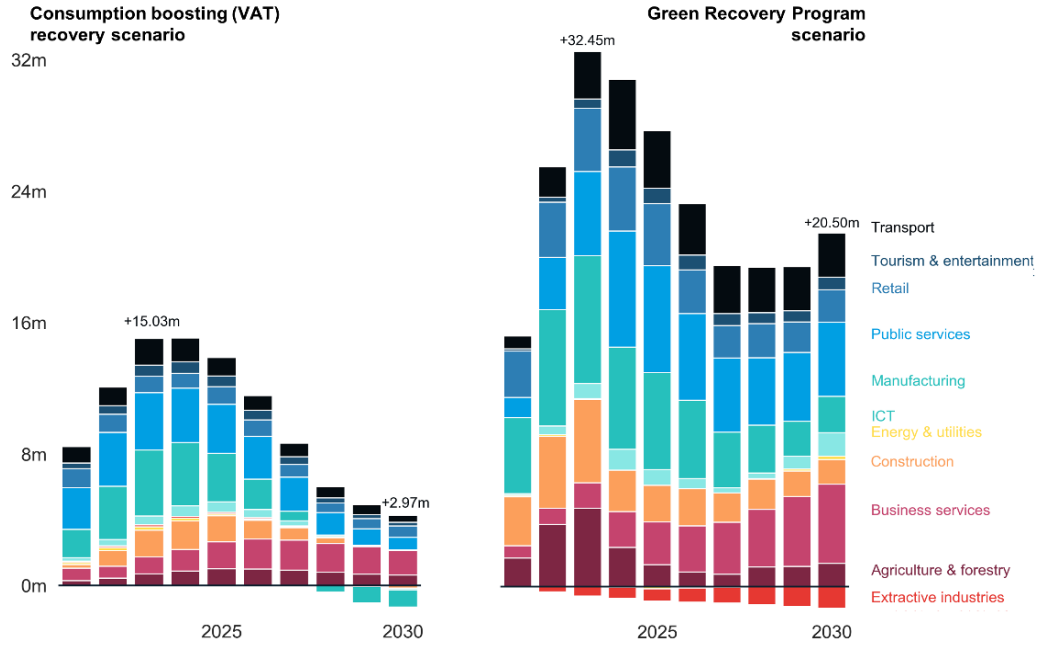


FIGURE 3. IMPACTS ON GLOBAL EMPLOYMENT BY SECTOR - % DIFFERENCE FROM BASELINE.



Source: Cambridge Econometrics and UN PAGE, forthcoming 2021

Importantly, it is not direct employment in the energy sector itself that grows the most, but jobs in business and public services in the value chain. Similarly, a modal shift to public and electric transportation would add employment not only in the transport sector but also in the ICT and manufacturing sectors.

These scenarios point to the importance of linking energy policies to employment and labour market policies, and this requires a whole economy approach when designing a green energy transition. Gender-sensitive skills training programmes across all sectors of the economy, together with social protection systems, need to be available to compensate for job losses. Retraining is at the forefront of Just Transition polices.

HOW TO ENSURE A GREEN AND JUST ENERGY TRANSITION

As demonstrated above, the COVID-19 crisis and unfolding recovery efforts offer a rare opportunity to reap a triple dividend of higher GDP and job creation, greener energy, and lower CO_2 emissions, while also building more social cohesion and inclusion. The forthcoming Cambridge Econometrics and UN PAGE study estimated that by January 2021 global stimulus measures would amount to about US$ 15 trillion, or close to 17% of global GDP.

In the energy sector, a majority of early stimulus investments favoured fossil fuels. According to the latest data from Energy Policy Tracker (2021), as of early March 2021 at least US$ 249 billion was committed in support of the fossil fuel sector and fossil fuel-dependent industries in G20 countries, mostly without conditions to improve environmental sustainability. After lagging behind earlier, clean energy commitments have now risen to US$ 230.6 billion, but 79% of that sum has been given as conditional support.

It is essential to ensure a truly green recovery, and level the playing field between women and men. Stimulus investments need to be paired with a comprehensive set of policies that can advance a just energy transition and a decent work agenda. This will require industrial policies to leverage local capabilities, and to strengthen capabilities along the value chains for renewables and other green sectors. In addition, there will need to be new efforts to support: green energy enterprise and entrepreneurship development; labour market policies; skills training and retraining (including efforts to coordinate between industry and educational/training institutions); strategies aimed at training, recruiting, retraining and promoting more women, and facilitating the participation of youth and underrepresented communities; and social protection measures for fossil fuel sector workers as they try to find new jobs. It is also critical to address the energy poverty and energy access challenges (see Box 1). Furthermore, modelling exercises are needed to support the objective of promoting the involvement of women on an equal footing with men in green recovery strategies.

Holistic economic stimulus packages, recovery plans and policy frameworks can drive the wider structural shifts needed in the energy sector, fostering national and regional transition strategies as decisive steps in building more inclusive and resilient economies and thus more just societies. The Sustainable Energy Jobs Platform (http://sejplatform.org), which was initiated by IRENA with ILO and other international partners[28], is dedicated to analysing underlying issues and promoting holistic policy solutions.

[28] Listed in alphabetical order, the SEJP members at present are the Energy Sector Management Assistance Program (ESMAP) of the World Bank, Global Green Growth Institute (GGGI), Global Women's Network for the Energy Transition (GWNET), GOGLA, IASS Potsdam, International Labour Organization (ILO), International Renewable Energy Agency (IRENA), Power for All, SELCO Foundation, and United Nations Industrial Development Organization (UNIDO).

Policy making does not take place in a void. Measures adopted and priorities established reflect the views of those stakeholders who have an opportunity to weigh in. It is therefore critical to ensure that all voices are heard, including community energy groups, unions, gender mainstreaming advocates, and many others. The pursuit of energy democracy is as important to the success of the energy transition as are more technology-oriented efforts or strategies principally interested in scaling up projects and achieving cost reductions. Reconciling these different approaches requires strong public policy guidance, as exclusively market-led strategies cannot be expected to accomplish this critical task.

Addressing energy poverty and just transition linkages: the case of biomass supply chains

Today some 750 million people do not have access to electricity and around 2.6 billion people lack access to clean cooking. Despite progress in several countries, such as Kenya, Ethiopia, Ghana, Senegal and Rwanda, current and planned efforts to provide access to modern energy services barely outpace population growth. Projections indicate that by 2030, 660 million people would still lack access to electricity and nearly 2.3 billion people lack access to clean cooking, with the majority living in Sub-Saharan Africa (IEA, IRENA, UNSD, World Bank, WHO, forthcoming 2021).

Energy poverty in Africa is manifested in many forms. Lack of access, or unreliable access, to modern energy limits economic activity, reduces productivity, increases dependence on fossil fuel-based solutions and results in drudgery. Traditional use of biomass, which provides around half of the total energy supply across Africa (and a much higher percentage in Sub-Saharan Africa), accounts for a significant share of the labour market. Half of the continent's people live in rural areas and depend on collecting, trading or selling firewood and/or charcoal.

In Nigeria, 75% of total primary energy supply comes from biomass (almost exclusively traditional uses) while oil and gas provide 15% (IRENA, 2020f). About 40 million people (a quarter of the total population) are directly engaged in firewood and charcoal collection and production, representing some 400,000 full-time equivalent jobs. These jobs are largely informal, and working conditions are poor. In comparison, employment in oil and gas stands at only 65,000 direct jobs (ILO and UNDP, 2021).

When designing energy transition policies in such contexts, it is of utmost importance to assess the energy-job link so as to prioritize key sectors. In the Nigerian case, because oil and gas are produced mainly for exports, and provide a small number of formal jobs, the impacts of the energy transition will be different than for workers in the firewood and charcoal industry. Any energy transition policy must urgently address the sectors' resource base, for example, the biomass provided by wood from the trees and forest. Forest management is key, as forestation degradation in Nigeria is among the highest in world, with similar patterns across Africa. Significant risks of job losses and accelerated losses of traditional biomass, such as through forest clearance, need to be addressed in tandem. Sustainable forest management and decent work go hand in hand too. This would involve providing forest rights, including to indigenous peoples and communities, to sustainably exploit forest resources, as well as entrepreneurship and skills training for diversification, and social protection for those losing jobs. Women, who are most often responsible for energy in Africa, will be significantly impacted and require particular attention (ILO and UNDP, 2021).

TARGETS, INDICATORS AND DATA

This policy brief has drawn on a number of available statistics and trends at the intersection between SDGs 7 and 8, such as: the number of jobs being created in renewable energy and other energy transition-related fields; the expected net employment changes between greener energy and the fossil fuel sector; jobs in the energy access context; and the participation of women in the renewable energy workforce. These sets of indicators, and their underlying data, continue to be collected and fine-tuned.

REFERENCES

Bungane, B., 2020. "Nigeria announces new energy access project 'Solar Power Naija'", ESI Africa, 7 December, www.esi-africa.com/industry-sectors/renewable-energy/nigeria-announces-new-energy-access-project-solar-power-naija/

Cambridge Econometrics and UN Partnership for Action on Green Economy (UN PAGE) (forthcoming 2021). *Modelling a Global Inclusive Green Economy COVID-19 Recovery Programme.*

Energy Policy Tracker, 2021. "G20", www.energypolicytracker.org/region/g20/

Garrett-Peltier, H., 2017. "Green versus brown: Comparing the employment impacts of energy efficiency, renewable energy, and fossil fuels using an input- output model", *Economic Modelling*, Vol. 61/February, pp. 439 447, www.sciencedirect.com/science/article/abs/pii/S026499931630709X (behind paywall).

GOGLA, 2019. *Powering Opportunity in East Africa: Providing Off-Grid Solar is a Power Tool for Change.*

Grafakos, S., Senshaw, D., Quezada, D., and Toro, A., 2020. *Employment Assessment of Renewable Energy: Power Sector Pathways Compatible with NDCs and National Energy Plans*, Global Green Growth Institute, Seoul.

Hemetsberger, W., 2020. "Solar defies expectations to reach new heights in 2020", *Energy Monitor*, 16 December, https://energymonitor.ai/technology/renewables/solar-defies-expectations-to-reach-new-heights-in-2020.

IASS Potsdam, 2020. *Reviving National Economies and Health Systems Following the COVID-19 Pandemic*.

IASS Potsdam, 2019. *Future Skills and Job Creation through Renewable Energy in Vietnam: Assessing the Co-benefits of Decarbonising the Power Sector.*

IEA, IRENA, UNSD, World Bank, WHO (forthcoming 2021). *Tracking SDG7: The Energy Progress Report 2021*, World Bank, Washington

ILO, 2020. *COVID-19 Crisis and the Informal Economy: Immediate Responses and Policy Challenges*, International Labour Organization, Geneva.

ILO, 2015. *Guidelines for a Just Transition Towards Environmentally Sustainable Economies and Societies for Asll*, International Labour Organization, Geneva.

ILO and UNDP (forthcoming 2021). *Assessment of Nigeria's Climate Policies' Impact on Employment, Economy and Emissions*.

IRENA, 2020a. *Renewable Capacity Statistics 202*0, International Renewable Energy Agency, Abu Dhabi.

IRENA, 2020b. *Renewable Energy and Jobs – Annual Review 2020*, International Renewable Energy Agency, Abu Dhabi.

IRENA, 2020c. *Wind Energy: A Gender Perspective*, International Renewable Energy Agency, Abu Dhabi.

IRENA, 2020d. *Global Renewables Outlook: Energy Transformation 2050*, International Renewable Energy Agency, Abu Dhabi.

IRENA, 2020e. *Post-COVID Recovery: An Agenda for Resilience, Development and Equality*, International Renewable Energy Agency, Abu Dhabi.

IRENA, 2020f. *Energy Profile Nigeria*, International Renewable Energy Agency, Abu Dhabi. IRENA (2019), Renewable Energy: A Gender Perspective, International Renewable Energy Agency, Abu Dhabi.

Krauss, C., 2021. "A Slap in the Face': The Pandemic Disrupts Young Oil Careers", *New York Times*, 3 January, https://www.nytimes.com/2021/01/03/business/oil-industry-careers.html.

Ojiambo, S., 2021. "Post-crisis recovery is a chance to address gender inequality", *Financial Time*s, 8 March.

Power for All, 2019. Powering Jobs Census 2019: *The Energy Access Workforce*.

Reed, S., 2020. "Renewable Power Grows Strongly, Despite the Pandemic", *New York Times*, 10 November, https://www.nytimes.com/2020/11/10/business/renewable-energy-coal.html.

SECTION 3.8

INTERLINKAGES BETWEEN **ENERGY AND INDUSTRY, INNOVATION AND INFRASTRUCTURE (SDG 9)**

CONTRIBUTING ORGANIZATIONS:
UNIDO, THE EUROPEAN COMMISSION, ECA, CCA

Summary/Key Messages

SDG 9 on industry, innovation, and infrastructure aims to redirect economic forces for positive development outcomes. While industry is currently a major contributor to GHG emissions, it can play a significant role in reaching a carbon-neutral economy if SDG 9 is aligned with related goals for clean or carbon-neutral development, including SDG 7. In response to the global COVID-19 pandemic, governments around the world are spending trillions of dollars to stimulate their economies. In this context, the interlinkages between SDG 7 and SDG 9 can provide guidance for "building back better" – through investments in cleaner and more sustainable sources of energy, energy efficiency, a circular economy, clean-tech innovations, and sustainable infrastructure development through green public procurement.

The industry sector accounts for over one-third of global GHG emissions, while energy use across all economic sectors generates the majority of all anthropogenic GHG emissions. Therefore, clean sustainable energy generation through renewable energy, reductions in energy consumption and energy-related GHG emissions, and other interlinkages of SDG 7 and SDG 9 are directly related to the goals of SDG 13 on combatting climate change.

This policy brief addresses the most critical interlinkages between SDG 9 and SDG 7 on affordable and clean energy – supplying accessible and reliable clean energy for industrialization; creating local manufacturing value chains for renewable energy technologies in developing countries (including clean cooking); and linking energy efficiency and decarbonization strategies across different industries.

Fuel switching, low/no-carbon fuels, electrification of heat, and use of green hydrogen in industry can contribute to achieving SDG 7 goals. In addition, smart manufacturing can lead to more robust efficiency in industry, while carbon capture, utilization and storage can support industrial decarbonization, and innovations in material efficiency and circular economy can help to reduce demand for energy and materials in industry. Energy-intensive sectors can become cleaner via sustainable infrastructure and green public procurement policies, as well as through research and development policies and subsequent innovations in transformative clean/green technologies that can assist in the transition to clean energy and low-carbon industry.

While SDGs 9 and 7 should be addressed in parallel, there are some key challenges to creating synergies between the two. Energy demand from industry is increasing at a faster rate than development and deployment of clean technologies in this sector, while existing regulatory frameworks for sustainable clean energy use in industry are weak. In addition, there is insufficient coordination between governments, regulating agencies, and stakeholders to set and enforce sustainability standards for industrial emissions and green public procurement. Lastly, there is inadequate infrastructure, financing, and knowledge supporting the use of clean energy for industrial activities, as well as limited research and development in these areas. Addressing these challenges will require solutions related to: policies and regulations; technology, innovation, and infrastructure; information dissemination; and workforce training.

OVERVIEW OF INTERLINKAGES BETWEEN SDG 7 AND SDG 9

Affordable clean energy access and sustainable industrial development: One of the goals of SDG 7 is to ensure that everyone has access to affordable, reliable, and modern energy services by the year 2030. Around 789 million people – predominantly in Sub-Saharan Africa – are living without access to electricity, and hundreds of millions more only have very limited or unreliable electricity. Meanwhile, 2.8 billion people still lack access to clean cooking solutions, which contributes to trillions of dollars a year in damage to health, the climate, and local economies (UN, n.d.). Policies and measures should be put in place to ensure that the increased demand for energy in the industry sector does not compromise access to clean and reliable energy by households. Creation of local manufacturing value chains for renewable energy technologies in developing countries (including clean cooking) is an important area requiring policy support.

Energy and resources efficiency: Energy efficiency is a foundational decarbonization strategy, and it remains the most cost-effective option for GHG reductions. A systems-based approach, applied across entire types of motorized systems, could result in much larger energy savings than individual efforts. For example, a UNIDO study showed that optimization of motor systems could result in potential electricity savings of 27%–50% (McKane and Hasanbeigi, 2011). The adoption of energy management system standards, such as International Organization for Standardization (ISO) 50001, can provide a framework for pursuing energy savings. While improved resource efficiency has great potential for increasing profitability, at the national, state, and corporate levels, there is a lack of integrated resource efficiency strategies and policies, and insufficient understanding of market and saving potentials (Material Economics, 2019).

Fuel switching to low-carbon /no-carbon fuels, electrification of heat, and green hydrogen use in industry: The heat energy needs in industry present significant challenges for clean energy transition efforts. Heat represents two-thirds of all energy demand in the industrial sector, and one-fifth of energy demand across the globe. However, only 10% of this demand is met using renewable energy. The industry sector can be decarbonized by shifting heat production away from carbon-intensive fossil fuels to low-carbon or zero-carbon fuels such as solar thermal, biomass, and biogas (IRENA, 2014; McKinsey, 2018). With the rapidly decreasing cost of renewable electricity, and potentially carbon-free hydrogen, the industrial sector could conceivably be decarbonized by using either electrification or hydrogen combustors (Hasanbeigi et al., 2021; Rightor et al., 2020).

Smart manufacturing and industrial through the 'Internet of Things' (IoT): Smart manufacturing and advanced data analytics can assist the manufacturing sector in increasing energy efficiency throughout the entire supply chain, thus making industries more competitive, productive, clean, and efficient. Smart manufacturing builds on and utilizes existing tools such as the Internet of Things, artificial intelligence, automation, robotics, and big data to improve the efficiency of industrial production. Smart manufacturing tools could assist with cross-cutting efficiency measures by improving process controls, simulating industrial systems and scenarios (i.e., through digital twinning), improving sensor technology, and characterizing supply chains with greater precision using big data tools (Behrendt et al., 2020; Birch, 2020; Rogers, 2014).

CCUS and its cross-section with innovation and infrastructure development: Carbon capture, utilization, and storage (CCUS) is the most important GHG mitigation strategy for difficult-to-abate industry sectors such as cement and steel industry (ETC, 2018; ICEF, 2017). While post-combustion carbon capture and oxy-fuel technology are already being utilized by some industrial plants, many other technologies are in the research and development stage, including post-combustion capture technologies using membranes for CO_2 separation, and calcium looping. CCUS require more pilot and demonstration projects to meet the technological challenges of carbon transport and storage (Abramson et al., 2020).

Impacts of material efficiency and a circular economy on industrial energy use: Large emissions reductions can be achieved by means of materials efficiency and the development of a circular economy that promotes reuse of materials that have already been produced and previously used. Recycling of used steel and aluminum is already widely applied in steel and aluminum produc¬tion, substantially reducing CO_2 emissions. However, only around a third of the steel produced globally is from recycled steel. Opportunities for material efficiency exist at every stage of any supply value chain. IEA's sustainable development scenario illustrates that by extending building lifetimes through repair and refurbishment, and reducing vehicle demand (largely through mode-shifting), there could be an approximately 50% reduction in demand for steel, cement and aluminium by 2030 (Material Economics, 2019; IEA, 2020).

Energy- and carbon-intensive sectors and their links to sustainable infrastructure and green public procurement (GPP): Because public entities exercise large-scale purchasing power in contracts for goods, services, and construction of infrastructure, policies prioritizing environmentally and socially responsible purchasing, especially for carbon-intensive materials such as cement and steel, can drive markets in the direction of sustainability. In fact, public procurement accounts for an average of 12%of GDP in OECD countries, and up to 30% of GDP in many developing countries. A wide range of countries around the world practice some form of green public procurement to promote products and materials that are more environmentally friendly and have lower energy or carbon footprints (Hasanbeigi et al., 2019; Dell, 2020). Green public procurement should be a priority in post-pandemic public infrastructure spending in order to "build back better".

Small and medium enterprises (SMEs) – challenges and opportunities: SMEs play a major role in the economies of most countries. In the EU alone, 23 million SMEs provide around 75 million jobs and represent 99% of all enterprises. Although their energy consumption per company is often low, the SME sector as a whole consumes a significant amount of energy. There is a great need for research and development to support the design and adoption of energy policies and energy efficiency programmes for SMEs, even for businesses that are not energy-intensive (Thollander et al., 2017). More emphasis needs to be placed on sharing information and best practices on energy efficiency between SMEs, and providing guidance on meeting energy efficiency goals (Bröckl et al., 2014; Grimmig, 2010), as SMEs are critical in the development of the clean energy sector and its supply chain.

Deep decarbonization of industry and RD&D/innovation policies: Currently, national governments spend roughly US$ 15 billion annually on RD&D for clean energy technologies (Sandalow et al., 2019). This is not enough to help industries reach clean energy and deep decarbonization goals. Because many of the technical innovations are precommercial and precompetitive, there may be considerable benefits in stimulating international collaborative innovation efforts (Friedman et al., 2019; University of Cambridge and ELG Europe, 2019). Innovation policies should also focus on helping clean-tech entrepreneurs, especially those in developing countries, bring their innovations into the market and commercialize their technologies at scale.

KEY CHALLENGES FOR CREATING SYNERGY

A. Policy and Regulation

Meeting increased energy demand from industry with clean sources: Rapid industrialization in many developing countries needs to be coordinated with increased access to sustainable and clean/low-emissions energy sources. The industry sector accounted for 37% (157 EJ) of total global final energy use in 2018. Growth in energy consumption has been driven largely by a long-term trend of rising production levels in energy-intensive industry subsectors (including chemicals, iron and steel, cement, pulp and paper and aluminum). The highest rate of industrial energy consumption growth in the 2010-2018 period occurred in developing economies, particularly India and the ASEAN countries, which had over 4% annual growth (IEA, 2020).

Setting strong regulatory frameworks for sustainable clean energy for industry: While a number of countries have set minimum energy performance standards for industrial equipment such as electric motors, few have mandatory overall energy productivity targets for industrial firms and sectors (IEA, 2020). In 2018, mandatory policy-driven energy efficiency targets and standards covered less than 25% of total industrial energy use in most regions, with no major increases in coverage relative to the previous year. Thus, there is a need for strong regulatory frameworks to be designed and enforced for clean energy and energy efficiency in industry across countries.

Coordinating the policies of government organizations and different regulating agencies: In many countries, there is a lack of coordination between industrial development policies and energy and environmental policies, making it difficult to meet rigorous emissions reductions goals. While ideally energy and climate policies would involve smooth coordination between relevant actors, it is more common to find friction between different levels of government, and between the state and civil society, in responding to energy and climate challenges. In order to meet industrial emission reduction and efficiency goals there need to be specific initiatives that encourage cross-sectoral and multi-level coordination.

Creating a more certain policy and regulatory environment: Uncertain policy and regulatory environments make it difficult for industry to make long-term investment decisions for capital intensive clean technologies. Concerns about whether a policy is going to last can keep enterprises from making investments in new technologies, as their payback periods may be longer than the duration of the policy. In addition to keeping policies stable and predictable, revisions of policies to adjust to market changes are also necessary. RD&D investments are particularly affected by uncertainty because the return on these investments is sensitive to what happens with government policies (Davis, 2016).

Promoting green energy criteria for public procurement: A number of key challenges to the implementation of green public procurement are: lack of political support based on the perception that green products cost more, insufficient legal expertise in applying environmental criteria, limited usable tools and information for planning and executing green public procurement, inadequate training in how to meet clean energy criteria, limited cooperation among authorities, and lack of established environmental criteria for products and services (Hasanbeigi, 2019).

Addressing high capital costs and limited financing options for SMEs: Although many energy efficiency technologies have favourable payback periods, there are typically high upfront capital costs. For many companies, especially SMEs, it is often challenging to obtain financing from traditional financial institutions to implement energy efficiency measures. It is even more difficult in developing economies, where SMEs' access to capital is especially limited. Supporting market-based financing channels for energy efficiency financing based on international examples (such as energy efficiency revolving funds) could be particularly useful in addressing this issue (Bröckl et al., 2014).

B. Technology, innovation, and infrastructure

Increasing investments for innovations on clean energy and low carbon technologies: Larger investments in RD&D on clean energy and low carbon technologies, specifically for industrial decarbonization, are critical to meet the Paris Agreement goals. Deep decarbonization technologies, such as CCUS, hydrogen as fuel, and electrification of some high-temperature heating processes for production of cement, glass, and some chemicals, are especially challenging and require further RD&D (IEA, 2020). In addition to innovations in technology development, RD&D on integration of technologies into industrial processes is equally critical (Hasanbeigi et al., 2021).

Transforming electricity grid infrastructure to support a clean energy transition: Expanding deployment of renewable electricity is critical in meeting emission reduction goals, and today's renewable energy capacity would need to increase dramatically by 2030 to meet energy demand (Larson et al., 2020). In addition, new or expanding industrial zones in developing countries require large amounts of electricity and the grid infrastructure to support that. The electricity grid infrastructure in most countries is not capable of supporting large-scale green electrification of industry, decarbonization, and a shift to clean hydrogen. Generation from combustible fuels accounted for 66% of total world gross electricity production in 2018 (IEA, 2020).

Building infrastructure for clean electricity, and for captured carbon and hydrogen transport and storage: There is currently a deficit of infrastructure for clean electricity and captured carbon and hydrogen transport and storage. It is critical to build stakeholder support in industry for building this infrastructure, particularly CO_2 transport and storage facilities, and ensuring affordable access to infrastructure and energy inputs (IEA, 2020).

C. Information and Workforce

Dissemination of energy efficiency information and knowledge, especially to SMEs: One of the main barriers to low implementation of cost-effective energy efficiency measures is lack of information and knowledge, especially in SMEs. It can be costly and difficult for small businesses to obtain information about energy efficiency options and opportunities, or to understand current trends and information related to energy efficiency decisions and energy contracts (Zuoza and Pilinkiene, 2018; Palm and Backman, 2020).

Training for workers, and managers, on clean technologies and energy efficiency: Especially in many developing countries, there is a critical need for a trained workforce to install and operate cutting-edge clean technologies in industry. In addition, many companies, especially SMEs, often have no designated personnel for energy issues and have little in-house knowledge about energy efficiency. Companies seldom have an energy management system, or procedures for integrating energy issues into other decision-making processes in ways that could provide the management focus needed on clean energy and energy efficiency (Bröckl et al., 2014).

HOW TO ADDRESS THESE CHALLENGES

A. Policy and Regulation

To increase clean energy access for industrial growth, better development planning is needed across different government agencies to ensure that clean, sustainable energy infrastructure development goals are in line with anticipated industrial growth, and that industries have adequate low-carbon energy sources. New industrial parks should provide access to clean energy sources such as wind and solar, and grid infrastructure that supports future green electrification.

Regarding regulatory frameworks, it is important to extend mandatory policies on clean energy use to a larger portion of the industrial sector. To achieve high emission reductions, policies need to cover energy efficiency and process optimization, as well as process emissions and technological shifts (IEA, 2020). China and India have imposed mandatory policies for energy savings in industry sectors (IEA, 2020). Voluntary agreements can also be effective, especially when regulations are difficult to enforce.

Better policy and planning coordination is needed among government agencies. Preparing and disseminating information on international best practices, and training of government officials in developing countries, can help address this challenge. Coordination within the public administration system on implementation of integrated policies will also help build appropriate institutional mandates, budgets and instruments, and avoid institutional fragmentation (IEA, 2020; Russel et al., 2020).

Government agency coordination, and establishment of long-term policies and plans, will give assurance to industry on the continuity of energy transition and decarbonization policies, and build industry confidence about their investments in capital intensive assets. When a particular technology is well-established and cost-effective, financial incentives may be removed and provided to support other emerging technologies (Liu, 2016).

Governments around the world need to adopt green public procurement (GPP) programmes, or amend their existing programmes, to include energy intensity and carbon intensity criteria related to materials used in infrastructure building, such as cement, concrete, and steel. Hasanbeigi et al., (2019)

identified the GPP programme in The Netherlands as one of the world's best, especially with regard to GHG reductions related to construction materials. Countries should continually revise their GPPs by periodically reviewing their GPP criteria to assess changing market conditions, and make criteria for cleaner products more stringent.

On the issue of high capital costs, innovative financing mechanisms are needed to support companies, especially SMEs. In addition, the non-energy benefits of new technologies should be quantified and communicated. Subsidies for fossil fuels and wasteful consumption should be phased out to make clean energy technologies more cost competitive. Government policies can help to reduce investment costs and risks for clean energy via fiscal subsidies – including tax incentives, investment tax credits, production tax credits, waivers of sales, value-added taxes or import taxes, grants, loan guarantees, feed-in tariffs for renewable natural gas, and contracts for differences (Sandalow, 2019). ESCO financing mechanisms should also be considered to mobilize clean energy financing (European Commission, 2021).

B. Technology, innovation, and infrastructure

The advantages of RD&D and innovation for developing smart manufacturing technologies should be highlighted and communicated with governments, industry and other stakeholders, as increased support for RD&D is needed to advance the development and deployment of transformative technologies. Private-public partnerships can be useful, as well as green public procurement, contracts for difference, and near-zero-emission materials quotas, which can generate early demand and enable producers to gain experience and lower costs (IEA, 2020).

All countries need to support more low-cost integration of renewable energy into the grid. This will help to decarbonize industry operations when there is a switch to more electrified technologies for process heat, and more green hydrogen as fuel or feedstock. Electrification and delivery of renewable electricity for use by industry needs to be coordinated. If electrification of industrial operations occurs rapidly, based on locally supplied electricity that has a relatively low proportion of low/no-carbon electricity, CO_2 emissions can increase.

Government and industry should work together to develop the infrastructure needed for carbon and hydrogen transport and storage. This is critical for adoption of CCUS and hydrogen use in industry, which are key for achieving net zero GHG emissions in some industries, especially cement, steel, and chemical production. Utilities also need to expand their renewable energy electricity generation and distribution capacity to be able to support increased demand from industry for low/no-carbon electricity (Sandalow, 2019).

C. Information and Workforce

Capacity building efforts are needed to address the current lack of information. Guidebooks, tools, and training workshops can help train industry professionals and government officials about clean energy solutions available for industry. Promotion of energy management systems has been a good way to get companies to work with energy efficiency in a structured way. Cooperating with industry associations, and creating peer groups or local networks, have also triggered interest among SMEs (Bröckl et al., 2014).

Public-private partnerships are needed to train local workers about next generation industrial technologies and digitalization of manufacturing. Gender and race equity issues should be considered when training the workforce for a clean industrial transformation. Training and workforce development are needed across different industrial sectors and for different levels of personnel within a company on a continuous and evolving basis.

POLICY CASE STUDIES

India - Perform, Achieve, Trade (PAT) Scheme for Energy-intensive Industries

India's Perform, Achieve, Trade (PAT) programme is a market-based trading scheme that aims to improve energy efficiency in energy-intensive industries. The PAT scheme is the first developing country cap-and-trade programme for energy efficiency, and it is being implemented in phases. The scheme aims to enable industrial firms to continue expanding their activities, as long as they operate in an environmentally conscious manner. It has created an institutional structure to enable online data submission, annual audits and verification by designated auditors. It also helps enhance capacity-building in enforcing policies, collecting data, conducting monitoring and verification, and assessing compliance and levying penalties, which are all prerequisites for successfully implementing the scheme. PAT Cycle-I was designed to improve efficiency in eight energy intensive sectors: Aluminum, Cement, Fertilizer, Iron and Steel, Paper and Pulp, Thermal Power Plants, and Textiles. The achievement in PAT Cycle-I is 8.67 Mtoe. PAT Cycle-II and III have added many more industrial plants and several new sectors, and aim to achieve higher energy savings (Bureau of Energy Efficiency, 2020).

ESCOs and energy efficiency financing in South Korea

Energy service companies (ESCOs) deliver energy efficiency projects that are financed through the energy savings achieved. The value of the global ESCO market grew 8% (to US$ 28.6 billion) in 2017, up from US$ 26.8 billion in 2016. On average, ESCO projects are delivering energy savings around 25%. The majority of ESCO projects are in the non-residential buildings sector, followed by industry (IEA, 2018). In order to be successful, ESCOs require stable financing. In South Korea, the Korean Energy Agency (KEA) provides loans to projects where ESCOs replace inefficient facilities of energy consumers who lack technology and financing, and guarantee reductions in their energy consumption. ESCOs conduct site surveys for replacement or upgrade of existing energy-consuming facilities, make business proposals, provide draft and detailed designs, construct and install facilities, perform a test run, and provide maintenance and follow-up management services (Korea Energy Agency, n.d.). ESCOS and their clients are generally supported by energy performance contracts (EPCs) which commit the ESCO to installing the necessary equipment, provide a performance guarantee, and establish the terms of any upfront or ongoing payments, which are intended to be less than the financial savings realized by the project. There are shared savings or guaranteed savings models for EPCs. The guaranteed savings model is utilized by the Korean ESCO programme (IEA, 2018).

TARGETS AND INDICATORS

SDG 7 has five goals related to sustainable clean energy access, renewable energy, energy efficiency, enhanced international cooperation on innovation and technology transfer, and infrastructure development and upgrades to supply clean energy, especially in developing countries. These SDG 7 goals and targets also relate to SDG 9 and the industry sector in terms of energy access, energy efficiency and use of renewable energy in industry. Besides, SDG 9, "Industry, Innovation, and Infrastructure", can substantially contribute to meeting SDG 7 goals. The table below shows different targets and indicators related to SDG 7 and their interlinkages with SDG 9.

SDG 7 Goal	Indicator	SDG 7 target	SDG 7 target links to SDG 9	SDG contribution
Goal 1	Access to affordable, reliable and modern energy services	100% people have access to clean reliable energy	100% of industry has access to reliable energy	Industry innovates to supply clean energy technologies
Goal 2	Share of renewable energy in the global energy mix	Increase substantially	100% increase in the use of RE in industry	Industry supplies the RE technologies and also adopts more RE
Goal 3	Global rate of improvement in energy efficiency	Double EE by reducing energy intensity by half	Double industrial EE by reducing energy intensity (energy use/$ of output) by 50%	Industry innovates to supply EE technologies and also adopts them more rapidly
Goal 4	International cooperation – $ spent on joint RD&D programmes	Enhance international cooperation and increase $ spent	Enhance international cooperation and double the $ spent on industrial EE and decarbonization	Industry forms international public-private partnerships to innovate and adopt transformative technologies
Goal 5	Infrastructure and technology for supplying modern and sustainable energy services	Expand and upgrade Increase $ spent on RD&D and deployment	Expand and upgrade clean grid infrastructure and develop transport and storage infrastructure for hydrogen and captured carbon for industrial facilities	Industry will conduct RD&D to develop affordable technologies for new infrastructure and help to put them in place

REFERENCES

Abramson E., McFarlane, D., Brown, J., 2020. Transportation Infrastructure for Carbon Capture and Storage: A White Paper on Regional Infrastructure for Mid-century Decarbonization

Bartlett, Jay and Krupnick, Alan, 2020. Decarbonized Hydrogen in the US Power and Industrial Sectors: Identifying and Incentivizing Opportunities to Lower Emissions. https://www.rff.org/publications/reports/decarbonizing-hydrogen-us-power-and-industrial-sectors/.

Behrendt, Andreas; de Boer, Enno; Kasah, Tarek; Koerber, Bodo; Mohr, Niko; and Richter, Gerard, 2020. Leveraging Industrial IoT and advanced technologies for digital transformation

Birch, Scott, 2020. BCG: Taking action through Green Factories of the Future. https://www.manufacturingglobal.com/smart-manufacturing/bcg-taking-action-through-green-factories-future

Brockl, Markia; Illman, Julia; Oja, Laura; Vehvilainen, Iivo, 2014. Energy Efficiency in Small and Medium Sized Enterprises. https://www.diva-portal.org/smash/get/diva2:708035/FULLTEXT01.pdf

Bureau of Energy Efficiency (Government of India, Ministry of Power), 2020. PAT cycle. https://beeindia.gov.in/content/pat-cycle

Davis, Lucas, 2016. Policy uncertainty discourages innovation and hurts the environment. https://theconversation.com/policy-uncertainty-discourages-innovation-and-hurts-the-environment-70261

De Pee, A. et al., Decarbonization of Industrial Sectors: The Next Frontier. 2018. McKinsey & Company

Korea Energy Agency, n.d., Energy Service Companies (ESCO). https://dco.energy.or.kr/renew_eng/energy/industry/esco.aspx

Energy Transitions Commission, 2018. “Mission Possible: Reaching Net-Zero Carbon Emissions from Harder-to-Abate Sectors by Mid-Century.”

European Commission, n.d., ESCO-Financing Options. https://e3p.jrc.ec.europa.eu/articles/esco-financing-options

Fraunhofer ISI and ICF, 2019a. Industrial Innovation: Pathways to deep decarbonization of Industry. Part 1: Technology Analysis.

Fraunhofer ISI and ICF, 2019b. Industrial Innovation: Pathways to deep decarbonization of Industry. Part 2: Scenario analysis and pathways to deep decarbonization

Friedmann, J., Fan, Z., and Tang, K., 2019. “Low-Carbon Heat Solutions for Heavy Industry: Sources, Options, and Costs Today.” Columbia University Center on Global Energy Policy.

Global CCS Institute, 2020. Global Status of CCS. https://www.globalccsinstitute.com/wp-content/uploads/2020/12/Global-Status-of-CCS-Report-2020_FINAL_December11.pdf

Grimmig, Bodo; Elle, Marion; Stege, Andraes, 2010. Energy Efficiency in Small and Medium-sized Enterprises (ENGINE). Available at: https://ec.europa.eu/energy/intelligent/projects/en/projects/engine

Hasanbeigi, Ali; Becque, Renilde; Springer, Cecilia, 2019. Curbing Carbon for Consumption: The Role of Green Public Procurement. Global Efficiency Intelligence, LLC.

Hasanbeigi, Ali, Krishbaum, L., Collison, B., and Gardiner, D., 2021. Electrifying U.S. industry: A Technology-and Process-Based Approach to Decarbonization

IEA (International Energy Agency), 2020. Tracking Industry 2020. https://www.iea.org/reports/tracking-industry-2020

IEA, 2019. Material Efficiency in Clean Energy Transitions. https://www.iea.org/reports/material-efficiency-in-clean-energy-transitions

IEA, 2019. The Future of Hydrogen: Seizing Today's Opportunities. https://www.iea.org/reports/the-future-of-hydrogen

IEA, 2018. Energy Service Companies (ESCOs) https://www.iea.org/reports/energy-service-companies-escos-2

Innovation for Cool Earth Forum (ICEF), 2017. "Carbon Dioxide Utilization: ICEF Roadmap 2.0"

Kempener, Ruud and Deger Saygin, 2014. IRENA- Renewable Energy Manufacturing: A Technology Roadmap for Remap 2030. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2014/IRENA_REmap-2030-Renewable-Energy-in-Manufacturing.pdf

Larson, E., et al., 2020. Net-Zero America: Potential Pathways, Infrastructure, and Impacts, interim report. Princeton University, Princeton, NJ.

Liu, Xu; Shen, Bo; Price, Lynn K; Lu, Hongyou; Hasanbeigi, Ali, 2016. What China can learn from international policy experiences to improves indutrial energy efficiency and reduce CO_2 emissions. https://china.lbl.gov/publications/what-china-can-learn-international-0

Material Economics, 2019. Industrial Transformation 2050 – Pathways to Net-Zero Emissions from EU Heavy Industry

McKane, Aimee and Ali Hasanbeigi, 2001. Motor System Energy Efficiency Supply Curves: A Methodology for Assessing the Energy Efficiency Potential of Industrial Motor Systems. Energy Policy 39 (October 2011): 6595–6607.

McKinsey & Company, 2018. "Decarbonization of Industrial Sectors: The Next Frontier"

McMillan, 2019. Solar for Industrial Process Heat Analysis. https://www.nrel.gov/analysis/solar-industrial-process-heat.html

Palm, Jenny and Backman, Fredrik, 2020. Energy efficiency in SMEs: overcoming the communication barrier. Energy Efficiency volume 13, pages 809–821(2020).

Rightor et al., 2020. Beneficial Electrification in Industry. ACEEE.

Rogers, Ethan, 2014. The Energy Savings of Smart Manufacturing. https://www.aceee.org/research-report/ie1403

Russel et al., 2020. Policy Coordination for National Climate Change Adaptation in Europe: All Process, but Little Power. Sustainability 2020, 12, 5393; doi:10.3390/su12135393

Sandalow, D., Friedmann, J., Aines, R., McCormick, C., McCoy, S., and Stolaroff, J., 2019. "Industrial Heat Decarbonization Roadmap." Innovation for Cool Earth Forum.

Thollander, Patrik et al., 2017. Energy Efficiency in SMEs. https://iea-industry.org/annexes/annex-xvi-energy-efficiency-in-smes/

United Nations (UN). (n.d.). "Affordable and Clean Energy". https://www.un.org/sustainabledevelopment/energy/

University of Cambridge and ELG Europe, 2019. Forging a carbon-neutral heavy industry by 2050: How Europe can seize the opportunity

Zuoza, Andrius and Pilinkiene, Vaida, 2018. Barriers of industrial energy efficiency. Conference: The 15th International Conference of Young Scientists on Energy Issues. At Kaunas, Lithuania

SECTION 3.9

INTERLINKAGES BETWEEN **ENERGY AND REDUCING INEQUALITIES (SDG 10)**

CONTRIBUTING ORGANIZATIONS:
IIASA, MFA NETHERLANDS, HIVOS

Summary/Key Messages

THE MOST IMPORTANT INTERLINKAGES

- High socio-economic inequality in the access to high quality and innovative energy services inhibits progress on the targets for both SDG 7.1 (equal access) and SDG 10 (inequality).
- Working towards reducing socio-economic inequality is a prerequisite for a just and inclusive energy transition, which in turn is a prerequisite for progress on all SDG 7 targets.

PRIORITY ACTIONS

- Consciously address potential energy transition inequalities. While the energy transition presents huge social and economic opportunities (such as economic growth, cost reductions, resilience and jobs), in developing transition policies and finance, it is important to make sure that no one is left behind.
- Include the principle of a just and inclusive low-carbon energy transition as a constituent element of all policies aimed at reaching SDG 7 goals.

- Use the SDG 7 agenda as a roadmap for the energy sector to lead the way on reducing inequalities, applying a coherent and focused approach to policy making.
- Readjust fuel-related tax subsidy schemes with a view to inducing a transition from fossil fuels to renewable sources, as well as increasing social justice.
- Ensure that (a) policies are in place that align corporate incentives with a just and inclusive transition, (b) policy decisions are based on an open and inclusive process that enlists all relevant actors, and (c) energy supplies are democratized to the largest extent possible.

Recommended targets and indicators for measuring impacts

- Inclusion of explicit targets aimed at (i) identifying and eventually curbing inequality in access to energy services and (ii) achieving a just and inclusive energy transition.
- Design of explicit inequality indicators that cover the full distribution (e.g., Gini or Lorenz).
- Use of continuous rather than discretionary indicators to better capture utilization patterns.

THE INTERLINKAGES BETWEEN SDG 7 AND SDG 10

This policy brief considers the interlinkages between energy (SDG 7) and inequality (SDG 10) with regard to (a) inequality in the consumption of energy services, and (b) a just and inclusive transition towards sustainable patterns of energy supply and demand.

1. Inequality in the consumption of energy (services)

According to recent analysis, energy consumption is unequally distributed across and within countries, and is closely correlated with inequality in the consumption of goods and services (and the energy contained therein), as well as with income distribution (Oswald et al., 2020). This suggests a strong and direct linkage between energy access and socio-economic inequality.

The correlation between economic inequality and energy poverty was discussed in Policy Brief 3.1 on SDG 7-SDG 1 interlinkages. This brief focuses on inequality across the whole statistical distribution of energy consumption, including extremely high top-end consumption, the economic, political and geographic concentrations in the supply of energy, and issues of discrimination.

1.1 Excessive top-end consumption (linkage 7.1 10.1-10.4)

Challenges: High consumption of energy by the wealthy, especially for energy services such as mobility, housing, and digital services, is limiting access to energy services by poorer consumers. This problem extends beyond (domestic) electricity use, and also relates to transportation, housing, and the energy content of goods and services consumed. The energy consumption of the richest 5% exceeds that of the poorest 50% of the global population (Oswald et al., 2020). Such inequality pertains both across countries and within countries, and correlates with a large inequality in the generation of GHGs. Yet the poorest people also tend to experience the greatest exposure to fossil-fuel related pollution (Muller et al., 2018, Rao et al., 2020).

As inequalities in energy consumption and wealth are strongly correlated, policies that improve equality in the access, availability, quality and affordability of energy services can lead to a sustained reduction in socio-economic inequality. This is because energy is essential for the accumulation of human capital

(education and health), for knowledge and information (digital access) and for economic development and skilled employment. Ultimately, socio-economic development and energy access are complementary (Zhang et al., 2019).

Further issues arise in the context of energy taxes and subsidies, especially for fossil fuels. While subsidies have been promoted as a means for facilitating energy access, in reality the design of many energy subsidies tends to favour the wealthy because of their higher consumption. In addition, fossil fuel subsidies exacerbate harmful environmental impacts. Furthermore, subsidies draw public funds away from investments in areas such as education or health care that are more likely to reduce inequality (Couharde and Mouhoud, 2020, and references therein).

Policy approaches:

- Facilitating access to energy services may prove to be a better way to lower socio-economic inequality in the long term than financial transfers.
- Uniform energy subsidies tend to be regressive. To reduce inequality, they need to be targeted, so that they do not encourage greater consumption by wealthier consumers. Subsidies for investments in decentralized energy solutions for low-end consumers are likely to be more effective in the long-run than direct subsidization of consumption (see 1.2 and 2.1 below).

1.2 Biases in energy supply and innovation (linkage 7.3, 7.a, 7.b – 10.1-10.4)

Challenges: Monopolized control over energy supply structures, such as fossil fuel-based power stations, and the grid, can lead to unequal access biased towards wealthy, often urban, communities. This is because the return on investments in providing services to these consumers is higher.

Where competition could lead to a reduction in tariffs and an increase in supply, incentives to enter the market are again geared towards more valuable top-end energy markets. Moreover, unless properly regulated, privately owned grid structures may inhibit market entry of local community-held and/or cooperative suppliers.

Supply-side driven inequality is not confined to the private sector. Public sector investments tend to be influenced by powerful players in the political economy, biasing them, too, against the less wealthy. For a survey on issues involved with energy markets in developing countries, see Rudnick and Velasquez (2018).

Similar issues relate to innovation, where both private and public innovation tends to be geared towards generating solutions targeted at top-end consumers, due to their high energy consumption. At the same time, inequality in access to education may mean that poorer people may lack the knowledge required for access to clean and safe energy.

From a needs-based perspective, the concern should be more about inequality in access to *energy services* rather than energy alone. This type of focus would encourage both technological innovations for more energy-efficient technology *and* organizational innovation related to shared energy services, such as transportation). It would also help to reduce inequality, in situations where access to private services is restricted due to prohibitive prices. For further discussion and references see Policy Brief 3.1 on SDG 7-SDG 1 interlinkages.

Policy approaches:

- Breaking-up of monopolies and introducing regulation that facilitates grid access, especially for local/community suppliers. Universal supply commitments as a prerequisite for market entry.
- Decentralization of energy supplies and strengthening of local, community-owned suppliers, in particular relating to small scale off-grid renewable energy technologies, such as rooftop PV.
- Democratization of energy supply by means of peer-to-peer electricity trading schemes and crowd-funded local supply (Zhang et al., 2017).
- Implementing policy mechanisms to ensure that public energy investments are inclusive.
- Designing science and knowledge systems in ways that incentivize technological *and* organizational innovations towards inclusive access to energy services, including shared services.

Case studies:

- The World Bank / ESMAP "Rethinking Power Sector Reform in the Developing World" initiative offers an assessment and case study evidence of how supply-side reforms have to be tailored to the local context (World Bank, 2019; ESMAP).
- The "Energizing Finance" reports by SE4ALL, especially the 2018 edition, illustrate the differences in financing for off-grid/residential and on-grid/industry[29]
- For an example of peer-to-peer energy trading see information about Community Energy England.[30]

1.3 Discrimination in access and rights issues (linkage 7.1 – 10.2, 10.3 and 10.7)

Challenges: There are also inequalities in access to energy services related to discrimination based on gender or migrant status.

Female empowerment is increasingly recognized as an important driver of economic development (Bloom et al., 2017), and the effective and responsible use of energy services. Women entrepreneurs can earn income by providing energy services (such as clean cooking solutions) for remote and poor communities, and the energy services they provide can, in turn, improve the economic situation of the women who are their customers. However, clean cooking energy is often left out of funding programmes. This can result from funding decisions being made predominantly by men (Moniruzzaman and Day, 2020). Due to the lack of clean cooking options, women are often exposed to indoor air pollution from the use of polluting energy technologies. At the same time, the need to collect firewood for fuel keeps women from more productive uses of their time.

Policy approaches:

- Empowerment of women through access to clean energy.
- Reduction in gender biases in household, communal, national and international decision making to facilitate the adoption of clean energy sources and their efficient utilization.

[29] https://www.seforall.org/system/files/gather-content/EF-2018-ES_SEforALL.pdf. Further cases involving decentralization can be found under: https://greeninclusiveenergy.org/document/financing-decentralized-renewable-energy-for-the-last-mile/ and https://pubs.iied.org/17494IIED

[30] https://communityenergyengland.org/how-to-pages/peer-to-peer-local-energy-trading.

Case studies: See ENERGIA. https://www.energia.org/knowledge-center/.

Energy access, both for cooking and for communications, is crucial for migrants and refugees. Typically, temporary settlements (which can become semi-permanent with continued use) are not allowed to build up energy services, exposing people to undue hardships as well as health risks.

Policy approaches:

- Provide mobile energy sources to migrant populations on the move, or provide incentives/compensation for communal energy suppliers to provide energy to migrants.
- Organize and fund the installation of off-grid energy in temporary/semi-permanent settlements.

Case studies: See Chathamhouse. https://mei.chathamhouse.org/

2. Just and Inclusive Transition

The large-scale transformation of energy sectors that is required for sustainable development could increase inequality at various scales if it is not planned and implemented through a distributional justice lens (Campagnolo and Davide, 2019; Markannen and Anger-Kraavi, 2019; Zakeri et al., 2021). This requires a refocusing of energy policy away from (seemingly) "low-cost access to fossil-sourced energy" to "affordable sustainable energy".

2.1 Unequal distribution of benefits and costs (linkage 7.2, 7.a – 10.1-10.4)

Challenge: The replacement of fossil energy with renewable energy will have differing impacts on people and households, depending on their ability to alter energy intensive, fossil fuel-driven consumption patterns. The ability to use renewable energy will often depend on local supply. Generally, wealthy individuals can be expected to switch fuel sources more easily, while poor households might be deprived of access to certain energy services. If tax-subsidy schemes are set up to provide incentives for using of renewable energy, and the poorer households and communities are unable to pay the full upfront price for installing renewable energy systems, then it might turn out that only middle-class citizens enjoy subsidized energy prices.

In the context of transportation, the scope for substitution may depend on the availability of public transport, and the affordability or practicality of other modes of transport.

Policy approaches:

- Careful planning of policies to ensure equal and wide-spread availability of renewable energy and access to energy-efficient services, such as public transport, e-mobility infrastructure, or car sharing.
- Carbon pricing, with revenues recycled into lump sum transfers to households (which has a progressive net effect) or into a reduction of distortionary (labour) taxes, or into public investments for renewable energy expansion and sustainable infrastructure (Mintz-Woo et al., 2020).

Case study: Saelim (2019) simulates the effects of a (high) carbon tax rate (at US$ 37 per tonne CO_2) under various scenarios. A scenario where revenues are recycled through a pension scheme is shown to be progressive and likely to reduce poverty.

2.2 Impact through sectoral, occupational and regional change (linkage 7.2, 7.a – 10.1-10.4)

Challenge: The transition to renewable energy-based societies will require large-scale structural changes (e.g., away from fossil fuel extraction towards the construction, installation and servicing of renewable energy facilities, and away from supply systems focused on the combustion engine towards ones geared to electric or hydrogen motors). It will also require major changes in occupations, which could impose high adjustment costs on firms and individuals. Where industries are geographically concentrated (e.g., coal-mining areas, automobile towns) large-scale restructuring will also be required at a regional level. Regional transitions may also be caused by changes in transportation costs that arise from CO_2 pricing. All of these developments have considerable potential to exacerbate inequality at the individual and regional levels due to higher unemployment, escalating adjustment costs, and earnings losses.

Policy approaches:

- Compensatory financial transfers to individuals and regions to mitigate short-term impacts.
- Large-scale retraining programmes for workers, and assistance to companies in adjusting product lines and processes.
- Regional structural policies aimed at attracting new, sustainable and innovative industry.
- Transformational policies to alleviate long-standing social and economic inequalities.

2.3 Procedural justice and inclusive civic engagement (linkage 7.2, 7.3 – 10.2 and 10.3)

Challenge: The transition to low-carbon and resilient development pathways will bring large-scale economic and social changes that will require widespread participation in decision making processes. As a matter of procedural justice, those affected by the consequences of policy making should have a say. In addition, broad political support and active participation are essential for a successful energy transition. In particular, there is a need for the inclusion of local communities in the planning of large-scale renewable energy projects. In the past, there have been human rights violations and forced migrations due to hydro energy projects and large-scale biomass plantations in developing countries. In high-income countries, there are social issues related to the placement of large wind farms and high-capacity power lines, especially when affected local communities do not have direct access to the electricity or financial returns from such projects.

Policy approaches:

- Treat the supply of energy (services) as public or community services with stakeholder involvement throughout. To date, energy solutions have been mostly developed by engineers, without sufficient political and societal backing.
- To avoid societal push-back on energy transformation schemes, replace top-down approaches with bottom-up approaches that ensure local participation, for example on siting issues. Grant local communities full or partial ownership rights and ensure their participation in the returns from off-grid or on-grid renewable energy systems.
- Use research results to support real world development. Strengthen communications to dispel misperceptions and misinformation about allegedly regressive impacts of policies aimed at a just transition (Hsu, 2021).

2.4 International issues (7.1-7.3 – 10.a and 10.b)

Challenge: The transition from a fossil fuel-based to a renewable energy based economy will involve changes in fuel import and export patterns. This may mitigate or worsen international inequality depending on changes in the terms of trade and, ultimately, on the underlying trade rules and ownership rights (Xu et al., 2020). In addition, projects aimed at trading renewable energy may fail if they lack support from host communities due to an unfair split of returns or unjust procedures.

Policy approaches:

- Changing trade patterns of fuels that are geared towards a transition should be explicitly addressed in international trade agreements, which should be designed and monitored with a view to fair terms of trade and procedurally just institutions.

- Foreign direct investments in generating and trading renewable energy should be designed to provide fair sharing of returns, and consideration of all stakeholder interests, in particular those of local host communities.

Case study: Schmitt (2018) studied the processes that led to a failure of "Desertec", a large-scale project aimed at building up solar-energy production and hydrogen-conversion infrastructure for the joint purpose of local consumption and export.

TARGETS, INDICATORS AND DATA

Targeting inequality in energy consumption: Recognition of the significant income/wealth-related inequality in the consumption of energy (Zimm, 2019; Oswald et al., 2020) suggests the possibility of creating a distinct SDG 7 target aimed at a more equal distribution of access to and utilization of energy services. Such a target would recognize the cross-dependency of SDG 7 and SDG 10 targets, and could be complemented by targets aiming at equal access by gender, ethnicity or migrant status.

Distributional Indicators: In order to better measure income-related inequality, especially extreme top-end inequality (Oswald et al., 2020), adequate distributional indicators should be adopted, such as the Gini concentration index and/or Lorenz Curves (Zimm, 2019). These indicators should be based on utilization rather than access alone, and could be applied to measure inequality across the world population, across countries, or groups of countries, or within countries.

Basing targets on energy services rather than energy consumption: As was briefly discussed in Section 1.2, a needs-based perspective suggests that the focus should be more on energy services rather than energy alone. Consideration should thus be given to complementary indicators that measure access to publicly provided and/or shared energy services (communications, transportation), as these have the greatest potential to mitigate inequality. (See also Policy Brief 3.1 on the SDG 7-SDG 1 interlinkages.)

REFERENCES

Bloom, DE, Kuhn, M & K Prettner, 2017. Invest in Women and prosper. *FINANCE & DEVELOPMENT*, September 2017

Campagnolo, L & M Davide, 2019. Can the Paris deal boost SDGs achievement? An assessment of climate mitigation co-benefits or side-effects on poverty and inequality. *World Development* 122, 96-109.

Couharde, C & S Mouhoud, 2020. Fossil fuel subsidies, income inequality, and poverty: Evidence from developing countries. *Journal of Economic Surveys* 34(5), 981-1006.

ESMAP. Rethinking Power Sector Reform. esmap.org/rethinking_power_sector_reform

Hsu, SL, 2021. Carbon Taxes and Economic Inequality. *Harvard Law & Policy Review, Forthcoming*.

Markkanen, S & A Anger-Kraavi, 2019. Social impacts of climate change mitigation policies and their implications for inequality. *Climate Policy* 19(7), 827-844.

Mintz-Woo, K, F Dennig, H Liu & T Schinko, 2020. Carbon pricing and COVID-19. *Climate Policy*, 1-9.

Moniruzzaman, M & R Day, 2020. Gendered energy poverty and energy justice in rural Bangladesh. *Energy Policy* 144, 111554.

Muller, NZ, PH Matthews & V Wiltshire-Gordon, 2018. The distribution of income is worse than you think: Including pollution impacts into measures of income inequality. *PLoS One* 13(3), e0192461.

Oswald, Y, A Owen & JK Steinberger, 2020. Large inequality in international and intranational energy footprints between income groups and across consumption categories. Nature Energy 5(3), 231-239.

Rao, N, G Kiesewetter, J Min, S Pachauri & F Wagner, 2020. Who pollutes and who suffers from air pollution in India. Research Square.

Rudnick, H & C Velasquez, 2018. Taking stock of wholesale power markets in developing countries: A literature review. *World Bank Policy Research Working Paper* 8519.

Saelim, S, 2019. Carbon tax incidence on household demand: effects on welfare, income inequality and poverty incidence in Thailand. *Journal of Cleaner Production* 234, 521-533.

Schmitt, TM, 2018. (Why) did Desertec fail? An interim analysis of a large-scale renewable energy infrastructure project from a Social Studies of Technology perspective. *Local Environment* 23, 747-776.

World Bank, 2019. Rethinking Power Sector Reform in the Developing World. worldbank.org/en/topic/energy/publication/rethinking_power_sector_reform

Xu, Q, S Dhaundiyal & C Guan, 2020. Structural conflict under the new green dilemma: Inequalities in development of renewable energy for emerging economies. *Journal of Environmental Management 273*, 111117.

Zakeri, B, K Palavets, L Barreto-Gomez & L Gomez Echeverri, 2021. Report on Second Consultative Science Platform. Bouncing Forward: Pathways to a post-COVID World. Sustainable Energy, International Institute for Applied Systems Analysis and International Science Council.

Zhang, T, X Shi, D Zhang & J Xiao, 2019. Socio-economic development and electricity access in developing economies: A long-run model averaging approach. *Energy Policy* 132, 223-231.

Zhang, C, J Wu, C Long & M Cheng, 2019. Review of existing peer-to-peer energy trading projects. *Energy Procedia* 105, 2563-2568.

Zimm, C, 2019. Methodological issues in measuring international inequality in technology ownership and infrastructure service use. *Development Studies Research* 6 (1), 92-105.

SECTION 3.9

INTERLINKAGES BETWEEN **ENERGY AND SUSTAINABLE CITIES (SDG 11)**

CONTRIBUTING ORGANIZATIONS:
REN21, THE EUROPEAN COMMISSION IRENA, ECA

Summary/Key Messages

Status of the interlinkages between SDG 7 and SDG 11:

Some of the actions needed to achieve SDG 7 fall under the authority of cities and are interlinked with the delivery of SDG 11 on sustainable cities and communities. Although national governments typically are seen as the main bodies responsible for governing energy supply and infrastructure, and for driving the transition to renewables-based energy systems, city governments are uniquely positioned to curb energy use and related greenhouse gas emissions while accelerating the uptake of renewables.

- Cities account for three-quarters of global final energy consumption (and a similar share of global energy-related CO_2 emissions). They are home to 55% of the global population, a share that continues to grow.
- Urbanization comes with the need for housing and basic infrastructure for more urban dwellers; city planning and design will influence the energy intensity of these systems.
- Investments in renewable energy, together with greater energy and resource efficiency, are critical to ensure the sustainability of cities. Municipal action is essential in the electricity sector, but it is also needed in other sectors that, despite representing the bulk of global energy use, have so far lagged in the energy transition, notably the heating and cooling of buildings, and transportation.
- As target setters, regulators, policy makers, facilitators and advocates for renewables, city governments can not only shift municipal operations to renewables, but also to encourage the city-wide uptake of renewable energy.

City governments have harnessed the synergies between SDG 7 and SDG 11 in various ways, including by: implementing cross-sectoral urban planning to reach carbon neutrality goals; working with utilities and other cities to achieve renewable energy targets; leveraging public-private partnerships to decarbonize high-polluting urban systems; installing, purchasing and/or contracting for renewable capacity for urban infrastructure; taking advantage of falling technology costs to increase the ambition of energy and climate targets; and promoting citizen participation to accelerate the energy transition.

Priority actions to realize the synergies identified in this policy brief:

- The NDCs (as well as other national policies) need to explicitly recognize the role of cities and urban development in the energy transition (and in climate action)[31], and consider what is needed to implement measures in/by cities to advance SDG 7 in a timely and cost-effective manner.

- To ensure the implementation of energy goals in cities, an integrated approach to urban development should be adopted, taking into account competing priorities, access to finance, and administrative and capacity constraints. This should include cross-sectoral urban planning and multisectoral investments, for example: (a) planning, design and implementation of compact and accessible cities to reduce energy demand from urban systems (including transport, industry, and households.); (b) a shift to clean, efficient, safe and affordable public transport ,and non-motorized transport options; (c) renovation of the existing building stock and design of energy and resource efficient and resilient new buildings; and (d) power generation from locally available renewable energy sources.

- Context-specific energy and climate solutions are needed to address local conditions and barriers to the joint achievement of SDG 7 and SDG 11.

- City governments need to complement their targets with clear and ambitious action plans, implementation strategies and policies for renewable energy deployment.

- Multi-level governance is key to ensuring that municipal efforts to scale up renewables are closely connected to the policies, regulations and incentives adopted at higher government levels.

- Improved data is needed to increase knowledge about the opportunities that renewable energy presents for cities, to engage cities in the energy debate in a more holistic way, to integrate policy and regulatory frameworks at different levels, and to build investor confidence.

INTERLINKAGES BETWEEN SDG 7 AND SDG 11

This policy brief identifies and illustrates the main opportunities for synergies between SDG 7 and SDG 11. Recommendations are made for how actions, targets and policies could be better designed in order to contribute more effectively to the joint achievement of both SDGs.

Cities[32] are home to around 55% of the global population (a share that is constantly growing) and contribute to around three-quarters of CO_2 emissions from global final energy use (Seto et al., 2014; World Bank, 2020). Energy demand in cities has risen rapidly in recent years, due mainly to trends

[31] As of 2019, only 23 of the 160 countries that had submitted an NDC acknowledged the urban opportunity for climate change mitigation (Coalition for Urban Transitions, 2019).

[32] No international criteria exist to determine what a city is. Most definitions of a 'city' rely on settlement density and/or population numbers, although the criteria vary widely across countries. Generally, the term 'urban area' refers to a settlement area that is more densely populated than suburban or peri-urban communities within the same metropolitan area. The term 'city', meanwhile, has broader meanings. According to the United Nations, a 'city' can connote a political or civic entity, a geographic unit, a formalized economy, or an infrastructure bundle (UN DESA, 2018).

in global population growth, urbanization and growing economic activity in cities (Seto et al., 2014; UN DESA, 2018). Still, around 180 million people living in urban areas lacked access to electricity in 2019 and 2.6 billion people worldwide lacked access to clean cooking (IEA, 2020; World Bank, 2020). Cities – as energy consumers, managers of energy networks, and energy producers – are uniquely positioned to curb energy use and related emissions while expanding energy access and reducing energy poverty for their residents. To achieve this, municipal governments can deploy energy efficiency and renewable energy solutions across urban systems (IRENA, 2017).

Local action is essential in accelerating renewable energy uptake in all sectors, in particular those that, despite representing the bulk of global energy consumption, have historically lagged behind. Buildings, concentrated in and around urban centres account for 33% of total final energy consumption, while urban transport is responsible for 13%[33] (REN21, 2020). Renewables are becoming more prevalent in the power sector, supplying around a quarter of the world's electricity, however electricity accounts for only 17% of global final energy demand. Heating and cooling, and transport, together account for over 80% of final energy demand, but the share of renewables in these sectors remains low – around 10% and 3% respectively. Urban policies, decentralized renewable energy technologies and emerging enabling solutions such as electric vehicles represent key levers for decarbonizing these sectors.

The success of cities in meeting their energy goals has relied not only on municipal governments installing, purchasing or procuring renewables for their own operations, buildings and vehicles, but also on their ability to influence the decisions of other urban actors (e.g., individual households, communities and businesses) – for example, by adopting comprehensive policies, by raising awareness about the business opportunities and other benefits associated with renewables, and by facilitating dialogues among stakeholders (IRENA, 2021a). Collaboration between all types of urban actors and integration across levels of government – often referred to as multi-level governance – is needed to ensure access to affordable, reliable, sustainable, and modern energy for all.

City governments are increasingly recognizing the interlinkages between SDG 7 and SDG 11, acknowledging how the delivery of energy targets could help create sustainable cities, and vice-versa. For example:

- The ways in which cities are designed, built, managed and financed have important implications for energy consumption, including in the context of transport demand, since the scope for active transport (walking and cycling) and public transport are shaped by urban form and density., Costs associated with the provision of electricity also depend on urban density.
- Shifting urban energy use directly contributes to achieving greenhouse gas emission reductions and net-zero targets, including by integrating energy efficiency and renewable energy solutions in buildings, and shifting to a circular economy, including in the context of green buildings.
- Increasing the share of renewables across end-use sectors not only contributes to reducing emissions and improving air quality in cities, but also reduces the risks of climate-driven disasters and increases urban resilience.
- Distributed renewable generation capacity helps provide access to affordable, reliable and modern energy services for people living in urban slums where there is limited grid-based electricity access, or where the main grid is frail and overburdened.

[33] Urban transport accounts for 40% of all the energy used in the transport sector, and the whole sector accounts for 32% of total final energy consumption.

The drivers for renewables in cities are broad, with efforts motivated by diverse social, economic and environmental objectives depending on the local context and priorities. Generally, city governments have pursued renewable energy as an opportunity to create more liveable urban areas and to enable a better quality of life for residents.

The COVID-19 pandemic and the resulting lockdowns to slow the spread of infections had major impacts on the driver for renewables. There was a general shift in government priorities (especially for municipalities), with efforts to ensure public health and wellbeing being pushed higher up on the policy agenda. However, images of blue skies and clearer air during the early lockdowns helped to increase societal expectations and pressures towards a green recovery, and also created momentum for the development of renewable energy (REN21, 2021).

Despite facing challenges such as limited regulatory mandates, human capacity constraints, and restricted authority over revenue management, many municipal governments around the world have demonstrated leadership in the context of the energy transition (REN21, 2021; IRENA, 2021). The following case studies illustrate some of the best approaches to linking the pursuit of energy and climate action with wider opportunities to create sustainable cities.

CASE STUDIES

Cross-sectoral urban planning
Case study: Amsterdam (The Netherlands)

To shape the city's COVID-19 recovery plan, Amsterdam officials have drawn on the City Doughnut model which aims to reduce city-level energy use, emissions and waste, and move towards carbon neutrality (Doughnut Economics Action Lab, 2020:3). This model represents a holistic transformative approach to improving cross-departmental and multi-stakeholder collaboration within the city to "shape humanity's chances of thriving in balance with the living planet" (Ibid).. This objective has translated into synergetic city targets in the areas of health, housing, water, jobs, mobility, and energy. For example, Amsterdam is working on making 28 neighbourhoods become natural gas free as a first step in making the entire city natural gas free before 2040. Achieving this target will have positive impacts for creating a thriving city that is both socially just and ecologically safe.

Working with utilities and other cities
Case study: Cities in the United States

Depending on their local resource options, laws and regulations, and other location-specific variables, cities may not be able to directly or independently install, purchase or procure renewable energy. Therefore, many municipal governments use alternative avenues to achieve their renewable energy targets, including working with other cities and/or utilities. A number of U.S. cities have pursued partnerships with their electric utilities to advance the deployment of renewables and energy efficiency solutions. For example, in 2013 Minneapolis, Minnesota, was among the first large U.S. cities to sign a memorandum of understanding establishing a "Clean Energy Partnership" with a local utility, which aimed at cooperation in achievement of the city's 100% renewable energy goal. In 2019, Denver, Colorado, entered into a partnership with a local utility to achieve shared energy goals through energy retrofits and renewable electricity procurement (Duncan and Bonugli, 2019). In the same year, Salt Lake City, Park

City and Summit County (all in Utah) entered into a collaboration with the investor-owned utility Rocky Mountain Power under the provisions of the state's Community Renewable Energy Act, which allows the utility to work with communities to tailor electricity portfolios to meet renewable targets (Salt Lake City, 2019).

Leveraging public-private partnerships to decarbonize transport
Case study: Kampala (Uganda)

The transport sector is responsible for the highest share of energy demand in Kampala, which consists mostly of inefficient motorcycles and private cars running on fossil fuels (KCCA, 2016). To reduce air pollution, noise and petrol demand, the Kampala Capital City Authority (KCCA) formed partnerships with start-ups such as Bodawerk and Zembo to introduce electric motorcycles. As a result, by 2020, more than 200 new and retrofitted electric motorcycles were in use in the city (charged mostly from the hydropower-dominant grid) (Smith, 2020). E-mobility provides a framework for KCCA to contribute to national and international climate change mitigation efforts by deploying renewables in the transport sector. Because electric motorcycles require little infrastructure, are silent and produce few emissions, they hold promise for successful uptake among motorcycle riders in Ugandan cities and elsewhere.

Building on the falling costs of solar systems to revise building mandates
Case study: Cities in India

Municipal governments in India have been adopting renewable energy obligations to improve the performance of buildings at the city level.[34] For instance, the municipal government of Karimnagar passed a regulation in 2019 making it mandatory for new buildings to install rooftop solar PV if the building area exceeds 251 m^2 (Dayashankar, 2019). Rajkot also has a mandate requiring solar PV rooftop systems on new buildings, while Chandigarh has a mandate for the use of solar hot water in publicly-owned buildings and new residential construction (CapaCITIES India, 2018).

The experience of Bengaluru, the capital of Karnataka state, illustrates how strict implementation rules increase the effectiveness of solar mandates. To combat chronic power shortages, Karnataka enacted a solar mandate in 2007 that required developers to install solar water heaters in all buildings with at least 56 m^2 of floor space. Two years later, the municipal utility Bangalore Electricity Supply Company (BESCOM) started denying grid access to households that were not equipped with a solar water heater. This strict compliance rule, combined with an additional incentive for residential water heaters offered by India's Ministry of New and Renewable Energy, led to more than 1,200 million m^2 of solar collector area installed across the city by 2017. BESCOM's policy was copied by other utilities across Karnataka, making it the leading Indian state for solar water heater capacity (Malaviya, 2018).

Promoting citizen participation in energy plans
Case study: Cities in South Africa

Municipal governments have also stimulated the engagement of citizens in climate and energy planning (REN21, 2021). In South Africa, planning processes are by law open to public comment, making it a leading country for citizen participation in energy planning processes, including in cities. eThekwini municipality aims to achieve at least 40% renewable energy supply by 2030 and 100% by 2050. The Draft Energy Policy, which outlines how the city plans to reach these goals, was open to public comment until early 2021 (eThekwini Municipality, 2020).

[34] In India, implementation and enforcement of all buildings-related policies occurs at the city level but is, to a large extent, guided by model regulations and rules provided by the national and state authorities (WRI India, 2019).

Influencing higher-level policy
Case Study: Barcelona (Spain)

City governments can also influence higher-level policy and regulations. For example, the pioneering solar thermal ordinances in Barcelona, Spain, led to new national-level policies (IRENA, 2021b). Cities can also take control of their electricity supply through community aggregation efforts or municipalization of electricity procurement and distribution; introduce stricter requirements for renewable energy on public procurement processes; increase and diversify the renewable thermal sources of their district energy networks; and partner with international development agencies or similar organizations to deploy clean cooking solutions (REN21, 2021; REN21 and FIA Foundation, 2020).

TARGETS, INDICATORS AND DATA

Indicators to help track the impacts of synergies between SDG 7 and SDG 11:

City-level renewable energy targets and policies: By the end of 2020, over 800 municipal governments had adopted renewable energy targets, many of which aimed for 100% renewable energy. While most targets are related to the power sector, some also cover heating and cooling, and transport, as well as economy-wide targets. Most targets have emerged in Europe and North America, followed by Asia and Latin America and the Caribbean. To help achieve these targets, some 800 municipal governments have regulatory policies, fiscal and financial incentives, and indirect policies that support the enabling environment for renewables.

E-mobility and renewable electricity targets in cities: As of 2020, at least 67 cities had e-mobility targets. Although most cities with e-mobility targets did not link them directly to renewable electricity, 31 of these cities had separate targets for e-mobility and renewable electricity – including Amsterdam (Netherlands), Cape Town (South Africa), Dubai (United Arab Emirates), Hamburg (Germany), Toronto (Canada) and Portland (Oregon, U.S.).

Energy efficiency targets: Energy efficiency reduces the amount of energy required to deliver a product or service, and thus it is fundamental to achieving higher shares of renewables (IRENA, 2017). As of 2020, 475 local governments within the CDP-ICLEI Unified Reporting System had set or planned energy efficiency targets as a means to cut emissions and energy imports or to trim budgets.

City-level targets for emission reductions and net-zero targets: As of 2020, around 10,500 municipal governments, mostly in Europe but increasingly also elsewhere, had adopted targets to reduce their emissions by a specific date. Around 800 cities had committed to net-zero emissions, with the number of net-zero targets increasing roughly eight-fold from 2019. Net-zero targets are most prevalent in Europe, and in Latin America and the Caribbean.

Ultimately, although targets constitute an important tool, they do not guarantee success. If targets are not met within the established timeline or if they are not accompanied by clear plans and implementation strategies as well as supportive policies, their usefulness decreases. Internationally recognized platforms such as CDP-ICLEI Unified Reporting System, with local governments reporting progress over time, help to make cities accountable for implementing their targets.

Data availability:

The geographical distribution of cities, their political, economic, social and environmental contexts and their diverse institutional capacities make tracking the uptake of renewables challenging. Data gaps (due to unavailability) and limitations still exist in the following key areas: energy access rates in cities, as well as targets; shares of renewables in municipal and city-wide energy use; targets and policies that promote renewables in the power, heating and cooling, and transport sectors, both for municipal and for city-wide use; generation capacity for renewable electricity, heating and cooling, and transport fuels, by municipal authorities and other urban actors (utilities, businesses, households, etc.); and community energy projects in cities (REN21, 2021).

The lack of comprehensive, consolidated and comparable data represents a barrier to effectively assessing the importance of cities in achieving SDG 7, determining objectives and baselines, and monitoring progress. Improved data availability would make it possible to increase knowledge about the opportunities that renewable energy presents for cities, and to further accelerate the global, system-wide energy transition.

REFERENCES

CapaCITIES India, 2018. "Climate Resilient City Action Plan – Rajkot". http://capacitiesindia.org/wp-content/uploads/2019/12/CRCAP_Rajkot_July-2018.pdf.

Coalition for Urban Transitions, 2019. *Climate Emergency, Urban Opportunity: How National Governments Can Secure Economic Prosperity and Avert Climate Catastrophe by Transforming Cities*, Washington, DC. https://urbantransitions.global/wp-content/uploads/2019/09/Climate-Emergency-Urban-Opportunity-report.pdf.

Dayashankar K.M., 2019. "Smart turn: Karimnagar looks to the sun". The Hindu, 25 February. https://www.thehindu.com/news/national/andhra-pradesh/smart-turn-karimnagar-looks-to-the-sun/article26358979.ece.

Doughnut Economics Action Lab, 2020. *The Amsterdam City Doughnut: A tool for transformative action*. www.kateraworth.com/wp/wp-content/uploads/2020/04/20200406-AMS-portrait-EN-Single-page-web-420x210mm.pdf.

Duncan J. and C. Bonugli, 2019. "How cities and utilities can form partnership agreements to accelerate climate action". Institute for Market Transformation. https://www.imt.org/how-cities-and-utilities-can-form-partnership-agreements-to-accelerate-climate-action/.

EEP Africa (Energy and Environment Partnership Trust Fund), 2020. *Electric boda bodas*. *The Innovative Business Model: Zembo*. https://eepafrica.org/wp-content/uploads/2020/09/IBM_Zembo_DigitalVersion.pdf.

eThekwini Municipality, 2020. "Public encouraged to comment on Draft Energy Policy". http://www.durban.gov.za/Resource_Centre/new2/Pages/Public-encouraged-to-comment-on-Draft-Energy-Policy-.aspx.

IEA (2020). *SDG7: Data and Projections*. https://www.iea.org/reports/sdg7-data-and-projections.

IRENA (International Renewable Energy Agency), 2021a. *Renewable Energy Policies for Cities: Experiences in China, Uganda and Costa Rica*, International Renewable Energy Agency, Abu Dhabi.

IRENA, 2021b. *Renewable Energy Policies for Cities: Buildings*, IRENA, Abu Dhabi.

IRENA, 2017. *Synergies Between Renewable Energy and Energy Efficiency*. https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Aug/IRENA_REmap_Synergies_REEE_2017.pdf.

KCCA (Kampala Capital City Authority), 2016. *Energy and Climate Profile*. https://www.kcca.go.ug/uDocs/Energy%20and%20Climate%20Profile.pdf

Malaviya J., 2018. "Successful solar energy bylaw in Bengaluru India". solarthermalworld.org, 17 August. https://www.solarthermalworld.org/news/successful-solar-energy-bylaw-bengaluru-india.

WRI India (2019). *Greening Indian Cities through Efficient Buildings.* https://www.niua.org/csc/assets/pdf/RepositoryData/Energy_&_Green_Building/Greening_Indian_Cities_through_efficient_buildings.pdf.

REN21 (Renewable Energy Policy Network for the 21st Century), 2020. *Renewables 2020 Global Status Report*. https://www.ren21.net/gsr-2020/.

REN21, 2021. *Renewables in Cities 2021 Global Status Report*. https://www.ren21.net/reports/cities-global-status-report/.

REN21 and FIA Foundation, 2020. *Renewable Energy Pathways in Road Transport*. https://www.fiafoundation.org/media/791530/renewable-energy-pathways.pdf.

Salt Lake City, 2019. "Utah communities celebrate landmark renewable energy legislation". SLC Blog, 22 April. https://www.slc.gov/blog/2019/04/22/utah-communities-celebrate-landmark-renewable-energy-legislation/.

Seto K.C. et al., 2014. "Human settlements, infrastructure and spatial planning". In O. Edenhofer et al. (eds.). Climate Change 2014: *Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, UK and New York, NY: Cambridge University Press. https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_chapter12.pdf

Smith T., 2020. "Uganda: Boda boda e-bike on a pay as you go model". Green Building Africa, 25 September. https://www.greenbuildingafrica.co.za/uganda-boda-boda-e-bike-on-a-pay-as-you-go-model-to-boost-sector.

UN DESA (United Nations Department of Economic and Social Affairs), 2018. *World Urbanization Prospects: The 2018 Revision*. https://population.un.org/wup/Publications/Files/WUP2018-Report.pdf

World Bank, 2020. Urban Development, https://www.worldbank.org/en/topic/urbandevelopment/overview

SECTION 3.11

INTERLINKAGES BETWEEN **ENERGY AND RESPONSIBLE CONSUMPTION AND PRODUCTION (SDG 12)**

CONTRIBUTING ORGANIZATIONS:
UNIDO, ESCWA, EUROPEAN COMMISSION, IIASA

Summary/Key Messages

The most important interlinkages:

- A 'circular economy' offers many opportunities to transform the ways we produce and consume, while advancing access to affordable, reliable, sustainable and modern energy for all.
- Improved energy and resource efficiency, waste management, eco-design, and 'reduce, re-use and recycle' practices, along with responsible consumption patterns, make complementary contributions to both SDGs and, consequently, to climate change mitigation and environmental sustainability.

Priority actions:

- Integrate circular economy principles and practices into sustainable energy plans and strategies, to support the phase-out of fossil fuels and reduce the extraction of raw materials.
- Encourage stronger policy coordination and integration at the national and regional levels, while reinforcing international cooperation and multilateralism.

- Incorporate circular economy principles into Nationally Determined Contributions under the Paris Agreement, and COVID-19 responses and recovery strategies.
- Prioritize green investments in renewables and the circular economy to create jobs and new business models, and promote sustainable lifestyles.
- Provide support to developing countries to improve awareness of the benefits associated with circular economy principles, and assist them in developing the capacity to integrate these principles into bankable business models and projects across value chains.

THE INTERLINKAGES BETWEEN SDG 7 AND SDG 12

In recent years, the concept of a circular economy has gained increasing prominence amongst policy makers as an innovative approach to sustainable development. A circular economy, which is based on the concept of an industrial system that is restorative and regenerative by design, offers many opportunities to transform the way we produce and consume, while also accelerating the transition to renewable energy (Ellen McArthur Foundation, 2013).

Improved energy and resource efficiency, waste management, eco-design, and 'reduce, re-use and recycle' practices, along with responsible consumption patterns, all illustrate the various synergies between SDG 7 and SDG 12. Understanding these synergies, and developing integrated approaches to the implementation of these goals, would help reduce the use of fossil fuels for energy production, decrease the demand for virgin materials, and promote sustainable lifestyles.

SDG 7 and SDG 12 can make complementary contributions to climate change mitigation and environmental sustainability. Energy efficiency and renewable energy systems together can address about 55% of total CO_2 emissions, while also reducing air pollution. SDG 12 addresses the remaining 45% of total CO_2 emissions, while also tackling all forms of pollution, by supporting sustainable ways of making and using products (Ellen MacArthur Foundation, 2021).

Technological advances in manufacturing aimed at improving energy efficiency are promoted by both SDG 7 and SDG 12. Renewable energy sources and energy access are central to achieving sustainable consumption and production, while sustainable consumption and production, in turn, promote the use of renewable energy and energy efficiency in manufacturing, and across value chains.

The COVID-19 pandemic has brought attention to the underlying vulnerabilities and limitations of existing linear supply chains and centralized energy systems, including their dependence on unrestricted access to raw materials, as well as overconsumption and underutilization. As the global community considers how to 'build back better', the integration of circular economy principles into recovery strategies and measures would help create more resilient economies while also advancing the achievement of SDG 7, SDG 12 and other related SDGs.

KEY CHALLENGES FOR CREATING SYNERGY:

Weak policy integration and insufficient coordination between government agencies responsible for energy and those dealing with industry and waste management. The complexity of the interlinkages between SDG 7 and SDG 12 challenges the conventional decision-making processes in government and private sector entities. Decision makers can no longer work in silos, and need to find ways of widening

collaboration and creating collective ownership. This will require a transformation in the structure of decision making, including the integration of vertical and horizontal planning. However, working across sectors and disciplines does not come naturally, as it challenges entrenched institutional and sectoral behaviours (Nerini et al., 2017).

Lack of awareness among private sector actors, including small and medium sized enterprises, about the potential multiple benefits of adopting circular economy practices, along with switching to renewable energy. There are significant challenges involved in building scientific evidence and then raising general awareness about the interlinkages between SDG 7 and SDG 12 among both policy makers and business leaders. A large number of companies in developing economies lack adequate knowledge and capacity to understand and analyse the benefits of circularity for improving the ways they produce and consume energy and products. Private financial institutions lack the capacity to identify potential benefits effectively beyond those related to renewable energy generation, and to diversify their financial services accordingly.

Inadequate access to technologies and finance for large-scale transformational programmes integrating a circular economy and sustainable energy in a holistic manner. In developing economies, people's access to innovative technologies associated with the 'Fourth Industrial Revolution' is insufficient, as is their access to finance for incorporating transformational approaches into national development plans. While a large number of projects are being implemented with support by United Nations entities, and multilateral and bilateral development cooperation agencies, most of these projects are aimed at either increasing the uptake of renewable energy or improving resource efficiency and waste management. Holistic interventions addressing multiple targets related to different SDGs have not yet become the norm.

While there is a growing awareness of the need to adopt more sustainable consumption patterns, reduce raw material use, and accelerate the energy transition, related changes in lifestyles and consumer behaviour are still slow to appear. Along with governments and industry, consumers have a fundamental role to play in making changes in consumption and production patterns – by demanding green products and services, and adopting low energy use and resource-conserving lifestyles. Notwithstanding various initiatives encouraging consumers to choose fair trade products or switch to green energy providers, as well as a positive trend showing increased numbers of vegetarians and vegans around the world, average consumers show a lack of willingness to change their personal lifestyles (Private Infrastructure Advisory Facility, 2012).

One of the problems in appealing to consumers to be more sparing in their use of products as a way to protect the environment is that it is difficult for them to see the connection between turning off the TV standby switch and improving the lives of people who are thousands of kilometres away, or ensuring the survival of future generations (UNCTAD, 2017). A concerted effort has to be made by key actors to increase consumers' responsibility: governments need to develop necessary public policies and incentives; educational institutions need to mainstream sustainability at all levels; and the private sector needs to adopt circular practices and offer green products and services at competitive prices.

Various global and regional initiatives promoting a circular economy are already in place, including ones relating to SDG 7 and SDG 12, but there is insufficient coherence, synergy and coordination for these undertakings. The absence of a multilateral instrument or a governance mechanism to coordinate efforts to address the unsustainable and linear use of natural resources at the global level makes these initiatives less effective, hinders synergistic approaches and leads to incomplete geographic coverage and fragmentation of support to developing countries.

HOW TO ADDRESS THESE CHALLENGES

To promote the interlinkages between SDG 7 and SDG 12, a large-scale industrial transformation is required, addressing in parallel the ways energy and goods are produced and consumed. Specific recommendations for enhancing synergies include:

- Encourage a stronger coordination and policy integration at the national and regional levels.
- Incorporate circular economy practices into Nationally Determined Contributions under the Paris Agreement – to promote resource efficiency, eco-design, waste management and other sustainable production and consumption measures, along with the uptake of renewable energy and energy efficiency.
- Invest in renewables and circular economy practices to create green jobs, while adopting 'just transition' strategies to support a phase-out of fossil fuels and to reduce extraction of raw materials.
- Create capacity-building and 'green skills' development opportunities for women, youth and workers, particularly in rural areas, who lose employment due to the transition to a circular economy and sustainable energy.
- Design development activities to prioritize green investments and new business models in holistic programmes, combining circular economy practices with access to renewable energy.
- Integrate sustainable energy and circular economy solutions into COVID-19 recovery strategies to help economies become greener and more resilient.
- Encourage a transition from energy and resource intensive lifestyles to more sustainable patterns.
- Strengthen international cooperation and multilateralism.

Support should be provided to developing countries to:

- Improve the awareness of businesses and policy makers regarding sustainable development benefits associated with energy efficiency savings, demand reduction measures, access to renewable energy resources, and security of resource and material supplies.
- Improve the capacities of local financial institutions to develop financial products and assess circular economy projects, and of private operators to develop relevant bankable projects.
- Develop the capacities of both businesses and governments to integrate sustainable consumption and production considerations into their business plans and operations across value chains, to accelerate the uptake of circular economy practices and improve their business performance.

CASE STUDIES PROVIDING EXAMPLES OF IMPACTS OR LESSONS LEARNED:

Integrating the circular economy into Nationally Determined Contributions

The circular economy represents a key element in the updated Nationally Determined Contribution of Chile. Through three components – a National Organic Waste Strategy, a Circular Economy Roadmap, and a set of circularity metrics and indicators – the country aims to promote more efficient use of its resources by extending the useful life of products and prioritizing non-conventional renewable energies. Some of the measures considered are: energy efficiency in large energy industries; assessment of energy demand and supply scenarios; improvement of household energy efficiency; and incentives for responsible production. The implementation of the updated NDC is expected to generate sustainable development benefits, especially in a scenario of limited resources and growing needs, in addition to contributing to an integrated and synergistic vision of climate action in Chile (Government of Chile, 2020).

Promoting market-based dissemination of integrated renewable energy systems for productive activities in rural areas

Through a partnership agreement with a private bank, and with support from the Global Environment Facility (GEF), the United Nations Industrial Development Organization (UNIDO) and the Mozambique Energy Fund are facilitating access to capital for industrial enterprises to set up renewable energy systems for productive uses. These include installations of solar water pumping systems for irrigation, and waste-to-energy projects for agro-food processing in rural areas.

Minimizing the negative environmental impacts of batteries

The European Union has passed legislation on waste batteries that is intended to contribute to environmental protection by minimizing the negative impacts of batteries sold, and of used batteries. The legislation prohibits the marketing of batteries containing hazardous substances, defines measures for collection and recycling of waste batteries, and establishes related targets. It sets out provisions on labelling of batteries, and on their removability from equipment, as well as requiring recycling of 50% of the material from waste batteries through smelter processes to extract the metals, such as copper, nickel and cobalt.

Combatting climate change through energy efficiency policies and standards

The annual loss of electricity in China is more than 20 billion kWh, about 30-40% of which comes from power transmission and distribution. The SWITCH-Asia project “Efficient Transformers” addressed energy consumption and standardization, energy distribution utilities, energy-intensive industries, and transformer manufacturers, as well as energy conservation and supervision centres. The aim was to increase the market penetration of higher efficiency transformers. The project developed three national standards for transformers: minimum energy performance standards, eco-design guidelines for manufacturers, and a total cost owning guideline and procurement tool. The tool, together with a products’ database, enables end-users to make informed decisions about purchases, based on economic and technical data about the whole lifespan of a transformer. The introduction of these energy efficiency standards and policies in China helps prevent more than 846,000 tonnes of CO_2 emissions per year (Switch Asia, 2011).

Enhancing coordination through regional approaches

The Arab Regional Strategy for Sustainable Consumption and Production aims to promote circular practices by encouraging the use of products and services that ensure environmental protection, and water and energy conservation, while contributing to poverty eradication and sustainable lifestyles. Energy was identified as one of the six priority areas, each of which has a set of policy objectives and measures. The objectives include the promotion of investments in cleaner technologies and energy efficiency for energy production and consumption, particularly in energy-intensive industries. The strategy emphasizes the importance of indicator-based monitoring of progress on sustainable consumption and production in the region.

Converting agricultural wastes to clean energy

The Biovalor project in Uruguay, supported by the GEF and implemented by UNIDO, promotes the valorisation of wastes from the agro-food -industry through the application of circular economy principles. Waste-to-energy, alternative fuels and synthetic diesel are at the core of the project, resulting in new renewable energy sources and increased incomes for small and medium-sized enterprises (SMEs) in rural areas. This is achieved by piloting new technologies, supporting a conducive regulatory environment, building capacities and sharing knowledge. Sustainable production and consumption are embedded in circular economy practices by creating virtuous loop cycles of value creation. In Uruguay, such value creation has taken a form of the development of alternative sources of affordable renewable energy.

Sharing sustainable procurement and production practices

The SWITCH-Asia project 'Sustainable cotton production in Pakistan's cotton ginning SMEs' has introduced cotton gin SMEs to sustainable production practices, supported by the procurement practices of European retailers. The increase in sustainable cotton procurement by SMEs triggered a change in cotton production at the farm level. Annually, this reduced the use of pesticides by up to 21%,chemicals by up to 16.15%, and fresh water by up to 21.15%. Adoption of Better Ginning Practices by SMEs promoted energy conservation, improved process efficiency and resource management, and helped them save about EUR 0.5 million. Implementing energy efficiency measures enabled the 60 participating SMEs to reduce their energy usage by 20%, save 4,820,631 kWh and prevent 2,400 tonnes of CO_2 emissions. The project enhanced the business sector's awareness of climate change risks through public campaigns on sustainable consumption and production (Switch Asia, 2017).

TARGETS, INDICATORS AND DATA

The strongest synergies between SDG 7 and SDG 12 can be seen in the connections between targets 7.1, 7.2 and 7.3, related to the deployment of renewable energy and energy efficiency, and targets 12.2, 12.5, 12.6 and 12.8, regarding sustainable management and efficient use of natural resources, reducing waste, promoting the adoption of sustainable practices, and awareness of sustainable lifestyles.

Synergies should be evaluated between the clean energy used for the production and consumption of goods and services and their material footprints and recycling rates. These synergies have not been fully assessed, hence there is a lack of reliable current data (ESCWA, 2020). Relevant indicators include: 7.2.1, 7.3.1, 7.a.1, 7.b.1, 12.2.1, 12.5.1, 12.a.1, and 12.c.1.

The SDG targets and indicators provide an enhanced evidence-based framework and useful new guidance for adopting key targets on sustainable energy consumption and production at the national and regional levels. Regional and national strategies should be implemented to fit into the SDG framework, ensuring alignment (ESCWA, 2017).

REFERENCES

Ellen McArthur Foundation, 2013. *Towards the circular economy*

Ellen MacArthur Foundation, 2021. *Universal Circular Economy Policy Goals*

Nerini, F.Fuso, J. Tomei and I. Bisaga, 2017. 'Mapping synergies and trade-offs between energy and the Sustainable Development Goals', *Nature Energy*, vol. 3, no. 1, pp. 10-15, 2017

Private Infrastructure Advisory Facility, 2012. 'Willingness to Pay', vol. Note 9 in series: Pricing and Affordability in Essential Services

United Nations Conference on Trade and Development (UNCTAD), 2017. Achieving the Sustainable Development Goals through Consumer Protection

Government of Chile, 2020, Chile´s Nationally Determined Contribution

Switch Asia, 2011. Project Progress Sheet - China Higher Efficiency Power and Distribution Transformers Promotion Project

Switch Asia, 2017. Impact Sheet - Developing a sustainable cotton supply chain in Pakistan

Economic and Social Commission for Western Asia (ESCWA), 2020. Assessment of Sustainable Consumption and Production in the Arab Region

Economic and Social Commission for Western Asia (ESCWA), 2017. Progress on Sustainable Consumption and Production in the Arab Region

SECTION 3.12

INTERLINKAGES BETWEEN **ENERGY AND CLIMATE ACTION (SDG 13)**

CONTRIBUTING ORGANIZATIONS:
IRENA, ECA, THE EUROPEAN COMMISSION, ESCWA, FAO, UNIDO, HIVOS, IIASA, CCA

Summary/Key Messages

THE MOST IMPORTANT INTERLINKAGES:

The COVID-19 pandemic has impacted every aspect of society. In terms of energy systems, it has exposed the vulnerability of long global supply chains, which have been interrupted as a result of movement restrictions. It has also exacerbated the existing vulnerabilities of people without adequate access to energy for health care, employment and basic services. However, COVID-19 has also provided the world with an opportunity to reshape global energy systems by aligning short-term recovery objectives with long-term climate and development goals, such as the Paris Agreement and SDG 7.

Although there has been some movement towards sustainable energy transitions around the world, especially in the last few years, more must be done to meet these goals, and particularly to limit temperature rise to 1.5°C. According to the International Renewable Energy Agency (IRENA), the window of opportunity to achieve a 1.5°C pathway is getting increasingly narrow, and it is therefore imperative for our actions in the next few years to be aligned with this goal. A holistic approach to the energy transition – rooted in climate-safe energy development, yet also focused on short-term imperatives – would reap multiple socio-economic benefits and help set the stage for a just, orderly, and inclusive transition.

In this context, SDG 7 provides clear priorities. A transition to more renewable and efficient energy systems represents an opportunity to deliver on climate action, while also contributing to the achievement of multiple SDGs.

THE INTERLINKAGES BETWEEN SDG 7 AND SDG 13

The nexus between energy and climate change is very strong, as the greenhouse gas emissions from energy production are a major factor in warming the atmosphere. Climate change results in land degradation, damaging storms and ecosystem shifts. In some regions, lack of access to modern forms of energy increases encroachment into natural habitats, as people need to gather biomass for energy. In countries that rely heavily on hydropower for electricity supply, more frequent and intense extreme weather events owing to climate change pose a serious risk to supply, which in turn affects the powering of critical facilities, such as hospitals and health centres.

Meanwhile, the COVID-19 pandemic has also exposed the vulnerability of energy systems that depend on long global supply chains, which have been interrupted as a result of movement restrictions.

Global actions so far to tackle climate change have been inadequate, and the world is on track for warming of at least 3°C above pre-industrial levels by 2100 – missing the Paris Agreement target: to keep warming well below 2°C and trying to limit the increase to 1.5°C to avoid the worst impacts from climate change.

Responding to climate change has to be a global priority, especially with the growing evidence of more frequent and extreme weather events that endanger the lives and livelihoods of people around the world. This climate change urgency, combined with the world's growing appetite for energy use, is leading nations to seek an energy mix that simultaneously lowers greenhouse gas emissions, improves health, protects biodiversity and the environment, enables economic growth, creates jobs, resilience and socio-economic prosperity, and ensures no one is left behind.

The global response to the COVID-19 pandemic adds a new context for addressing these combined climate and energy priorities.

Decarbonization of the energy sector is at the core of the climate action agenda since energy consumption accounts for about two-thirds of global anthropogenic emissions. The need to reduce energy-related CO_2 emissions is a key driver for energy transitions. Urgent action is therefore necessary to align energy patterns with the Paris Agreement comparable pathway. It should be noted that energy transitions can take many forms, depending on local circumstances, endowments and starting points. SDG 7 defines some of the key elements of the energy transition required, including universal access, significant growth of renewable energy in the global mix, and doubling of energy efficiency, and these actions also represent an opportunity to deliver on climate action and, while also contributing to the achievement of multiple SDGs.

According to the International Renewable Energy Agency (IRENA), renewable energy solutions and energy efficiency measures can potentially achieve 90% of the energy-related carbon reductions needed by 2050 in line with IPCC recommendations, while ensuring clean energy access for everyone (IRENA, 2021). However, decarbonization of the energy sector requires urgent action on a global scale, as well as alignment with the goals of the Paris Agreement and the 2030 Agenda, to ensure this transition is just and leaves no one behind.

Over the next decade, every aspect of current energy-related systems will be affected by changes in demand and supply, developments in policy and continuous technological advancements. The ongoing changes are transformational and already profoundly affecting the systems that have evolved over the past century. Previously unimagined possibilities are emerging for millions who lack access to energy, with the potential for ending poverty and inequalities, building resilience and achieving the SDGs.

SDG 7 AND SDG 13 AND THE PANDEMIC

The COVID-19 pandemic has profoundly challenged the entire energy system, and highlighted the cost of tying economies to fuels prone to price shocks. It has magnified the very real challenges facing health care systems due to unreliable energy access. The difficulties people faced in continuing work or schooling were amplified, with many households lacking remote access. The energy system – along with the rest of economy – has been severely shaken.

Countries recovering from the COVID-19 pandemic are faced with a choice of either continuing business as usual or seizing the opportunity to invest in a clean, just, fair, resilient, and orderly future. When incorporated into stimulus and recovery plans, the energy transition can represent a far-sighted investment in the lives of the people affected by this crisis, overcoming the economic slump and creating much-needed jobs.

Overview of country actions on energy transitions during the pandemic

During the early stages of the pandemic, many countries prioritized measures revolving around guaranteeing affordable energy supplies to citizens and businesses. As the pandemic progressed, there was a shift in some cases towards more long-term priorities, with planning for a green recovery and the achievement of climate and development goals. For example, some countries used COVID-19 relief packages to support investments in climate mitigation and low-carbon energy.

COVID-19 recovery measure trends

The pandemic showed the importance of planning for and achieving long-term climate and development priorities. Some countries recognized this and focused their efforts on increased ambitions to address climate change and build back better.

However, countries are not the only ones aiming for ambitious targets and aligning climate action with energy transitions. Led by the High-level Champions for Climate Action, Race to Zero is a global campaign to rally leadership and support from businesses, cities, regions, and investors for a healthy, resilient, zero carbon recovery that prevents future threats, creates decent jobs, and unlocks inclusive, sustainable growth. Race to Zero mobilizes a coalition of leading net zero initiatives, representing 454 cities, 23 regions, 1,397 businesses, 74 of the biggest investors, and 569 universities. These commitments reflect the need to reduce global emissions by 45% by 2030, compared to 2010 levels, as outlined by the Intergovernmental Panel on Climate Change (IPCC, 2018).

However, some countries have used recovery packages to invest heavily in fossil fuel industries. According to the Climate Transparency Report 2020, G20 countries spent more on polluting measures than on climate-friendly measures in their packages. Data from the Energy Policy Tracker shows that at least US$ 268 billion of G20 bailout funding has been committed to fossil fuels, compared to US$ 199 billion for clean energy.

In some countries, recovery packages and plans are being used to focus on providing universal access. For example, Sierra Leone received US$ 50 million from the International Development Association for increasing access to electricity via solar off-grid projects. In addition, the Asian Development Bank followed up a recent US$ 600 million loan to expand electricity access in eastern Indonesia. However, more action is required towards achieving the SDG 7 access target.

Crucially, energy and resource efficiency are also priorities in recovery plans. The City of Johannesburg Council of South Africa approved a draft policy for the development of energy-efficient buildings powered by cleaner sources of electricity, including renewables. Liberia's procurement and consulting firm signed contracts for a solar-powered Inland Storage Facility that is expected to enable companies to achieve efficiency gains and expand their operations. Also, India's Government financing package includes INR45 billion (US$ 603 million) of investments over five years to support the domestic development of high-efficiency solar PV modules. Further, the Canadian Government's fiscal strategy allows citizens to qualify for grants of up to US$ 5,000 for work to improve the energy efficiency of their homes.

Over 100 countries have adopted energy-related recovery measures, which shows that energy transitions are already being prioritized in recovering from the COVID-19 pandemic, and demonstrates the potential these transitions have to provide socio-economic benefits.

ENERGY TRANSITION AS A TOOL TO ALIGN SHORT-TERM OBJECTIVES WITH MID-TERM AND LONG-TERM PRIORITIES FOR SDG 7 AND SDG 13

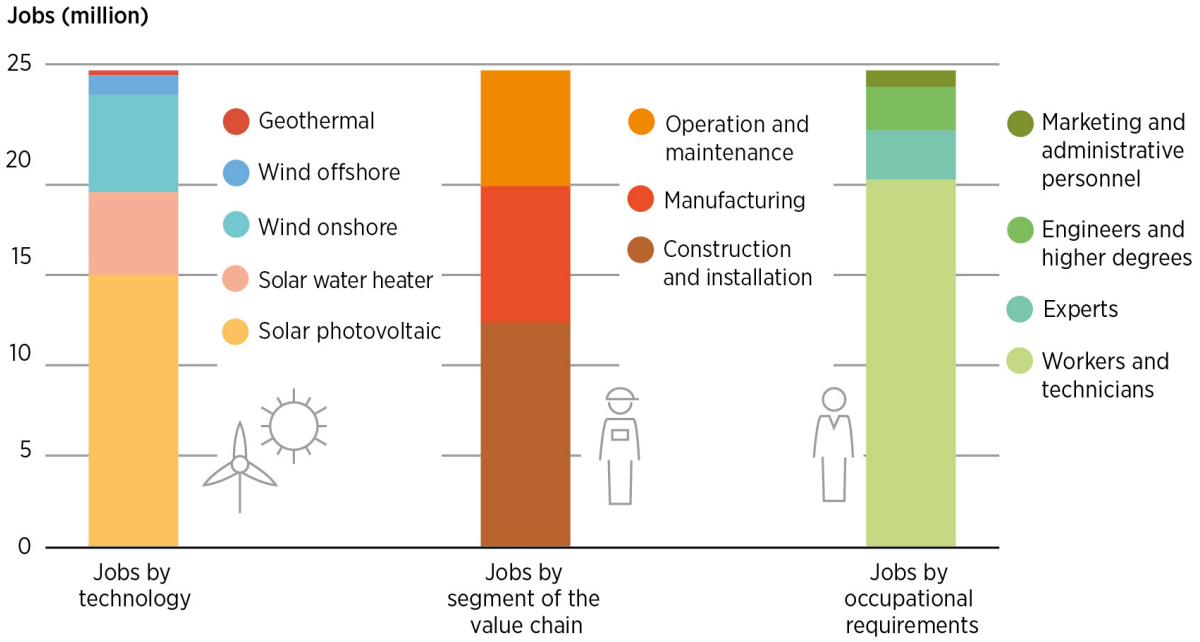
When incorporated into stimulus and recovery plans, the energy transition can represent a far-sighted investment. The pandemic has unveiled inadequacies in the current system, both in terms of reliance on fossil fuels and massive gaps in energy access, which in turn affect health care, water supply, information and communication technologies and other vital services. Recovery packages focused on the energy transition can help to overcome the economic slump and create much-needed jobs, both for the short-term and beyond. Beyond renewables and decarbonization, investments in the energy system in the wake of the COVID-19 pandemic can pave the way for equitable, inclusive and resilient economies.

Short-term objectives (recovery phase): building resilience and COVID-19 recovery, ensuring that actions support a just transition and energy access for all

Recovery measures over the next three years can either trigger a decisive shift toward resilient energy systems or lock in unsustainable practices for many years to come, jeopardizing efforts to achieve SDG 7 and Paris Agreement targets. A holistic policy approach – rooted in climate-safe energy development, yet also focused on short-term imperatives – would reap multiple benefits and help set the stage for a just transition.

Socio-economic benefits could accrue in the first three years of targeted recovery programmes, while simultaneously accelerating the energy transition. According to IRENA, if the required investment were mobilized and nimble recovery policies put in place, the transition would boost global GDP by 1% more than current plans, on average, over three years (IRENA, 2020). Further, each million dollars invested in renewables or energy flexibility would create at least 25 jobs, while each million invested in efficiency would create about 10 jobs. With the added investment stimulus, energy transition-related technologies

FIGURE 1. DEEP-DIVE ANALYSIS: JOBS CREATED IN CONSTRUCTION AND INSTALLATION, AND FOR WORKERS AND TECHNICIANS



Source: Jobs in selected renewable energy technologies by value chain segment and occupational category in 2050 (IRENA, 2020)

would add 5.5 million more jobs by 2023 than currently planned. The socio-economic impacts of the energy transition will differ between regions, depending on demographics, national economies, and relative stages of development. Ambitious energy transition strategies can bring a wide range of benefits in both developed and developing world, so any short-term action should consider wider priorities for forward looking, resilient economies and societies.

Mid-term and long-term priorities: 2030 Agenda and net zero by 2050

Investing in the energy transition will also have impacts in the long term – including job creation, increased GDP, lower air pollution, and better health – as well as contributing to phasing out coal, achieving universal access for all, and ensuring a just and resilient transformation. According to IRENA, an energy transition based on substantial growth in renewable energy power generation, electrification of end-use sectors, and improvements in energy efficiency will have long-term impacts.

Funding to expand access to modern forms of energy, including clean cooking, must be strengthened to achieve SDG 7. Investments in electrification and clean cooking should be scaled up to become a central pillar of the global recovery package. The socio-economic dividends of reliable, sustainable and affordable energy access are substantial and underpin a just and inclusive recovery process, while contributing to multiple SDGs.

[34] In India, implementation and enforcement of all buildings-related policies occurs at the city level but is, to a large extent, guided by model regulations and rules provided by the national and state authorities (WRI India, 2019).

SDG 7 PARTNERSHIPS FOR CLIMATE ACTION AND SDG 13

In the last few years, an increasing number of global, regional, and national initiatives have emerged that promote the energy transition as a solution to climate change, while galvanizing cooperation at all levels. Many of these initiatives are using the upcoming COP 26 as a focal point for setting the world on a climate-safe pathway.

Marrakech Partnership for Global Climate Action

Under the leadership of the High-Level Climate Champions, the Marrakech Partnership for Global Climate Action (UNFCCC (a)) supports implementation of the Paris Agreement by enabling collaboration between governments and cities, regions, businesses and investors. Promoting higher ambitions for all stakeholders to collectively strive for the 1.5°C goal and a climate-neutral and resilient world, the High-level Champions have led the development of Climate Action Pathways for several sectors, including energy. The Energy Pathway provides an overview of the transformational actions and milestones needed for the power sector, including for green hydrogen, coal phase-out, end-uses, and those needed for the oil and gas sectors. The pathways highlight the synergies and interlinkages across thematic and cross-cutting areas, and guide all actors to take an integrated approach to achieve 1.5°C by 2050.

UN Secretary General's High-level Dialogue on Energy

The UN Secretary General is convening a High-level Dialogue on Energy during the 76th Session of the UN General Assembly in September 2021. The Dialogue is mandated by United Nations resolution 74/225, which *"invites the Secretary-General to convene a high-level dialogue in 2021 to promote the implementation of the energy-related goals and targets of the 2030 Agenda for Sustainable Development."* The last time the General Assembly mandated a high-level meeting on energy was in the wake of the oil crisis in 1981. Energy is again high on the global agenda, clearly demonstrating its importance in the global fight against climate change. The preparations for the Dialogue include action across different themes, including: energy access; energy transitions; energy action to achieve other SDGs; innovation, technology, and data; and finance and investment.

COP 26 Energy Transition Council

The COP 26 Energy Transition Council, co-chaired by the UK Government and SEforAll, aims to bring together global leaders from politics, finance and technology, to work together to accelerate the global transition from coal to clean power as part of a green economic recovery. The Council focuses on improving the international offer of support for clean power to developing countries, so that it becomes the most attractive option of new power generation, and enabling coal-intensive economies to equitably transition from coal. The overall purpose of the Council is to facilitate an effective dialogue between countries that are looking for greater support in their energy transition and the major international actors offering that support.

SIDS Lighthouses Initiative

The Small Island Developing States (SIDS) Lighthouses Initiative coordinated by IRENA, is a framework for action to support SIDS in their transformation from predominantly fossil-based power to renewables-based and resilient energy systems, through the implementation of enhanced NDCs (IRENA (a)). The initiative addresses all elements of the energy transition, from policy and market frameworks

to technology options and capacity building. It brings together 36 SIDS as well as 29 other partners, including regional and international organizations, development agencies, private companies, research institutes and non-profit organizations.

Three Percent Club for Energy Efficiency

The Three Percent Club is comprised of countries, businesses and international organizations committed to work together to drive a three percent global increase in energy efficiency each year – a move that can help limit climate change and increase global prosperity (UNFCCC (c)). Launched at the UN Climate Action Summit in 2019, the Three Percent Club builds on IEA's research showing that the right efficiency policies could deliver over 40% of the emissions reductions needed to reach the goals of the Paris Agreement, without new technology.

ECA's SDG 7 Initiative for Africa

Many developing countries have identified clean energy actions in their NDCs, based on conditional and unconditional climate finance. In light of tightening fiscal space, it is necessary to mobilize additional investments from the private sector. The Economic Commission for Africa's SDG7 Initiativeaims to align the interests of governments, the private sector, project developers and development partners to accelerate clean energy investments for expanded access and enhanced climate action in Africa. It is based on the three pillars of (i) sustainability - countries commit to revise their NDCs to increase bankable clean energy actions, (ii) governance - countries commit to addressing policy and regulatory barriers to investment, and (iii) finance - sourced from capital markets (UNECA (a)).

CALL FOR ACTION TOWARDS 2025 NDC REVIEW, 2030 AGENDA, AND NET ZERO BY 2050

To ultimately succeed, government actions must be in full adherence to the principles of sustainability, resilience, and human solidarity. Economic stimulus plans and measures should be consistent with the 2030 Agenda, the Paris Agreement, and plans for their implementation, such as those outlined in the Addis Ababa Action Agenda on Financing for Development. The following are some of the measures that can help align energy and climate action:

Green recovery

Beyond renewables and decarbonization, energy investments undertaken as short-term responses to the pandemic's effects can support increasingly ambitious longer-term targets for renewables and efficiency in all sectors, as well as reinforcing enhanced climate pledges.

Coal phase-out, green hydrogen economy, energy storage innovation

Post-COVID-19 stimulus packages and related policies could promote the scaling up of transition-related investments in heating and cooling innovations, and research, and demonstration projects to support less mature technologies, such as green hydrogen. The recovery should focus on clean and renewable technologies, including flexibility solutions such as energy storage, and prioritize phasing out coal.

Holistic policy making to create jobs and promote a just transition

Recovery programmes also offer opportunities for comprehensive approaches to ensuring that supply chains, enabling infrastructure and skills are in place when investments are made. Such a holistic approach would allow governments to tailor investments to meet a range of domestic policy agendas and ensure a just and orderly transition that leaves no one behind.

Channelling finance towards clean solutions

Mobilizing the finance needed to scale up investments in renewable energy and energy efficiency requires swift and decisive policy measures in a number of areas. Public finance must be shifted away from fossil fuels and towards energy transition-related investments, and mobilized to trigger investment in enabling infrastructure for renewable energy, such as smart grids and EV charging stations. Public international finance needs to be massively scaled up to fund conditional NDC targets, and to support developing countries in implementing climate actions promoting renewable energy and energy efficiency solutions. Debt relief initiatives, such as the Debt Service Suspension Initiative or debt for climate swaps, should be expanded and used to free up resources for action.

The strategic use of public finance could leverage infusions of private capital to support the energy transition. Financial markets are already noticing the energy transition and reallocating capital towards green energy technologies, such as renewables. For instance, in 2020, the S&P Clean Energy Index of clean energy stocks grew by 138%, as compared to S&P Energy Index of fossil fuels which declined by 37% (IRENA, 2021).

International cooperation and global solidarity

The pandemic crisis demonstrates the axiom that no country exists in isolation. Resolving the COVID-19 crisis, like resolving the climate crisis, requires strong international cooperation. Through a vigorous multilateral approach, the responses can draw on the capabilities and resources of countries around the world, making certain that lessons and solutions are shared, and ensuring that no region, country or community is left behind. The entire world now needs to act in solidarity through a re-set of global systems to ensure a stronger multilateral architecture that can restore and sustain growth, finance the global commons and ensure a strengthened global financial architecture.

Energy as a resilient system of the 21st century

Clean and sustainable energy is currently high on the global agenda as both a solution to climate change and opportunity to recovery from the pandemic. This is not just about preventing carbon from entering the atmosphere, but also about building back better.

REFERENCES

IPCC, 2018. *Special Report on Global Warming of 1.5°C,* https://www.ipcc.ch/sr15/

IRENA, 2021. *World Energy Transitions Outlook: 1.5C Pathway (Preview)* https://www.irena.org/publications/2021/March/World-Energy-Transitions-Outlook

IRENA, 2020a. *The Post-COVID Recovery: An agenda for resilience, development and equality* (2020), https://irena.org/publications/2020/Jun/Post-COVID-Recovery

IRENA, 2020b. Global Renewables Outlook Energy Transformation 2050 (2020), https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2020/Apr/IRENA_Global_Renewables_Outlook_2020.pdf

IRENA (a) https://islands.irena.org/

UN, 2021. https://www.un.org/en/conferences/energy2021

UNECA, 2020. https://www.uneca.org/%E2%80%9Csdg7-initiative-africa%E2%80%9D-accelerating-clean-energy-investments-access-and-climate-ambition-africa

UNFCCC (a). https://unfccc.int/climate-action/marrakech-partnership-for-global-climate-action

UNFCCC (b). https://unfccc.int/climate-action/marrakech-partnership/reporting-and-tracking/climate_action_pathways

UNFCCC (c). https://climateaction.unfccc.int/views/cooperative-initiative-details.html?id=118

SECTION 3.13

INTERLINKAGES BETWEEN **ENERGY AND SUSTAINABLE USE OF LAND (SDG 15)**

CONTRIBUTING ORGANIZATIONS:
FAO, THE EUROPEAN COMMISSION, CCA AND THE PERMANENT MISSION OF THE UAE TO THE UN

Summary/Key Messages

INTERLINKAGES BETWEEN SDG 7 AND SDG 15

Energy production is just one possible use of land, and competing uses need to be considered when planning the location of energy systems. Links between energy and land use can be direct, or indirect (for example, land use for energy in one place can cause land use changes in another place).

Fostering sustainable synergies between energy and land use faces several challenges, including:

(a) insufficient coordination between land use and energy-related bodies, which results in lack of coherence in related policies, regulations and programmes; and

(b) unplanned negative land impacts related to certain types of renewable energy due to their relatively high land footprint.

Land use planning related to energy is influenced by climate features, production uses and water resources, and therefore has to adequately consider these factors.

Bioenergy systems can improve soil conditions and contribute to land rehabilitation through the application of by-products such as fertilizer from biogas, and biochar from biomass pyrolysis.

Non-renewable energy systems present far greater environmental risks than renewable energy ones. However, renewable energy can also cause environmental damage, including through the unsustainable mining of minerals needed for manufacturing renewable energy technologies, and in poorer rural areas, damage to forests due to unsustainable collection of wood fuel.

Priority actions proposed to ensure the sustainability of actions related to the close and sometimes complex linkages between energy and land use:

- Plan land-based sustainable energy systems starting not from the energy side but from the land use side, in order to reduce the energy land footprint through increased land productivity, and address conflicts between multiple uses of land. Solutions include co-location of different types of energy with other land uses, and the use of bioenergy by-products to increase the productivity of agricultural land.
- Promote modern and clean energy cooking solutions as effective tools in the fight against environmental degradation and biodiversity loss.
- Adopt a comprehensive planning approach – such as the CLEW framework, which considers climate, land, energy and water in an integrated way.
- Develop a set of indicators that reflect the possible synergies between renewable energy and sustainable land use, starting with the quality of implementation of proven and agreed sustainable land use practices.
- Develop policies that reward renewable energy installations with low land impacts, and tax GHG emissions from land use rather than renewable energy, to reduce the risk that climate policies increase land needs for such types of energy.

THE INTERLINKAGES BETWEEN SDG 7 AND SDG 15

Land use matters

Energy is just one possible use of land. For this reason, as regards land-based energy, one has to give due consideration to the following:

- Address possible competing and complementary uses of land in an integrated, landscape-based approach when carrying out land use planning.
- Consider land tenure and governance issues, as these are key to deciding on how to sustainably use land.

Energy land use footprint

While more land is needed to produce one unit of energy from renewable energy than from fossil fuels (except regarding bioenergy from organic residues and waste), the situation changes when (a) one considers the land footprint of the energy distribution infrastructure, and (b) the combination of different types of renewable energy on the same piece of land (co-location) (Fritsche et al., 2017).

Energy used for the improvement of agricultural land productivity through mechanization leads to higher yields and more sales of agricultural products. One risk associated with this is a possible rebound effect – i.e., that more land is converted to agricultural use to provide additional income for farmers (Phalan et al., 2016).

Energy can hinder land use sustainability

Fossil fuel use creates higher environmental, climate and health risks than renewable energy, affecting soils, water and air (Fritsche et al., 2017). Land clearing, mining (including extracting raw materials for renewable energy) and energy infrastructure development can all increase deforestation, water scarcity, pollution, biodiversity loss, GHG emissions, land degradation and desertification, and are especially damaging in the case of fossil fuel-based energy systems.

However, one should give due consideration to the fact that mining of critical materials needed for renewable energy and related technologies can cause significant environmental damage. In addition, as regards traditional bioenergy, unsustainable gathering of wood for fuel not only contributes to climate change, but can also lead to forest and land degradation, resulting in mudslides, damage to watershed, loss of biodiversity and desertification, putting further pressures on regional food security and agricultural productivity (Bailis et al., 2017).

Energy can improve land use sustainability

A lot of energy is needed for agricultural inputs aimed to improve crop yields (e.g., the manufacturing of fertilizers and pesticides, and irrigation and farm machinery), however the result is a reduced land food footprint, that is, less land needed to produce the same amount of food.

Renewable energy systems can be implemented where not many other land uses are possible, for example, placing wind or solar installations in deserts.

Bioenergy can improve soil fertility and therefore support soil carbon sequestration and land rehabilitation in two ways:

- The use of by-products of bioenergy, such as biofertilizer from biogas and biochar from biomass gasification (Global Bioenergy Partnership, 2020).
- The use of energy crops where food crops cannot be grown.

This role of bioenergy (especially compared to other types of energy) is particularly important for farmers and for land rehabilitation in the context of the UN Decade of Natural Resources Rehabilitation.

Linked to the above, waste-to-energy can also play a key role in reducing needs related to land-based energy.

Bioenergy can reduce land encroachment by invasive plant species if those plants are used as feedstock for bioenergy systems (Fritsche et al., 2017).

Transitioning from traditional cook stoves and fuels to modern energy cooking solutions can reduce environmental degradation and biodiversity loss related to unsustainable wood fuel harvesting.

Sustainable energy could also contribute to the development of alternative livelihoods, such as eco-tourism, which can reduce the pressures on land.

Need to consider other factors that influence energy / land use links

Water: Particular concerns include the high water use and pollution from the fossil fuel industry (including mining, extraction, transformation, and spills and accidents related to certain technologies such as fracking), plus the role of energy in irrigation, and the possible impact of large dams on land use.

Climate: The potential impacts of climate change and variability affect the feasibility of implementing land-based renewable energy

KEY CHALLENGES FOR CREATING SYNERGY

Challenges in measuring and addressing indirect land use changes - Energy production in one place can cause land displacement and ecosystem loss in another place.

Insufficient coordination between land use and energy-related bodies (in governments, and relevant units in international organizations). This leads to insufficient coherence between land use and energy (with the exception of biofuels) in:

- Energy and land use governance (policies, regulations, programmes and institutions).
- Private sector investments.
- Metrics used to measure SDG 7/ SDG 15 links (i.e., being too simplistic (area of land/unit of energy output) to reflect synergies between energy and land uses.

The above can result in lack of consideration to:

- Possible conflicts between different land uses in the location of energy systems and distribution infrastructure (except possibly for biofuels).
- Possible environmental impacts of large-scale energy developments, including regarding renewable energy (Global Bioenergy Partnership, 2020).
- Possible synergies between energy and other land uses, including integrated food-energy systems such as agroforestry, or agro-photovoltaic systems in renewable energy programmes (Weselek, A. et al., 2019).

Unforeseen land impacts from the promotion of renewable energy - Given that, taken individually, renewable energy systems have a larger land footprint (area needed to produce one unit of energy) than fossil fuels, policy measures aimed at promoting renewable energy, such as carbon taxation, might lead to more land being needed to produce energy from renewables than from non-renewables (Phalan, 2016).

HOW TO ADDRESS THESE CHALLENGES

Plan land-based energy systems looking not just from the energy side but also from the land use side, in order to reduce the energy land footprint through increased land productivity, and address conflicts between multiple uses of land. Solutions to achieve this include:

- Co-locating different types of energy (which improves energy efficiency) or combining energy and other land uses on the same land (which improves land use efficiency).
- As regards agriculture, support sustainable yield increases while addressing rebound risks through zoning for energy locations combined with incentives to conserve natural resources such as forests, and sustainably manage land through integrated landscape approaches.

- Linked to the above, give due consideration to the possibility of bioenergy to improve soil quality and rehabilitate degraded land.

Reduce the risk of energy-related land degradation through:

- Prioritization of the use of already converted land, bare land areas or areas that cannot be restored as locations for energy systems.
- Sustainable management of bioenergy feedstocks in grasslands and forests, linked to financial incentives.
- Promotion of modern energy cooking solutions as effective tools in the fight against environmental degradation and biodiversity loss.
- Reduced production and use of fossil fuels, replaced by sustainable and renewable sources.
- Promotion of energy and resource efficiency, and appropriate waste management.

Develop a set of indicators that reflect the possible synergies between renewable energy and sustainable land use (including co-location of different types of renewable energy with food production, energy for yield increases and food loss reduction), starting with the quality of implementation of sustainable land-energy practices (Fritsche et al., 2015). Another set of indicators would relate unsustainable energy sources with negative impacts on land and ecosystems.

Adopt a Climate-Land)-Energy-Water (CLEW) approach for medium to large-scale energy developments, given that land, energy and water are the foundational resources of a country, and have a number of complex interactions with a changing climate.

Policy measures, including:

- Incentives for lowered land impacts from renewable energy, including clean cooking solutions as well as integrated landscape approaches to land and energy use (see Kiesecker et al., 2020).
- Taxes based on GHG emissions from land use rather than cap and trade, to reduce the risk that climate policies will increase land needs for energy (McDonald et al., 2009).

CASE STUDIES TO DEMONSTRATE EXAMPLES OF IMPACTS OR LESSONS LEARNED

Forest landscape restoration through a sustainable wood energy value chain in Ghana (Global Bioenergy Partnership, 2020). This project aims to deploy biochar technology in Ghana. This involves the production of pellets from forestry/agricultural residues, improved stoves/kilns for efficient production of cooking energy, and the production and use of biochar. Biochar is a bioenergy by-product that can improve soil fertility and crop yields and restore toxic and degraded forestry and/or agricultural soil. This project was implemented by the non-governmental organization ASA from 2009 to 2017, and has continued as a regular activity of ASA since then. This integrated food-energy system is replicable across the country, and in other countries where maize is cultivated, as its knowledge and financial requirements are not significant.

Balancing land requirements with the potential for renewable energy – The case of crop residues in India (FAO, 2018): Crop residue burning causes significant problems in terms of air pollution, which has severe implications for the environment and for human health. The winter burning of crop residues, especially the rice straw in Punjab and Haryana, has been identified as a major challenge for human health and pollution in the country. The problem is multifaceted and requires collaborative technical interventions across all core disciplines, including agriculture, environment and energy. There is a need to identify possible feasible solutions that can lower GHG emissions from the burning and find alternative uses for the residues, such as using crop residues for soil amendment, or as raw material for the production of goods, or for the production of energy.

This case is an example in which generation of crop residues from the land can be used to produce energy, net of soil requirements. The amount of crop residues produced in this case is very large, reaching an average of 11 million tonnes in 2016-2017, and cannot be totally used for soil amendment. The net amounts can be used to produce renewable energy in the form of bioenergy. This shows how land requirements can be coupled with renewable energy production for a more circular approach to land use, in an integrated manner that considers different options for using agricultural residues.

Improving land use productivity /reducing renewable energy land footprint through the co-location of RE types or of RE and other land uses – for instance, through agro-photovoltaics (APV) (Weselek, et al., 2019). The application of APV systems offers a number of opportunities, which differ depending on regional and climatic conditions. The real added value of the APV technology is that it enables the simultaneous production of food and energy, providing undeniable economic benefits for farmers, with additional potential synergistic effects. This is of particular interest in densely populated industrial countries, where the expansion of renewable energies is becoming increasingly important, but productive farmlands need to be preserved. APV can be an important component of future agricultural systems, addressing some of the major current and prospective societal and environmental challenges, such as climate change, global energy demand, food security and land.

Integrated planning – the case of agro-ecological zoning for sugarcane ethanol in Brazil (ELLA, 2020). One key strategy the Brazilian government adopted was to provide guidelines for land allocation and rural development policies regarding sugarcane ethanol through the National Agro-Ecological Zoning of Sugarcane (Zoneamento Agroecologico da Cana de Açúcar), commonly known as ZAE Cana. This policy instrument was the first of its kind to adapt principles of zoning to the production of biofuel in Brazil. Through ZAE Cana, the government has been able to drive expansion in the areas most favourable for cultivation in terms of potential output and least irrigation needed.

At the same time, to reduce environmental harm, certain areas that are environmentally fragile or possess high biodiversity are designated as off-limits for ethanol crops. Importantly, ZAE Cana includes incentives and clear mechanisms for monitoring, such as requirements for compliance before financial institutions will issue loans. Brazil's experience shows that competition between food and fuel production and the loss of fragile native biomes can be avoided through effective implementation and enforcement of zoning, especially when coupled with incentives for compliance. Evidence suggests that, if implemented from the onset of ethanol expansion, ZAE Cana could have preserved native forests and increased sugarcane production by incentivizing cultivation on more productive land.

TARGETS, INDICATORS AND DATA

The two following proposals could improve the tracking of energy-land linkages:

- The systemic land use indicator approach proposed by the GLOBALAND project (Fritsche et al., 2015). One starts with known and accepted sustainable land use practices and localizes their validation by local actors and according to local agro-ecological conditions. This good practice step could be then followed by more quantitative impact monitoring and evaluation. The interest of this approach lies in (a) the fact that it starts with agreed good practices, which makes the indicator approach quite doable and cost effective, and (b) the final selection of good practices is made based on local contexts and local stakeholders' decisions. This makes the monitoring and evaluation process much more useful, relevant and acceptable.

- Development of indicators that reflect possible synergies between energy and land use, including energy efficiency/co-location with different types of renewable energy, land productivity/multiple uses of land besides energy (e.g., integrated food energy systems), energy production's role in yield increases, and sustainable wood energy to rehabilitate forestland.

REFERENCES

Bailis et al., 2017. Getting the numbers right: revisiting woodfuel sustainability in the developing world. Environ. Res. Lett. 12 (2017) 115002. https://iopscience.iop.org/article/10.1088/1748-9326/aa83ed/pdf

CLEWs – Climate, Land (Food), Energy and Water Strategies. http://www.osimosys.org/

ELLA, 2020. Sugarcane agro-ecological zoning: Greening the expansion of ethanol. https://assets.publishing.service.gov.uk/media/57a08a03e5274a31e000039a/130520_ENV_BraEthPro_BRIEF4.pdf

FAO, 2018. Getting bioenergy from crop waste instead of burning them. http://www.fao.org/energy/news/news-details/en/c/1144592/

Fritsche, U. et al., 2015. Global Sustainable Land Use: Concept and Examples for Systemic Indicators. GLOBALANDS Working Paper 3.3. http://iinas.org/tl_files/iinas/downloads/land/IINAS_2014_GLOBALANDS_WP_33_Systemic-Indicators.pdf

Fritsche, U. et al., 2017. Energy and Land Use - Global Land Outlook Working Paper. http://www.globalbioenergy.org/uploads/media/1709__UNCCD_IRENA__Energ__and_Land_Use..pdf

Global Bioenergy Partnership, 2020. Positive Relationships between Sustainable Wood Energy and Forest Landscape Restoration, June 2020. http://www.globalbioenergy.org/fileadmin/user_upload/gbep/docs/AG4/AG4_Collection_of_examples_links_sust._wood_energy_and_FLR_June2020.pdf

Kiesecker, J. et al., 2020. Renewable energy and land use in India: A vision to facilitate sustainable development, Sustainability 2020 (1) 281. https://www.mdpi.com/2071-1050/12/1/281/htm

McDonald et al., 2009. Energy Sprawl or Energy Efficiency: Climate Policy Impacts on Natural Habitat for the United States of America. PLOS One. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0006802

Phalan, B. et al., 2016. How can higher yield farming help to spare nature? Science, 20 2016, Vol 351, Issue 6272. https://science.sciencemag.org/content/351/6272/450/tab-e-letters

Weselek, A. et al., 2019. Agrophotovoltaic systems: applications, challenges, and opportunities. A review. Agronomy for Sustainable Development volume 39, Article number: 35. https://link.springer.com/article/10.1007/s13593-019-0581-3

SECTION 3.13

INTERLINKAGES BETWEEN **ENERGY AND PEACEFUL AND INCLUSIVE SOCIETIES (SDG 16)**

CONTRIBUTING ORGANIZATIONS:
UNITAR, IMPERIAL COLLEGE LONDON, IOM

Summary/Key Messages

SDG 7 and SDG 16 intersect at the 'Triple Nexus' where humanitarian, development and peacebuilding objectives converge. The need for durable solutions is particularly pronounced in fragile contexts and situations of displacement where energy access in affected populations is well below SDG 7 targets, and organizations rely heavily on fossil fuels for electricity.

Recommendations:

Moving forward, the following should be considered, which could help to achieve SDG 7 while contributing to SDG 16:

Provide evidence for policy making through dedicated research and data collection. Better data collection and sharing will be necessary to advance the use data for quality programming. Improving data availability within and between organizations can inform the design of sustainable energy programmes and support the involvement of the private sector.

Overcome silos and develop comprehensive solutions. Renewable energy expertise is limited in most fragile and displacement settings, and current projects are relatively small scale. Expanding energy expertise, with sensitivity to the nuances of fragile situations, is necessary to catalyse future project development. Solutions that cut across humanitarian, development and peacebuilding objectives could support better integration of sustainable energy in programming.

Integrate the energy needs of displaced and conflict-affected communities into global, national and local policies. A conducive policy environment is necessary for sustainable energy programmes. UN Member States should implement global frameworks and integrate displaced and conflict-affected people into national and local energy planning. Government, donor and humanitarian agencies should contribute to sustainable energy objectives and work with development and peacebuilding partners as early as possible to support durable solutions.

Focus on innovative financing mechanisms to unlock private sector partnerships. Multi-year planning can help unlock private sector investments, and adjusting legal and financial frameworks can help overcome the constraints of one-year budget cycles. These could reduce the reliance on traditional annual donor funding. UN Member States and humanitarian, development and peacebuilding organizations should develop policies geared towards making private sector partnerships feasible and desirable to operationalize.

To support these efforts, the Global Platform for Action for Sustainable Energy in Situations of Displacement (GPA) was established in 2018 (UNITAR, 2018). The GPA is a non-binding platform that provides a collaborative agenda and supports concrete actions to ensure that all people and communities affected by displacement will enjoy safe access to affordable, reliable, sustainable, and modern energy services by 2030. The Council on State Fragility and the g7+ group, organizations that aim to bring together countries affected by fragility, have highlighted sustainable energy access as a key element in local peacebuilding and have issued a call to action for scaling energy access in fragile contexts (Logan et al., 2021).

THE INTERLINKAGES BETWEEN SDG 7 AND SDG 16 IN FRAGILE AND DISPLACEMENT SETTINGS

The Humanitarian-Development-Peace Triple Nexus

On taking his oath of office, Secretary-General António Guterres remarked that "humanitarian response, sustainable development and sustaining peace are three sides of the same triangle" (UN, 2016). This 'Triple Nexus' is where humanitarian, development and peace objectives converge (Giæver, et al., 2020), but each component is necessarily governed by different laws, mandates, financing structures and administrative regimes. Humanitarian action – based on the principles of humanity, impartiality, neutrality and independence – must remain needs-focused and non-discriminative, whereas peace operations might include political or military interventions in ongoing conflicts (Sommaruga, 1997). Peacebuilding, however, can focus on strengthening national capacities for conflict management and laying the foundations for sustainable peace and development; this is often highly context-specific and while the risk of politicization is present, it is relatively low (Giæver, et al., 2020).

The Sustainable Development Goals (SDGs) provide a comprehensive framework to analyse how humanitarian programming can contribute to long-term development, and where solutions are reliant on building and sustaining peace in order to be truly sustainable. This Policy Brief explores the interlinkages between SDG 7 and SDG 16 which are particularly clear in fragile states, situations of internal displacement and refugee settings. Access to sustainable energy for displaced people is well below SDG 7 targets, with an estimated 80% of those residing in camps having Tier 0 cooking energy access (Lahn et al., 2015). Meanwhile 86% of the people without access to electricity worldwide are in fragile states affected by conflict and lack of security (Logan et al., 2021). Sustainable access to energy (SDG 7) can contribute directly and indirectly to peacebuilding efforts by improving wellbeing,

and offering opportunities for community development. Peace, justice and strong institutions (SDG 16) can provide the foundations for successful sustainable energy programmes, through more inclusive and representative decision making (Giæver, et al., 2020). Framing energy decisions in terms of justice can reduce conflicts between individual and community values, improve the governance of energy projects, and more equitably distribute the benefits they offer (Fuso Nerini et al., 2018). Sustainable energy programmes in displacement settings and peacebuilding contexts have further interlinkages with other migration-related targets (for example, SDG 10.7, 8.8, 10.c and 17.3) and those aiming to reduce drivers of displacement (such as SDG 11.5 and SDG 13.1) (Huber and Mach, 2019).

KEY CHALLENGES FOR SYNERGY BETWEEN SDG 7 AND SDG 16 IN FRAGILE AND DISPLACEMENT SETTINGS

Achieving SDG 7 for each topic under the Triple Nexus is challenging.

Humanitarian agencies do not currently have the means to prioritize energy beyond addressing the basic needs of persons of concern, such as providing food, water and medical assistance. Meanwhile, a lack of policy recognition for the situations of displaced people, and their potential integration within the host society, limits their incorporation under national programmes for energy access and so inhibits inclusion of their needs in long-term development planning and peacebuilding efforts. In fragile contexts, the governance and investment frameworks that would support sustainable development are very limited, and the general lack of access to energy and development creates conditions that lead to the structural persistence of instability (Logan et al., 2021).

Sustainable energy projects for displaced people can risk perpetuating existing inequities. Host communities often have levels of energy access that are no higher than those of displaced people, but the displaced people may receive more attention from on-site non-governmental organizations (NGOs). Cultural or societal attitudes towards marginalized groups, within and between host and displaced communities, can influence what energy is used for who gets access to it, and potentially undermine peacebuilding efforts (Giæver, et al., 2020). Understanding and overcoming these potential issues requires stronger coordination between UN agencies, NGOs and government organizations working at the Triple Nexus, and should include meaningful participation by affected populations in the project design process to build local support for sustainable energy projects.

Historically, both humanitarian responses and peace operations have had planning and budgetary time horizons of one year at most, enforcing their supposed temporality. Despite differences in the funding and administrative structures of humanitarian and peacekeeping activities, short-term planning has led both to continue relying on fossil fuels for energy provision and logistics, with diesel being the default. The relatively high capital investments required for renewable energy systems, and their longer payback times, do not fit well with the available financing mechanisms and structures governing UN agencies and NGOs. As humanitarian and peace operations are among the main mechanisms through which the international community engages with fragile states, coordinated long-term financing and programming should be considered in addressing their energy-focused development goals.

THE UN'S NEW WAY OF WORKING (NWOW) CALLS FOR HUMANITARIAN/DEVELOPMENT COLLABORATION

Launched at the World Humanitarian Forum in 2016, the NWOW urges humanitarian and development actors to work together to reduce humanitarian relief needs, mitigate risks and reduce vulnerabilities. The NWOW also encourages longer-term planning and, in doing so, underscores the importance of reinforcing local systems, and shifting to more predictable financing. The framework provided by the NWOW could support cooperation between sectors and overcome short-term budget cycles, two prerequisites for investments in sustainable energy to be considered systematically in fragile and displacement settings. Other frameworks, such as the Global Compact for Safe, Orderly and Regular Migration (GCM) and the Global Compact on Refugees (GCR), demonstrate the political will of UN Member States to collectively address migration and refugee issues and lend support to tackling the energy and environmental considerations resulting from, or contributing to, population movements.

Replication of the energy-related commitments of the global policy frameworks at the national level could also benefit the 50.8 million people currently identified as internally displaced (Internal Displacement Monitoring Centre, 2021). The High-Level Panel on Internal Displacement, established by UN Secretary-General in 2019, develops recommendations to governments, humanitarian organizations, and others about steps that should be taken to prevent, respond, and find durable solutions for internal displacement. The Triple Nexus is embedded in these policy frameworks and initiatives and, despite limited direct references to energy, they offer entry points to advance SDG 7 via improved and better-integrated governance and coordination (Mach, 2019).

UN Member States adopting the Triple Nexus approach at a national level will encourage the implementation of SDG 7 in displacement contexts and other fragile situations. Direct pledges, such as those made on energy, environment and climate change by 22 Member States at the first Global Refugee Forum in 2019 (UNHCR, 2019a), provide greater leadership and tangible support to strengthen clean energy access within humanitarian and development responses.

Governments that host displaced populations may be able to directly incorporate the energy needs of affected communities into their national energy and development strategies. In Jordan, for example, coordination between the government, humanitarian agencies and private donors led to the world's first solar farm in a refugee camp; it currently supports the electricity needs of 20,000 refugees by providing additional power to the national grid, in line with the country's development objectives (UNHCR and IKEA Foundation, 2017). In fragile or emergency contexts, however, humanitarian and peacebuilding actors are crucial partners in building a conducive environment for energy programming. In either case, development actors should be involved as early as possible to ensure that both immediate and longer-term needs are met, in line with the vision of the NWOW (Huber and Mach, 2019).

Private sector engagement

Complex organizational frameworks, short-term planning and a lack of policy and regulatory support hinder engagement between humanitarian actors and the private sector. Commercial organizations usually require longer-term commitments both for large-scale infrastructure, such as for renewable electricity systems to power humanitarian operations, and also to develop viable energy markets for displaced people and host communities, such as for domestic solar products. Investments in sustainable energy have clear financial and environmental advantages, but come with a perception of permanence which has been difficult to overcome.

Multi-year planning by humanitarian agencies could facilitate private sector investment in sustainable energy and help to de-risk projects. This shift in thinking under the NWOW, from short-term response to long-term development, could unlock opportunities for innovative financing mechanisms to cover the upfront investments in energy technologies or to enable organizations to procure energy as a service offered by specialized sustainable energy companies – delivering sustainable benefits to both affected populations and organizations serving them. This could also capitalize on the growing attention to the impacts of energy practices in fragile states, and demonstrate their potential to leverage organizational activities to provide sustainable energy legacies for local communities (Mozersky and Kammen, 2018; Holt et al., 2021).

Pioneering examples are demonstrating how this can become a reality. In 2020, private sector developers installed a solar mini-grid system to provide electricity to the humanitarian hub run by the International Organization for Migration, which hosts organizational staff in Malakal, South Sudan. This is estimated to have reduced diesel consumption by 80-90% and offset 800 tonnes of CO_2 (Giæver et al., 2020). The solar system was made possible by an upfront grant, which leveraged further private investment. Innovative financing approaches are also being developed. For example, Peace Renewable Energy Credits (P-RECs), which provide accredited links between corporate renewable energy procurement and the social and environmental benefits of sustainable energy projects in fragile states, have been used to finance a project in the Democratic Republic of the Congo (Energy Peace Partners, 2021).

TARGETS, INDICATORS AND DATA

Tracking the synergy between SDG 7 and SDG 16 in fragile and displacement settings

Access to affordable, reliable and modern energy services for displaced people, and communities affected by crisis or conflict, must be ensured in order to achieve SDG 7 (7.1). Organizations providing support to affected populations have substantial opportunities to replace diesel generation for operational facilities with renewable alternatives (7.2). Further gains are possible from energy efficiency measures (7.3), behaviour changes, and longer-term financial investment and technological solutions (Grafham and Lahn, 2018). These actions are also in line with SDG 13 on the need for urgent climate action.

Fragile situations are susceptible to increased rates of conflict-related violence, as well as sexual and gender-based violence (16.1 and 16.2). Some of this violence could be decreased, however, by reducing women's need to collect cooking fuel from the local environment, or by improving public lighting. Greater coordination between organizations on energy issues can support more effective, accountable and transparent institutions (16.6) in overcoming the complexities of implementing long-term sustainable energy infrastructure. Engaging with affected communities during energy decision making, particularly with the women and girls who could benefit the most from sustainable energy solutions that reduce indoor air pollution and the burdens of gathering fuel (Adair-Rohani et al., 2016), will be a critical step in ensuring responses are inclusive and representative of their needs and priorities (16.7).

Longer-term commitments and international cooperation can facilitate access to cleaner technologies and promote sustainable energy investments (7.a). Private sector engagement, the NWOW and frameworks such as the GCM and GCR, along with the UN Sustainable Development Cooperation Framework, can each help to overcome the current one-year budgetary constraints. Coordinated agreements between

host governments, humanitarian agencies, and development and peacebuilding organizations can strengthen the ability of local institutions to prevent violence and conflict (16.a) and leave beneficial sustainable energy legacies. Achieving these targets can expand the energy infrastructure in regions that otherwise have difficulties attracting private investments, in particular in developing countries (7.b) that host the most displaced people worldwide, and for whom non-discriminatory laws and policies for sustainable development (16.b) would have significant impacts.

UN Member States should include displaced people in their energy access policies, and humanitarian, development and peacebuilding organizations should include sustainable energy in their responses (7.1.1, 7.1.2) (Mach, 2019). The Office of the United Nations High Commissioner for Refugees (UNHCR), for example, has an internal Global Strategy for Sustainable Energy (UNHCR, 2019b), and this is accompanied by the Clean Energy Challenge (UNHCR and UNITAR, 2020), a campaign co-chaired by UNHCR and the Coordination Unit of the GPA, which aims to align stakeholders behind achieving SDG 7 for displaced people and enabling a clean energy transition for humanitarian infrastructure. These also support longer-term development goals, for example the principle to Leave No One Behind from the 2030 Agenda for Sustainable Development, under which SDG 7 in displacement settings has been tracked by ESMAP at the World Bank (IEA, IRENA, UNSD, World Bank, WHO, 2020). Meanwhile better integration of sustainable energy in national planning has been identified as a key element in local peacebuilding by the g7+ group of 20 UN Member States, and the Council for State Fragility (Logan et al., 2021).

Relevant actors could set minimum standards and objectives for renewable energy shares (7.2.1) and work together to support long-term energy investments (7.a.1). When feasible, organizations could also track the potential impacts of sustainable energy projects on violence and safety in affected contexts (16.1.3, 16.1.4, 16.2.3), as well as monitoring the effectiveness of intersectoral coordination (16.6.2) and inclusive decision making (16.7.2).

Data availability

Historically there has been a very limited amount of reliable data on SDG 7 in displacement, fragile and conflict-affected contexts but, with increasing attention, the body of evidence is growing both for project implementation (UNHCR, 2019c; UNHCR, n.d; UNITAR GPA, 2020) and tracking global progress (IEA, IRENA, UNSD, World Bank, WHO, 2020; Bhatia and Angelou, 2015; ESMAP, 2021). Improved data collection, analysis and dissemination can support larger-scale sustainable energy projects in displacement and fragile contexts, thus contributing to both SDG 7 and SDG 16. Government, humanitarian and development agencies could implement protocols for better energy data collection, which would help reduce the perceived investment risks (Grafham and Sandwell, 2019) and catalyse investments and financing to augment traditional donor funding (Kirn et al., 2021). Underpinning these should be greater investigation into the interrelationships among energy, migration, and humanitarian and peacebuilding activities in order to define information gaps, prioritize research needs, and identify opportunities for shaping public policies.

REFERENCES

Adair-Rohani, Heather, et al., 2016. *Burning Opportunity: Clean Household Energy for Health, Sustainable Development, and Wellbeing of Women and Children.* Geneva, World Health Organization

Bhatia, Mikul and Angelou, Niki, 2015. *Beyond Connections: Energy Access Redefined.* ESMAP Technical Report. Washington DC, World Bank, 2015. See also *The Multi-Tier Framework Measuring Energy Access: Tracking SDG7.1 and Beyond Yearly Update.* SDG7 Policy Briefs 2021. United Nations, 2021

Energy Peace Partners, 2021. Peace Renewable Energy Credit https://www.energypeacepartners.com/prec

Energy Sector Management Assistance Program (ESMAP), 2020. *Regulatory Indicators for Sustainable Energy (RISE): Sustaining Momentum.* Washington DC, World Bank, 2020. See also, for more details *Regulatory Indicators for Sustainable Energy.* SDG7 Policy Briefs 2021. United Nations, 2021

Giæver, Benedicte, et al., 2020. *EmPowering Africa's Most Vulnerable: Access to solar energy in complex crises*. Oslo, NORCAP and Boston Consulting Group

Grafham, Owen and Lahn, Glada, 2018. *The Costs of Fuelling Humanitarian Aid.* London, Chatham House

Grafham, Owen and Sandwell, Philip, 2019. *Harness better data to improve provision of humanitarian energy* Nature Energy, Vol. 4, pp. 993-996. https://doi.org/10.1038/s41560-019-0518-8

Holt, Victoria K., et al., 2021. *Shifting Power: Transitioning to Renewable Energy in United Nations Peace Operations.* The Stimson Center & Energy Peace Partners. Washington, DC.

Huber, Suzanna and Mach, Eva, 2019. *Policies for increased sustainable energy access in displacement settings.* Nature Energy, Vol. 4, pp. 1000-1002. https://doi.org/10.1038/s41560-019-0520-1

IEA, IRENA, UNSD, World Bank, WHO, 2020. *Tracking SDG 7: The Energy Progress Report.* Washington DC, World Bank

Internal Displacement Monitoring Centre, 2021. Internal displacement. http://www.internal-displacement.org/internal-displacement

Kirn, Andrej, et al., 2021. *Unlocking Humanitarian and Resilience Investing through Better Data.* World Economic Forum and GIB Asset Management. Geneva, World Economic Forum

Lahn, Glada and Grafham, Owen., 2015. *Heat, Light and Power for Refugees: Saving Lives, Reducing Costs*. London, Chatham House

Logan, Sarah and Sacchetto, Camilla, 2021. *Scaling up investments in fragile states*. Council on State Fragility. London, International Growth Centre

Mach, Eva, 2019. The Migration-Energy Nexus in International Policy. In Owen Grafham [ed.] *Energy Access and Forced Migration.* Routledge

Mozersky, David and Kammen, Daniel M., 2018. *South Sudan's Renewable Energy Potential: A Building Block for Peace.* Washington DC, United States Institute for Peace.

Nerini, Francesco, et al., 2018. *Mapping synergies and trade-offs between energy and the Sustainable Development Goals.* Fuso, Nature Energy, Vol. 3, pp. 10-15. https://doi.org/10.1038/s41560-017-0036-5

Sommaruga, Cornello, 1997. Keynote address by the President of the International Committee of the Red Cross. *Conference on Humanitarian Action and Peace-keeping Operations.* Singapore, 24 February 1997.

United Nations Secretary-General, 2016. Secretary-General-designate António Guterres' remarks to the General Assembly on taking the oath of office. 12 December 2016. https://www.un.org/sg/en/content/sg/speeches/2016-12-12/secretary-general-designate-ant%C3%B3nio-guterres-oath-office-speech.

UNHCR. Integrated Refugee and Forcibly Displaced Energy Information System. https://eis.unhcr.org/home.

UNHCR, 2019a. Member States Pledges on Energy and Environment, Climate Change and Disaster Displacement. *First Global Refugee Forum.* 17-18 December 2019.

UNHCR, 2019b. *Global Strategy for Sustainable Energy 2019-24.* Geneva.

UNHCR, 2019c. Clean Energy Challenge Baseline: Initial data visualization. https://www.arcgis.com/apps/webappviewer/index.html?id=1f2c23f25e5d416ebf7c1c0bc8c749ce

UNHCR and IKEA Foundation, 2017. Azraq, the world's first refugee camp powered by renewable energy. 17 May 2017. https://www.unhcr.org/en-us/news/press/2017/5/591c079e4/azraq-worlds-first-refugee-camp-powered-renewable-energy.html.

UNHCR and UNITAR, 2020. *Clean Energy Challenge: Affordable, Reliable and Sustainable Energy for Displaced and Host Communities.* Geneva. https://www.unhcr.org/en-us/publications/brochures/5f58e6214/clean-energy-challenge-affordable-reliable-sustainable-energy-displaced.html

UNITAR, 2018. *The Global Plan of Action for Sustainable Energy Solutions in Situations of Displacement.* Geneva. https://unitar.org/sites/default/files/media/file/gpa_framework_final-compressed.pdf

UNITAR, GPA Coordination Unit, 2020. Humanitarian Energy Data Sharing Exercise. https://bit.ly/GPA-HEDat.

SECTION 3.13

INTERLINKAGES BETWEEN **ENERGY AND SUSTAINABLE DEVELOPMENT THROUGH GLOBAL PARTNERSHIPS (SDG 17)**

CONTRIBUTING ORGANIZATION:
POWER FOR ALL

Summary/Key Messages

Energy is "the golden thread that connects economic growth, social equity, and environmental sustainability,"[35] and fully realizing those connections can only happen through a much greater level of partnership. Deep, systemic collaboration is still far too rare, and we must enter a decade of radical partnership to achieve SDG 7 and the other SDGs.

Sustainable energy innovation requires a systematic, multi-stakeholder approach to help bring a broader set of nascent technologies to technical and commercial maturity.[36] Partnerships help countries accelerate innovation processes by identifying

[35] UN Secretary-General Ban Ki-moon, April 20, 2012, https://www.un.org/press/en/2012/sgsm14242.doc.htm
[36] World Economic Forum, Accelerating Sustainable Energy Innovation, May 2018. http://www3.weforum.org/docs/Accelerating_sustainable_energy_innovation_2018.pdf

common priorities and challenges, tackling innovation gaps, and sharing best practices to improve performance, reduce costs and reach broad deployment of clean energy solutions.[37]

A much greater level of financial and organizational support for partnership is required, however, within the SDG 7 ecosystem as well as in relation to other SDGs. Siloed thinking persists in the energy sector itself, preventing the more integrated public-private approaches needed to meet SDG targets.

Given that energy is "inextricably linked to almost all of SDGs"[38] a new level of intersectoral, multi-stakeholder partnership is required if we are to reach the 2030 agenda and achieve broad -based, integrated solutions that are long-lasting and effective. International collaboration can increase effectiveness, bring efficiency benefits, and maximize the impact of energy technology innovation efforts.[39]

INTERLINKAGES BETWEEN SDG 7 AND SDG 17

Public and private partnerships are necessary for achieving SDG 7, in particular partnerships between regulators/utilities and private sector energy services providers.

The SDGs have been described as falling into three functional groups: catalytic, reactive, and enabling goals; the 'catalytic' SDGs are ones that have a significant impact on the attainment of other goals and targets.[40] On nexus issues linked to the energy sector, SDG 7 partnerships should focus first and foremost on the other development goals deemed 'catalytic': zero hunger (SDG 2), good health (SDG 3), education (SDG 4), and clean water (SDG 6). In addition, SDG 7 is an enabler of various cross-cutting linkages, including with regard to gender and inequality (SDG 5 and SDG 10), decent work (SDG 8), and climate resilience (SDG 13). SDG 7 is also particularly important for progress on SDG 9 (industry), which stresses the need to rethink infrastructure, technology development, and research and innovation in developing countries, with a focus on sustainable energy.

KEY CHALLENGES

- Solving complex problems does not produce immediate results and is often non-linear, making impact assessments more difficult.
- Insufficient financial and organizational resources are dedicated to encouraging sectors and organizations to engage in partnerships.
- Institutions, including governments and implementing agencies, remain disincentivized to jettison siloed thinking because funding sources are also siloed.
- Competing and/or unaligned goals, and competition for scarce resources, discourage partnerships.
- There is a lack of consistent and comprehensive inter-ministerial engagement at the regional, national and sub-national levels to ensure that SDG 7 and the other SDGs are being approached holistically.

[37] IEA, 2019. Three priorities for energy technology innovation partnerships. https://www.iea.org/commentaries/three-priorities-for-energy-technology-innovation-partnerships

[38] Global SDG 7 Conference, February 2018, Bangkok, Thailand https://sustainabledevelopment.un.org/content/documents/17977Outcome_Summmary_Global_SDG7_Conference_Feb_20181.pdf

[39] IEA, 2019. Energy Technology Innovation Partnerships. https://www.iea.org/reports/energy-technology-innovation-partnerships

[40] Gijzen, Huub (2021), *The SDGs in the Urban Context: An opportunity to shape sustainable cities:* https://www.researchgate.net/publication/350007259_The_SDGs_in_the_Urban_Context_An_opportunity_to_shape_sustainable_cities

HOW TO ADDRESS THESE CHALLENGES

Greater investment in partnerships: Dedicated annual budgets should be set aside by governments, donors and implementing agencies to actively foster partnerships linked to SDG 7.

Integrate partnership into success metrics: Governments and donors should voluntarily incorporate collaboration-driven impacts in measurement and evaluation.

High-level government prioritization of partnership: Country-level taskforces under the vice-president or higher-level official can help embed renewable energy across national SDG targets. While some countries have inter-ministerial SDG Taskforces (Samoa, for example), these are often limited in scope, with representation only by ministers of finance, environment and community development. There is a similarly narrow focus in the case of parliamentary taskforces, as well (for instance, in Pakistan).

Going beyond donor 'coordination' to pooled donor funding: Instead of having multiple funding facilities for each country, managed by different donors or implementing agencies, or multiple regional facilities with different impact criteria, donors and multilateral agencies should commit to reducing duplication and actively work to pool funding and programmatic work, thereby avoiding unnecessary bureaucracy and inefficient use of capital.

Adopt a demand-side perspective: The SDG 7 community should move away from supply side thinking, and understand and embed end user needs (such as health clinics, schools, labour markets, and farming) into funding, programmes, business models and technical assistance.

Be a unifying force: The energy sector can be a catalyst for cooperation because of its role in enabling other SDGs, and can take the lead in building partnerships with non-energy sectors.

Comprehensive mapping of resource overlap: In a time of finite resources, comprehensive mapping is needed that looks at all SDG 7 activities by country, and identifies ways to use partnerships to avoid duplication and fully leverage resources.

CASE STUDIES TO DEMONSTRATE EXAMPLES OF IMPACTS OR LESSONS LEARNED

Universal Energy Facility (UEF):

Donors, development banks and foundations often create their own financing vehicles, making it a major challenge for energy companies to access funding without dedicating considerable time and resources to tracking the myriad RFPs and expressions of interest from different organizations. But in 2019, commercial and social impact investors with billions of dollars under management called on donors to jointly create a unified, Africa-wide results-based financing (RBF) mechanism, which they said was needed as a de-risking signal for them to enter the energy access market more aggressively. Many RBF facilities have been started by different donors in different countries, with varying results. The fragmented nature of the various RBF approaches has often resulted in insufficient capital, a slow pace of capital deployment and an absence of standardized criteria for approval.

To overcome these issues, a group of funders came together to launch a Universal Energy Facility (UEF) — a multi-donor RBF facility that will provide incentive payments to companies that deploy energy solutions and provide verified end user energy connections. The UEF is managed by SEforALL, and has

support from The Rockefeller Foundation, Shell Foundation, Power Africa, Good Energies and UK Aid. It aspires to be a US$ 500 million facility by 2023, and to deliver about 2.3 million energy connections and 300,000 clean cooking solutions, with the potential for many more.

Joint SDG Fund:

This Fund is a UN inter-agency, pooled mechanism for integrated policy support and strategic financing, including for clean energy. The Joint SDG Fund provides catalytic grants to unblock SDG investment opportunities through financial and political de-risking. It also provides parallel funding to support the creation of a wider policy and legislative ecosystem for investments and technical assistance. Although Uruguay's energy matrix is comparatively green, key sectors like transportation and industry, which together account for about 70% of energy consumption, still rely heavily on fossil fuels. A programme that aims to decarbonize these sectors, provide universal access to clean energy, and improve Uruguay's energy efficiency by spurring the country's second energy transition, was awarded a grant of US$ 11 million from the Joint SDG Fund. There is also co-funding to operationalize the Renewable Energy Innovation Fund, a first-of-its-kind facility, and attract at least US$ 68 million as financial leverage.

The Fund takes the shape of a US$ 80 million blended finance window for green transition and clean technology upgrades, which aims to broadly influence Uruguay's financial sector trajectory. The facility tailors its financing terms to the needs of client enterprises and financial institutions, and the characteristics of the technological innovation that is required. Other energy- related projects are under way in Rwanda (health clinic electrification), Madagascar (sustainable energy incubator, an investment de-risking facility, and a sovereign development fund) and Zimbabwe (a gender-responsive climate finance facility).

Powering Agriculture, a 'Collaboration Accelerator':

The energy sector too often takes a supply side mentality to solving the energy poverty challenge. The Powering Agriculture initiative, launched in 2019 by Power for All, recognized that by helping to embed renewable energy across the food value chain it would accelerate the ability of farmers to improve their livelihoods, and governments to capture additional economic value from the agriculture industry. The Collaboration Accelerator is an intersectoral, multi-stakeholder platform, bringing together the public sector (ministries of agriculture, energy and water), private sector (farming and renewable energy), donors and other funders, civil society, researchers and other key stakeholders.

By creating a platform for partnership, the Collaboration Accelerator is: 1) establishing a consensus among key decision-makers about barriers to market adoption and scale, 2) prioritizing and sequencing those barriers for removal, and 3) removing the barriers through ad hoc working groups. Wrapped around this process is a data-driven methodology that can be replicated in other countries and provide a clear pathway for intersectoral coalitions of action.

[41] In India, implementation and enforcement of all buildings-related policies occurs at the city level but is, to a large extent, guided by model regulations and rules provided by the national and state authorities (WRI India, 2019).

SECTION 4

REGIONAL **PERSPECTIVE**

- AFRICA
- ASIA AND THE PACIFIC
- ARAB REGION
- UNECE REGION
- LATIN AMERICA AND THE CARIBBEAN
- LEAST DEVELOPED COUNTRIES
- LANDLOCKED DEVELOPING COUNTRIES
- SMALL ISLAND DEVELOPING STATES

SECTION 4.1

ADVANCING SDG 7 **IN AFRICA**

CONTRIBUTING ORGANIZATIONS:
ECA, BMZ, AFDB, FAO, GEIDCO, AFREC, AUC

Summary/Key Messages

STATUS AND PROGRESS TOWARDS ACHIEVING SDG 7 IN AFRICA

The current COVID-19 pandemic is a challenge because it reverses some of the gains that countries have made in infrastructure investments to improve electricity access. Public sector funding mainly drives the electricity sector. Due to the pandemic, planned investments were shelved, particularly in 2020, while governments focused on saving lives rather than proceeding with infrastructure projects. Furthermore, various lockdown measures resulted in disruptions of the energy supply chain and slowed down economic activities.

The pandemic came at a time when African countries were already facing severe challenges in achieving universal access. Financing energy infrastructure will now be an even more significant challenge, as more than before, there is a need for diversification of financing sources. Government resources will not be enough to afford much-needed investments, particularly for exploiting Africa's vast renewable energy sources and other cleaner fuels such as gas and for improving transmission and distribution networks, which are in short supply.

At least 25 African countries have electricity access rates of less than 40%. Access to clean cooking is still a significant challenge, as these same countries consistently rely on biomass fuels and technologies for their thermal needs. Meanwhile, renewables' penetration is still slow and limited to Tier Level 1, and as a result, has a limited impact on the African population.

However, at the same time, COVID-19 provides an opportunity to speed up the delivery of energy services. As the pandemic is likely to reset the African economy, this could encourage governments to 'build forward better' through a green recovery approach that prioritizes stimulus packages for investments in clean energy, infrastructure and the green economy in general, creating much-needed jobs, value addition and higher benefit-cost ratios of investments. In addition, the pandemic showed that energy services are essential for health and sanitation, and investments in this area could better prepare Africa for future pandemics.

Priority actions towards 2030

- Accelerate reforms related to energy policies, regulatory frameworks, and investment plans to ensure stepped-up financing to close the continent's chronic energy access deficit and build a more resilient energy mix with systems that can withstand shocks such as natural disasters and pandemics.
- Increase efforts to strengthen existing grids and make them more efficient to reduce losses and prepare for increased shares of variable renewables.
- Step up action to increase the capacity of existing power plants through rehabilitation and long-term maintenance plans.
- Identify and scale up innovative business models for off-grid energy systems that result in low tariffs and promote productive uses that will enhance people's ability to pay for services.
- Conduct comprehensive tariff reviews to ensure cost-reflective prices for services and establish tiered rates to ensure subsidies for needy populations.
- Organize the biomass market as an energy market, encourage its oversight by an energy regulatory authority, and formalize the market to better manage its affordability and transition.
- Develop and replicate effective de-risking instruments and frameworks, including blended finance models and credit enhancement structures that support private sector investments, particularly in challenging markets.
- Put in place an investment climate that supports local private sector participation, such as through public-private partnership frameworks and credit supports that level the playing fields between international investors and the local private sector.
- Focus on energy efficiency, power utility transformation (including efforts to enhance corporate governance and transparency), and support for improved storage solutions to underpin renewable energy development.

UPDATE ON THE CURRENT STATUS OF SDG 7 PROGRESS IN AFRICA

Progress on attaining SDG 7 targets in Africa remains alarmingly slow, despite significant investments in many countries to address electrification and policy and regulatory governance challenges.

However, there have been significant and positive developments as governments seek to address the energy deficits that hinder structural economic development. Almost all African governments have pursued energy policy reforms. In some cases, these policy reforms include creating an enabling

environment for private sector investments and participation in power generation. As a result, the number of independent power producers (IPPs) has increased exponentially in many countries, in many cases with support from programmes set up by various development partners, such as USAID's Power Africa, the World Bank's Scaling Up Solar Programme, and the African Development Bank's Programme for Infrastructure Development in Africa (PIDA).

There is a significant political will to exploit Africa's massive renewable energy potential. More than any other period, African governments are actively pursuing a renewable energy transition. All African countries have signed the Paris Agreement, and 52 have ratified the agreement, establishing nationally determined contributions to climate action (NDCS), including clean energy actions in various end-use areas, particularly power generation. However, the current clean power generation of only 22 GW remains far less than what is possible, especially given the continent's abundant clean energy resources. Additional financing and investments are needed.

Despite the rising policy consciousness and actions to exploit renewables, several African countries will not meet some or all of the SDG 7 targets by 2030. The emergence of the COVID-19 pandemic continues to impede many governments' efforts towards increasing energy services, even as the pandemic has highlighted the importance of universal access to modern energy services, particularly in the health and sanitation sectors, to mitigate future pandemics. Governments and other sectors need to take quick and decisive actions to address current challenges so that the energy sector can play a much-needed role in the continent's economic development.

Electricity access:

The COVID 19 pandemic has negatively impacted electricity access in many African countries, reversing prior gains as governments shifted their spending priorities. As a result, IEA projected an increase in the population without electricity access in 2020, for the first time since 2013.[41] The number of people lacking electricity rose to more than 590 million people in 2020, increasing 13 million people, or 2%, over the previous year.[42]

Electricity access is higher in urban centres, where significant progress has been made. However, the electricity supply is unreliable in many African cities. While urban electrification rates in some Sub-Saharan African countries are over 75% in some cases, the service quality is often low. The latest Afrobarometer survey from December 2019 suggests fewer than half (43%) Africans enjoy a reliable electricity supply.[43] Homes and businesses connected to the grid are plagued by unplanned, unpredictable power outages (blackouts) that are often lengthy (lasting hours, sometimes days) as well as voltage fluctuations (brownouts). There are also scheduled and controlled electricity shutdowns (load-shedding), where power is unavailable for a few hours each day. This situation is being experienced in South Africa, Zimbabwe and Zambia in particular. In Ethiopia, power outages increased firms' cost of production by 15%.

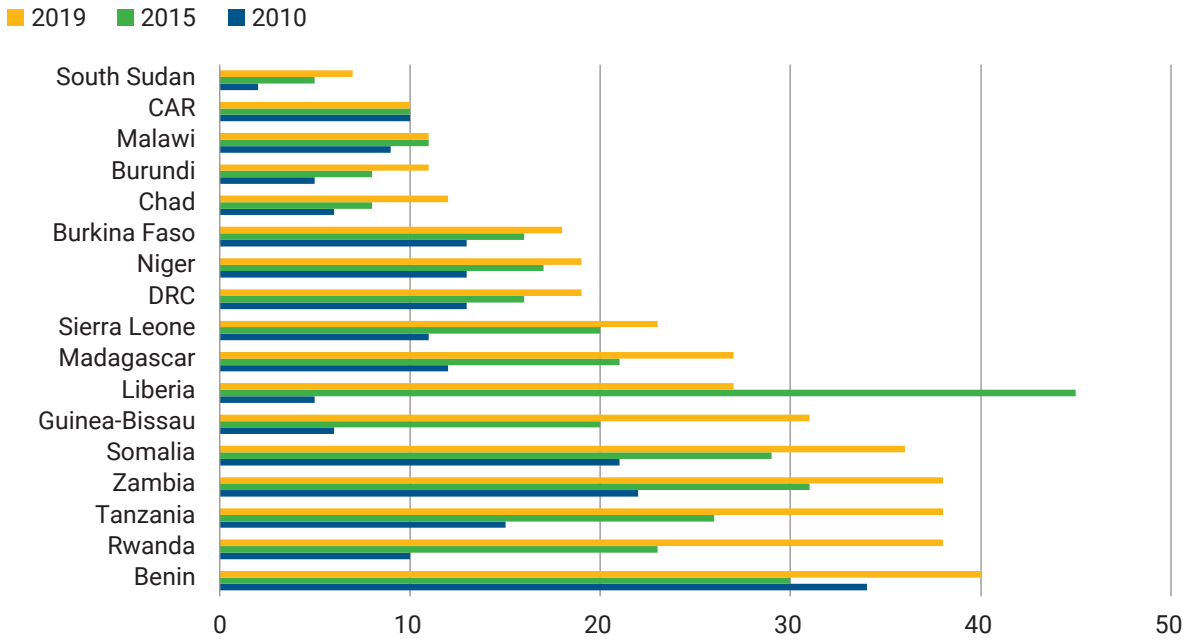
A total of 24 African countries have electricity access rates of less than 50%. It is worrying that some countries have either shown stagnation or reversal in electricity access since 2010 (Liberia, Malawi, Central African Republic, Burundi, and South Sudan).

[41] https://www.iea.org/reports/sdg7-data-and-projections/access-to-electricity

[42] https://www.iea.org/reports/world-energy-outlook-2020

[43] https://www.esi-africa.com/industry-sectors/business-and-markets/grid-reliability-in-ssa-is-a-neglected-gem/#:~:text=While%20urban%20electrification%20rates%20in,a%20reliable%20supply%20of%20electricity

FIGURE 1. AFRICAN COUNTRIES WITH 40% OR LESS ACCESS TO ELECTRICITY



Source: Analysis from SDG 7 data.

Figure 1 below shows 16 African countries with electricity access rates of less than 40%. However, almost all these countries (except for the United Republic of Tanzania) have small populations.

Rural electrification has not increased despite the many country-level efforts. A significant urban-rural divide persists, with an 84% electrification rate in urban areas compared with 29% in rural areas. Electricity access is mainly in Tier 1, meaning that it does not positively contribute to economic development. In the Multi-Tier Framework (MTF) context, electricity access means obtaining adequate electricity available when needed, reliable, of good quality, affordable, legal, convenient, healthy, and safe for all required electricity needs of households and community institutions. In Uganda, Liberia, and Sierra Leone, more than 30% of households report never having electricity despite being connected to the grid.[44]

Access to clean cooking fuels:

Although the number of people globally without clean cooking facilities has been declining gradually (particularly in India and China) due to liquefied petroleum gas (LPG) programmes and clean air policies, Sub-Saharan Africa's situation remains dire. Only 17% of the population has clean cooking access, and household air pollution, mostly from cooking smoke, is linked to about 500,000 premature deaths annually.[45] There is a strong correlation between traditional biomass production/consumption and lack of access to clean cooking.

[44] https://alsf.academy/blog/rethinking-policy-approaches-electricity-access-sub-saharan-africa
[45] https://www.iea.org/reports/sdg7-data-and-projections/access-to-clean-cooking

FIGURE 2. TOP 5 COUNTRIES WITHOUT ACCESS TO CLEAN COOKING VS BIOMASS USE

	Firewood (kt)	Charcoal production (kt)	Population without clean cooking
1. Nigeria	546,848	4,445	176,000
2. Ethiopia	102,488	6,633	104,000
3. DR Congo	88,575	4,129	80,000
4. Tanzania	22,111	1,925	54,000
5. Sudan	20,324	2,017	21,000

Source: https://au-afrec.org/publications/afrec-key-africa-energy-statistics-en.pdf

It is not a coincidence that the 5 African countries with the most biomass users (firewood and charcoal) also have more people without access to clean cooking. Nigeria, Ethiopia, the Democratic Republic of Congo and Tanzania are among the most populous African countries and have the most people without clean cooking options (Figure 2).

Only the countries in North Africa have reached near-universal access to clean cooking. This progress was mainly due to policies and actions that promoted LPG (including for electricity). In North Africa countries, the LPG penetration was 40-50 kg per person per year. In Sub-Saharan Africa, the household demand for LPG averaged 2.5 kg per person per year, with overall LPG penetration rates at approximately 13-16%of the population.[46]

According to the IEA, only 25 million people gained access to clean cooking in the region between 2015 and 2018, and the number of people without access increased to around 900 million. The COVID 19 pandemic is likely to reverse the very modest gains and lead to a lack of action in pursuing clean cooking actions at the country level. The dire economic situation caused by the pandemic, increasing unemployment levels and deteriorating health services could push traditional biomass use to unsustainable levels.

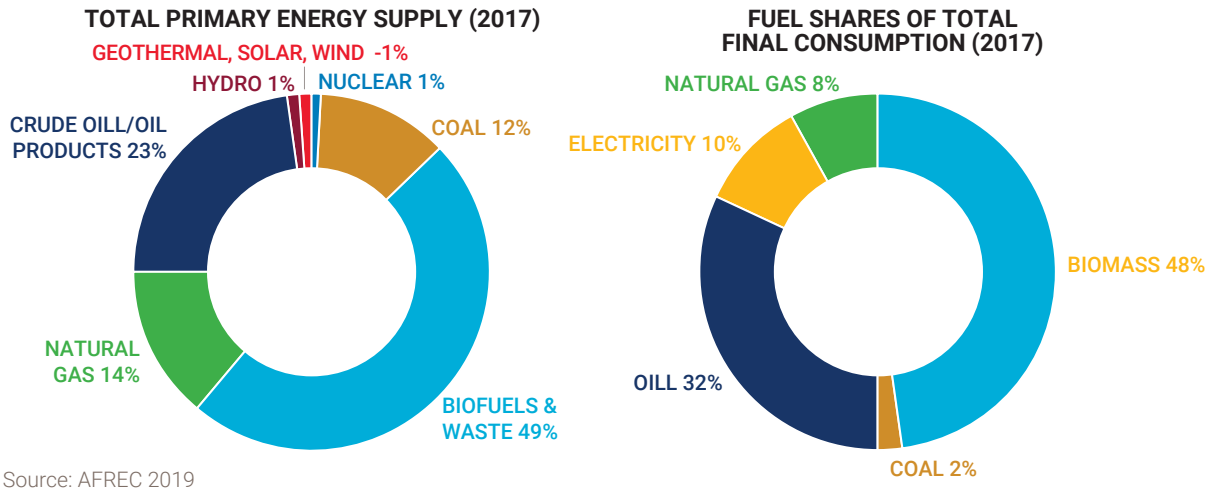
Renewable energy:

Africa's prospects for addressing its massive energy challenges lie in exploiting the vast renewable resources found across the continent. Almost every African country has actions and roadmaps for the renewable energy transition. At present, modern renewable energy represents a tiny portion of the continent's total primary energy supply. The energy economy (supply and demand) is dominated by traditional biomass and waste (see Figure 3).

The continent is taking an increasingly leading role in combatting climate change. All African states have signed the 2015 Paris Agreement, and 52 of them (all except Eritrea and Libya) have ratified the

[46] https://static1.squarespace.com/static/5633c4c2e4b05a5c7831fbb5/t/5acbc7d6562fa79982af9a6a/1523304406277/National+and+Regional+Targets+for+Clean+Cooking+Energy+Access+in+Africa+by+2030.pdf

FIGURE 3. ENERGY SUPPLY AND DEMAND IN AFRICA



Source: AFREC 2019

agreement with ambitious NDCs. Moreover, at least 30 African states have already indicated that they intend to enhance their NDCs from 2020 as part of the global effort. The development of renewable energy is often central to these commitments.[47]

Almost all countries present opportunities for investors in the renewable energy sector. Most look at reviewing the regulatory and legislative environments to make it easier for private sector participation in renewable energy generation. The environment also includes setting up renewable energy targets or quotas and making finance available for public investment for renewable energy projects. Countries like South Africa, Egypt, Morocco, Senegal, Kenya, and Ethiopia have a high degree of renewable penetration within their respective domestic energy mixes.

While IPPs remain a fraction in the energy generation space, there has been a remarkable increase of IPP projects on the continent in the last five years. This growth is mainly in the renewable energy sector. The IPPs are likely to grow even further in the post-pandemic period, owing mainly to the dwindling public sector budget to support energy supply, as well as new business opportunities provided by many countries for profitable investment in renewable energy.

KEY CHALLENGES

Despite some notable developments in improving electricity access, particularly in increasing the share of renewables in the energy mix, challenges persist and need to be addressed urgently in any 'build back better' plans so that existing gains are not reversed. The COVID-19 pandemic has magnified the energy access challenges across the continent.

Providing reliable electricity supplies

The technical state of many African electricity grids, sometimes coupled with design issues and the lack of preventive maintenance, results in high transmission and distribution losses. All this negatively impacts supply security. Many existing hydropower plants and electricity grids operate at reduced capacity due to lack of maintenance and improper operations.

[47] https://www.gtreview.com/supplements/gtr-africa-2020/africas-renewable-energy-opportunity/

The ageing, poorly maintained grid and generation infrastructure in many African countries is also a barrier to integrating more renewable energy in the electricity mix. According to the Afrobarometer, on average across the 36 countries, only four in 10 Africans enjoy a reliable power supply. On average, only 69% of connected households have electricity that works most or all of the time. In Nigeria, while 96% of households are connected, only 18% of these connections function more than half the time. In Ghana, 87% of households are connected, but only 42% of those connections provide reliable power.[48]

According to the Council for Scientific and Industrial Research (CSIR), the total economic impact of load shedding in South Africa between 2010 and 2020 could be as high as R338 billion (US$ 25 billion).[49] The costs of unreliable electricity to the economy are massive, including businesses cutting back or scaling down production or suffering losses as voltage fluctuations damage commercial and industrial appliances and healthcare equipment. Unreliable electricity also impacts entrepreneurship and job creation, employment and education.

Financing viable energy projects

Energy infrastructure seems to be the type most in need of financing in Africa, followed by water and sanitation. According to Africa Energy Outlook 2019, achieving full electricity access in Sub-Saharan Africa by 2030 and maintaining it to 2040 would require a total investment of about US$ 102 billion per year on average, including US$ 18.8 billion per year for green mini-grids and standalone systems. The current funding of the sector is just a tiny fraction of this, and a further slowdown is forecast due to the COVID-19 pandemic.[50]

In addition, there are existing bottlenecks hindering access to donor funding. The 2020 Africa Minigrid Developers Association's (AMDA) Benchmarking Report showed that only about 13% of the US$ 1.6 billion funding committed by the donor community to the mini-grid sector in Sub-Sahara Africa had been disbursed due to the limited capacity of recipient governments to manage procurement processes.[51]

The Infrastructure Consortium for Africa (ICA) states that funds for Africa's infrastructure development are available – but the challenges are finding bankable projects and establishing adequate institutional arrangements.[52]

A particular challenge in financing electrification projects lies in the fact that existing off-grid and mini-grid business models often result in higher electricity costs for the end-user than on-grid connections. This is partly because on-grid tariffs are often not cost-reflective. Also, electricity demand per connection in rural areas is low – meaning that the fixed costs of off-grid and mini-grid systems need to be recovered against only a limited number of kWh sold.

Increasing private sector investments in renewable energy infrastructure

The investment levels needed to meet Africa's growing energy demand with renewables are far greater than the funds available from public sources, such as African governments and development partners. This gap can only be bridged by private investments and lending, as well as private-public partnerships.

[48] https://afrobarometer.org/sites/default/files/publications/Dispatches/ab_r6_dispatchno75_electricity_in_africa_eng1.pdf
[49] https://www.scribd.com/document/443852343/CSIR-Setting-Up-for-2020#from_embed
[50] https://www.scribd.com/document/443852343/CSIR-Setting-Up-for-2020#from_embed
[51] https://africamda.org/wp-content/uploads/2020/11/AMDA-Benchmarking-2020-.pdf
[52] https://www.icafrica.org/en/news-events/ica-news/article/closing-africas-infrastructure-financing-gap-its-not-just-about-more-money-667928/

Despite the dramatic drop in costs, renewable energy developers in Africa still face structural barriers stemming from such projects' cash-flow profile, including significant upfront capital requirements, with payback over 20-25 years.

The real and perceived investment risks will differ from country to country. However, they are generally related to political instability, macroeconomic uncertainty, weak policy and regulatory frameworks, financially weak utilities, and a lack of transparency and institutional capacity. When compounded, these risks often make it difficult, costly and in some cases, impossible to raise the required debt and equity to scale up investments in renewable energy across Africa.

Reflecting actual costs in electricity tariffs

Electricity tariffs in most African countries are lower than the actual cost of generating, transporting and distributing electricity. Service providers (utilities) are seldom fully compensated for this shortfall in revenue, leading to several adverse effects, including a lack of incentives and financing to connecting new consumers, high off-taker risk for private electricity generators, and a consequence the underinvestment in the generation and the grid.

Providing a sustainable rural electrification model beyond simple connection

Electricity aims to improve people's lives, including their health, education, employment, and other productive activities. Assessing the quality of people's electricity access involves defining and measuring the usability of electricity in terms of connection power, daily capacity, availability, and quality, not just the presence or absence of a connection. In providing electricity in rural areas, it is also essential to establish specific mechanisms to promote productive uses of electricity.[53]

Linking energy provision to other development priorities

There is a disconnect between electricity access and other development priorities. Recent studies show that only 28% of health facilities have electricity connections, and close to three-quarters of facilities with electricity connections grapple with unreliable supply.[54] It is estimated that tens of thousands of health centres across low- and middle-income countries lack electricity.[55] A similar number of hospitals suffer from frequent and debilitating blackouts.

An assessment of electrification in primary and secondary schools in Sub-Saharan Africa also found that four out of every five schools surveyed lacked electricity access. The disconnect between electricity access and other development priorities is usually attributed to poor communication or coordination between energy agencies and those responsible for delivering services in other sectors such as health, education and agriculture.

HOW TO ADDRESS THESE CHALLENGES

In addition to improving livelihoods directly, access to reliable, sustainable energy services are also commonly seen as enablers for human development on a path to achieving the Sustainable Development Targets as defined in the Agenda 2030 and Agenda 2063. Energy facilitates access to education and

[53] https://www.worldbank.org/content/dam/Worldbank/Topics/Energy%20and%20Extract/Beyond_Connections_Energy_Access_Redefined_Exec_ESMAP_2015.pdf
[54] https://alsf.academy/blog/rethinking-policy-approaches-electricity-access-sub-saharan-africa
[55] https://poweringhc.org/about-us/

provision of health care services, drives the creation of employment opportunities and allows for the deployment and utilization of modern technologies, including the communication tools vital to today's economy. Productive use of electricity enables value creation and economic growth.

Several strategies will help African nations address their energy challenges:

- **Promote access to energy**

  Energy transition strategies to effectively fight poverty, enable new economic opportunities and promote equality must prioritize universal access to affordable, reliable and sustainable electricity in Africa by 2030. These efforts need to balance mini-grid and off-grid approaches and address supply security challenges, overall economic viability, and affordable access. Enabling technologies and innovative business models for off-grid and mini-grid electrification continuously mature, allowing for electrification of even the most remote households. However, dedicated financing, and subsidization, may be necessary to lower the costs of connection.

- **Improve the reliability of electricity supply from renewables**

  There must be improvements in the planning, operation and maintenance of electricity grids in many African countries to effectively introduce and scale up inexpensive variable renewable energy technologies (such as solar and wind). Investments in transmission and distribution are indispensable enablers for achieving universal access and realizing Africa renewable energy potential. These investments will be most effective if they are coupled with capacity building for planning, operating and maintaining electricity generation systems and grid infrastructure. Integration of renewable energies can be facilitated through enabling technologies, innovative market designs, and new business models for distributing, trading, and selling electricity. Adding and expanding interconnectors to allow for increased cross-border electricity exchange will provide additional flexibility to accommodate a high share of renewables and strengthen energy security.

- **Decommission existing fossil fuel power plants and prevent the construction of new ones**

  Across Africa, fossil fuel power plants currently under construction will have economic lifetimes well beyond 2050. As renewable energy prices keep falling, there is a clear risk that these plants – coal-fired power generation in particular – will end up as stranded assets in a low-carbon future. Therefore, governments need to consider this risk before allowing the new construction of fossil fuel power plants and prioritize using renewable energy sources to replace existing generation capacities from fossil fuels.

  African governments and governments worldwide should be discouraged from investing in additional fossil fuel-based generation assets and are encouraged to phase out fossil fuel-based electricity generation subsidies. Financing should be provided for African countries to support viable alternatives, including baseload capacity, as is being done through the Green Baseload component of the African Development Bank's Sustainable Energy Fund for Africa (SEFA).

- **Consider innovative financing for renewable energy projects**

  One approach to bringing down the cost of off-grid and mini-grid electricity is stimulating demand through results-based financing, which rewards development outcomes beyond a simple connection metric. Examples of such financing criteria include productive use and secondary effects on health and education, e.g., providing clinics and schools with electricity. In addition to lowering the cost of electricity per kWh and making off-grid and mini-grid solutions viable, this approach may also produce

additional development benefits, such as job creation. When it comes to bringing down capital costs and mobilizing financing, providing long-term debt and guarantee schemes for investors and other market actors in the mini-grid and off-grid space is another avenue.

- **Address the regulatory barriers to private sector participation in the electricity supply chain**

African governments can facilitate private sector investments by building stable, predictable enabling frameworks, identifying a pipeline of viable projects, and offering targeted de-risking instruments.

In many African countries, legal and regulatory frameworks for private investments are weak or absent. This increases risks and limits market participation on the part of national as well as international investors. Legal and regulatory systems need to ensure predictability and efficient risk and revenue sharing. A robust political commitment is needed to establish and maintain enabling frameworks, especially where they challenge existing political economies and incumbents power structures.

Financial institutions need to develop an acute understanding of investment appraisal processes and methodologies customized for renewable energy and off-grid and mini-grid technologies. Various guarantee instruments can enable investments that would not otherwise be feasible given the local context (e.g., actual or perceived political, off-taker, liquidity, or currency risks).

It may also be helpful to assist the private sector in navigating the local regulatory framework for renewables. For example, the Renewable Energy Independent Producer Procurement Programme (REIPPPP) of South Africa targets 26,030 MW of installed PV and wind resources capacity by 2030. Since the launch of this public-private partnership, US$ 16 billion in private sector investment has been committed for 79 awarded projects totalling 5,243 MW of renewable energy. Its success is based on the following key fundamentals: (a) effective management of the process by a dedicated IPP unit situated in the energy line ministry; (b) a clear, transparent procurement framework supporting investment and private-sector engagement; (c) availability of long-term project finance within the South African capital markets; and (d) engagement of international partners and advisors in the design and management of the programme.

- **Encourage limited use of natural gas as a transition fuel**

Over 800 million people in Africa still lack access to clean cooking solutions and technology and depend on traditional biomass for their energy needs, which results in 500,000 premature deaths from indoor pollution every year. Natural gas power plants are more reliable, and even though they are subject to feedstock availability, more than half of African countries have gas reserves. The African Continental Free Trade Area (AfCFTA) provides the potential for the ready availability of supplies for countries without gas reserves.

Several African gas producing countries – including Algeria, Ghana, Mozambique, Nigeria, Senegal and Sudan – have included natural gas actions in their NDCs. However, the use of natural gas should be consistent with an ambitious energy and climate protection policy and the absence of lower-emission alternatives. To avoid a long-term lock-in, there should already be an exit strategy or plan for phasing out or using alternative mitigation options in place in the planning phase. Policymakers are now seeing the transformative role that gas-fired plants can play as a transitional choice.

The exploitation of vast gas reserves can also provide a platform for the broad deployment of LPG to address most of the African population's immediate cooking needs and provide a substitute for

undesirable traditional biomass fuels and technologies. The transition would also make economic sense as Sub-Saharan Africa spends US$ 34 billion on wood, charcoal, and kerosene. In comparison, only US$ 13 billion is spent on clean cooking fuels.[56]

As gas technologies are widely available, the focus could be on designing business models to scale up and increase market opportunities for them. Members of the Economic Community of West African States (ECOWAS) have coordinated their LPG targets for clean cooking through the Regional Centre for Renewable Energy and Energy Efficiency (ECREEE). Cabo Verde has established goals for almost exclusive LPG use. Burkina Faso and Niger have set very high LPG targets for urban areas. Nigeria and Togo seek to have LPG represent 80% and 75%, respectively, of their cooking fuel mix by 2030.[57]

While natural gas exploitation in African countries can provide development benefits, the potentially negative socioeconomic consequences should not be neglected if well managed. For example, in Mozambique, natural gas exploitation projects have led to political disagreement, internal violence, and increased socioeconomic disparities.[58] Other negative consequences include violations of human rights, especially of minorities and women, forced displacement, corruption, tax evasions, and increased health risks.[59]

- **Promote the integration of energy, transportation, information (ETI) networks**

  Energy, Transportation and Information Network Integration (ETI Integration) refers to the transition from relatively independent development of facilities for energy, transportation, and information networks to the combined networks' integrated, shared and coordinated development. This coordination in form and function can maximize advantages by forming a comprehensive infrastructure system that is widely interconnected, intelligent, efficient, clean, low-carbon, and user-friendly. ETI networks can catalyze technological innovations, industrial upgrades, and high-quality economic development and significantly accelerate energy development in Africa.

  ETI integration includes a five-layer structure, and it is the energy layer that keeps ETI networks running. Their demand response capabilities will be enhanced by effectively coordinating the supply systems for energy networks, transportation, and information networks. This can help provide greater access to clean energy.

POLICY RECOMMENDATIONS

To facilitate universal energy access and at the same time harness, the potential of renewable energy, Africa requires a systemic approach underpinned by reliable and robust policy and regulatory frameworks, transparent short- and long-term power system planning, increased regional integration, and continuously strengthened institutional capacities.

In line with the principle of Common but Differentiated Responsibilities (CBDR) as formalized in the United Nations Framework Convention on Climate Change (UNFCCC), the international community should support African nations committed to decarbonizing their energy systems while striving to provide energy in line with the needs of everyone. The recommendations below consider the impacts of the COVID-19 pandemic on African economies.

[56] Clean Cooking Alliance, 2020. Building a Clean Cooking Industry: Market trends and Opportunities. DEVCO Environment and Climate Week, 19 February 2020 –Brussels

[57] https://openknowledge.worldbank.org/bitstream/handle/10986/26569/114846-BRI-PUBLIC-add-series-VC-LWLJfinOKR.pdf?sequence=

[58] Natural Gas and War in Mozambique | JIA SIPA (columbia.edu)

[59] Mapping the oil and gas industry to the SDGs: An Atlas | United Nations Development Programme (undp.org)

Ensure financial viability in electricity sector operations. Sector ministries or independent regulators responsible for overseeing utilities need to ensure that electricity tariffs cover the fair and efficient costs of producing and delivering electricity. Therefore, strengthening the regulatory framework and improving competent oversight will help build economically sustainable electricity sectors characterized by universal access and strong supply security. It is also essential that robust reforms focus on the transmission and distribution infrastructure, as these areas in the electricity supply chain are underdeveloped in many African countries. To this end, countries should implement the African Continental Electricity Transmission Masterplan being developed by the AUC.

Establish a framework for facilitating private sector investments in renewables. If African countries harness their renewable energy potential fully and affordably, investment risks need to be mitigated. An enabling environment must include improved regulatory frameworks, innovative financing instruments, modern procurement practices (such as auctions and feed-in tariffs), financial guarantee schemes, and financially sustainable power generators and system operators.

Develop a continental framework to deploy LPG for cooking that takes into consideration the risks of lock-in effects. There has been very little progress in offsetting biomass use as primary cooking fuel. Many countries and African subregions (like ECOWAS) have worked to enact programmes to increase LPG use. However, for this effort to succeed, it needs a continental framework, which should be championed and coordinated by the African Union Commission (AUC) and the Economic Commission for Africa (ECA), assisted by Africa's Regional Economic Communities (RECs).

SECTION 4.2

ADVANCING SDG 7 **IN ASIA AND THE PACIFIC**

CONTRIBUTING ORGANIZATIONS:
ESCAP, ADB

Summary/Key Messages

The Asia-Pacific region's progress towards the objectives of SDG 7 has been mixed. Greater efforts are needed to put the region on track, especially given the setbacks that economies face due to the COVID-19 pandemic.

Access to electricity

The COVID-19 pandemic has highlighted the importance of electricity access as an enabler of modern health care, remote education, and telecommuting to maintain productivity while social distancing. While countries of the Asia-Pacific region have been on track to deliver universal access to electricity by 2030, there is still a disparity between rates of access to electricity in urban versus rural and isolated areas. There are still policy and regulatory challenges in providing the high-quality, reliable electricity services – particularly in, light of competing post-COVID recovery concerns.

Access to clean cooking

Provision of universal access to clean cooking fuels and technologies presents a major challenge for a large proportion of the region. Cooking practices with inefficient combustion result in poor indoor air quality and a health threat on par with COVID-19, and it is women and children who bear the greatest burdens of smoke exposure and time lost in collecting conventional biomass fuels.

Clean cooking policies have not yet been afforded adequate attention and investment. Greater efforts are needed to understand the multidimensional nature of the challenge, including issues of affordability, convenience and safety, as without strong policy interventions fewer than three out of five people will have access to clean cooking fuels and technologies in 2030.

Renewable energy

In recent years, this region has been in the lead globally for renewable energy development, particularly in the power sector, where renewables now present the lowest cost option in many circumstances. While this achievement has not been matched in the process heat and transport sectors, electrification of end uses provides great opportunities for further progress.

Energy intensity

The major economies of Asia and the Pacific have made good progress in driving the regional average towards the target of doubling the rate of improvement in energy intensity. However, energy intensity in emerging economies is relatively high compared to advanced countries. Many smaller countries are not experiencing sufficient improvement, and require further policy attention in this area.

Climate policies and the phase-out of coal

In a major step towards effective climate policy, three of the region's largest economies – China, Japan and the Republic of Korea – have announced goals to achieve carbon neutrality by around the middle of the century.

Any investment in coal now risks locking in unnecessary costs, not just because of the negative externalities of worsening air quality and accelerating climate change, but also because renewable energy options are now cheaper than coal in most locations. Further policy efforts across the region will be instrumental in minimizing the negative impacts of using coal, and avoiding the high costs of existing and planned coal-fired electricity.

Impacts of COVID-19

The effects of the COVID-19 pandemic on the energy sector have been complex and varied. The pandemic has highlighted the critical role of energy in supporting education, health services and telecommunications as work and education shifted to homes and online. While challenges to global supply chains have delayed some aspects of sustainable energy development, an overall reduction in energy demand has resulted in an improvement in energy productivity.

New prospects for sustainable energy are becoming apparent as the vulnerabilities of old systems are exposed and momentum builds for greener, more equitable paths forward. There is now an enormous opportunity for green stimulus to harness the advantages of the energy transition not only for reinvigorating economies but for supporting job creation, better environmental stewardship and social development.

SDG 7 IN ASIA AND THE PACIFIC

The Asia-Pacific region had a population of 4.68 billion in 2020, about 60% of the world total. The economies in the region produce approximately one-third of the world's GDP, consume half of the global energy supply, include the world's top energy producers and consumers, and produce half of global greenhouse gas (GHG) emissions (nearly two-thirds of which are from coal[60]).

Despite efforts to improve energy efficiency and renewable energy, GHG emissions from fuel combustion in the region continue to rise on both an absolute and per-capita basis. However, countries of the Asia-Pacific region are demonstrating global leadership in terms of strong commitments and

[60] https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html

innovations in energy access, energy efficiency and renewable energy. China, Japan and the Republic of Korea have adopted zero net emissions targets to be achieved by the middle of this century. As the Paris Agreement has turned the world's focus toward decarbonization, new technologies and approaches have emerged, together with new and increasingly ambitious targets, to improve energy sustainability and drive the energy transition.

THE CURRENT STATUS OF SUSTAINABLE DEVELOPMENT GOAL 7

Countries of the Asia-Pacific region have a diversity of energy systems, which have been shaped by resource availability, economic development status, geography and climate. Accordingly, their pace is varied in progressing towards the SDG 7 targets.

Achieving the objectives of SDG 7 can increase the social and economic benefits of energy use and minimize its negative impacts on people's health and the environment, while also building greater capacity to withstand disruptive events such as the COVID-19 pandemic In addition, SDG 7 provides a valuable framework for tracking the extent to which the energy sector provides a solid foundation for a resilient and sustainable development pathway. Meanwhile, policy actions that take into account both climate change and pandemic concerns offer opportunities to tackle multiple challenges.

Access to electricity

Having a reliable, affordable and high-quality electricity connection is a step towards access to a modern lifestyle – one that includes heating, cooling, modern telecommunications and health services. During the pandemic, telecommunications and health services have taken on a new level of importance, as work and education have shifted to homes and online. Cooling, and increasingly heating as well, rely on having a sufficient electricity supply, and comfortable temperatures have been demonstrated to improve people's productivity. Environmental control of indoor spaces is also becoming more important because climate change is pushing temperatures and weather patterns to new extremes, creating a new dimension of need for quality, reliability and resilience in the electricity supply.

Among the SDG 7 targets, it is access to electricity in which the Asia-Pacific region has made the greatest strides. Most countries were on track to achieve universal access by 2030 before the COVID-19 pandemic, but competing concerns about the economic recovery may present new challenges. The regional electrification rate[61] reached 95.6% in 2018, and for the first time all ESCAP subregions achieved rates of 90% or higher. Although the overall population of the region has continued to grow, the number of people without an electrical connection dropped from 538 million in 2010 to 200 million in 2018. The greatest challenges lie within rural and remote communities, where geographic constraints impede conventional electrification through grid extensions. Grid extensions have been the primary enabling factor for increased electrification, though renewable off-grid solutions play a significant role in small and remote communities, as well as in areas with poor grid reliability.

Access to clean cooking

In 2016, poor indoor air quality contributed to an estimated 2.8 million premature deaths in Asia and the Pacific – 1 million more than the global death toll of COVID-19 in 2020. The Asia-Pacific region is home to more than 60% of the people worldwide who continue to use polluting and unhealthy cooking methods. Over 50% of the populations of some countries in the region still rely on traditional fuels and technologies.

[61] Asia Pacific Energy Portal https://asiapacificenergy.org/#main/lang/en/graph/1/type/0/sort/0/time/[min,max]/indicator/[1295:590]/geo/[ASPA,ENEA,NOCA,PACI,SSWA,SOEA]/legend/1/inspect/0

Unhealthy cooking methods not only impact health but also affect other factors of development, such as poverty, gender inequality, environmental degradation, air pollution, and climate change. Women and children often bear the additional burden of fuel gathering, while women also spend a high proportion of their time cooking, so these tasks reduce the time available for education and livelihood pursuits and increase their exposure to indoor pollution. Increasing access to clean fuels and technologies can therefore greatly contribute to the achievement of other Sustainable Development Goals.

Progress in expanding access to clean fuels and technologies for cooking is modest at the regional level and highly varied among Asia-Pacific economies. In 2010, 2.13 billion people, nearly half of the region's population, relied on highly polluting and harmful cooking solutions. By 2018, the uptake of clean cooking had lowered the deficit to 1.78 billion people[62], or 39% of the population. However, provision of universal access to clean cooking technology has not yet been given the policy attention and investment needed to transition populations away from the use of polluting cooking fuels and technologies. This lack of policy focus is one of the major contributing factors to slow progress in this area. Greater efforts are needed to understand the multidimensional nature of access to clean cooking – including aspects of affordability, convenience and safety, along with behavioural and cultural factors – as without strong policy intervention fewer than three out of five people will have access to clean cooking fuels and technologies in 2030.

Renewable energy

Increasing the utilization of renewable forms of energy supports a multitude of development objectives, including lower carbon emissions, cleaner air, and improved public health outcomes from reduced exposure to pollution. Compared with conventional sources, more jobs are created with renewable energy, and there are lower human and ecological risks, including workplace hazards associated with some stages of the production of fossil fuels.

The renewable energy share of the Asia-Pacific region's Total Final Energy Consumption (TFEC) has declined in the last two decades[63] due to reduction in the use of traditional biomass (which was down to 15.7% of TFEC in 2017). However, arguably just as importantly, after many years of decline and stagnation the share of *modern* renewable energy (i.e., excluding traditional biomass) rose from 5.9% in 2010 to 8.1% in 2017[64].

The case for clean energy is increasingly an economic one, especially in the power sector, where onshore wind and solar PV now economically out-compete fossil fuels in most countries. With the cost of these technologies now even undercutting the operational costs of a growing number of existing thermal powerplants, the total installed capacity of renewables across the region reached 877 GW in 2019[65].

However, the contributions of renewable energy to transportation and heating have been modest, and more attention is needed in this area. Despite the business case in favour of renewables, there is lingering resistance due to perceived high costs. In addition, there is evidence[66] that fossil fuel subsidies have

[62] Asia Pacific Energy Portal https://asiapacificenergy.org/#main/lang/en/graph/3/type/0/sort/0/time/[min,max]/indicator/[5072:2571]/geo/[ENEA,NOCA,PACI,SSWA,SOEA]/legend/1/inspect/0

[63] Asia Pacific Energy Portal https://asiapacificenergy.org/#main/lang/en/graph/1/type/0/sort/0/time/[min,max]/indicator/[4664:1469]/geo/[ASPA]/legend/1/inspect/0

[64] Asia Pacific Energy Portal https://asiapacificenergy.org/#main/lang/en/graph/1/type/0/sort/0/time/%5Bmin,max%5D/indicator/%5B7194:1469%5D/geo/%5BASPA%5D/legend/1/inspect/0

[65] Asia Pacific Energy Portal https://asiapacificenergy.org/#main/lang/en/graph/1/type/0/sort/0/time/%5Bmin,max%5D/indicator/%5B4727:4735%5D/geo/%5BENEA%5D/legend/1/inspect/0

[62] https://www.irena.org/publications/2020/Jun/Renewable-Power-Costs-in-2019

been underestimated, while renewable subsidies have been overestimated. In 2017, global fossil fuel subsidies and unpriced externalities totalled nineteen times the value of subsidies directed to renewable energy. At the same time, the externalities of fossil fuel use remain largely uncounted, so decision makers fail to incorporate the full set of economic, social and environmental ramifications into investments in energy systems that may be operational for decades. With the COVID-19 recovery at the forefront of the region's policy priorities, decision makers need to consider not only the economic aspects of energy development, but also its interactions with socio-economic development, the environment and climate change.

Energy efficiency

The region's progress in improving its energy efficiency is measured by proxy using energy intensity – a measure that tracks the energy consumed per unit value of economic output. Energy efficient technologies and demand management plans contribute to lower energy intensity, better use of energy resources, reduced gaps between those with sufficient, affordable energy and those without, and lower costs for households and businesses. Energy efficiency helps to support greater energy resilience and self-sufficiency, which is critical for nations that face supply uncertainties and vulnerabilities to events such as extreme weather. Greater efficiency also improves the reliability of supplies for communities serviced by off-grid and mini-grid solutions and can help to postpone investment requirements for power system expansion.

The Asia-Pacific region has demonstrated a long-term decline in the energy intensity[67] of its primary energy supply. Measured as the ratio of energy supply in megajoules to GDP in constant 2011 dollars, primary energy intensity dropped from 7.4 megajoules in 2000 to 5.2 megajoules in 2017 and is now approaching the global average of 4.9 megajoules. Largely driven by the major economies of East and Northeast Asia, the pace of this reduction has picked up over the past decade, with an annual reduction rate of 2.6% from 2010 to 2017, which is in line with the SDG 7 target.

Energy efficiency policies and regulations are the foundation blocks for driving improvements in this area. Incentives and mandates across sectors influence the choices made by energy providers and consumers, while minimum energy efficiency performance standards ensure that better choices are available for energy efficient appliances. As electricity demand for heating and cooling becomes more dominant, interventions which steer the market toward efficient options will become more important. Financing mechanisms also play an important role. Most Asia-Pacific economies have adopted energy efficiency targets, either at the economy level or for specific sectors. Regional cooperation – such as the ASEAN agreement to reduce the energy intensity of member states by 30% by 2025 – also plays an important role. However, there is wide variation in the scope of these targets and the application of supporting measures.

Challenging coal dominance in the power sector

The availability of modern and affordable energy has transformed the Asia-Pacific region, helping countries to develop their economies and lifting millions of people out of poverty. However, reliance on polluting and carbon-intensive sources of energy such as coal has come at a great cost. The region made up 80% of the world's coal consumption in 2018. It also accounts for almost 60% of global total carbon dioxide emissions, nearly two-thirds of which are from the power sector – and almost two-thirds of these come from coal-fired electricity generation. Despite the United Nations' call for an end to coal-fired power generation, and the business case against new coal, hundreds of new coal-fired power

[67] Asia Pacific Energy Portal
https://asiapacificenergy.org/#main/lang/en/graph/1/type/0/sort/0/time/[min,max]/indicator/[1295:590]/geo/[ASPA]/legend/1/inspect/0

plants are still being built, and hundreds more are in the pipeline[68]. The average age of coal-fired power stations in the Asia-Pacific region is only 12 years – with a typical economic lifetime of 40 years, this existing infrastructure risks locking high costs and high emissions into an energy system that urgently needs cost reductions and decarbonization.

Nevertheless, the region is slowly moving in a positive direction, and the number of planned coal-fired power plants is falling. Permits for new plants have dropped to record lows, and more than a thousand have been cancelled. For example, the Philippines made an about-face from prioritizing new coal power under its power development plan to announcing in late 2020 a moratorium on greenfield coal projects[69]. In December 2020, the Prime Minister of Pakistan also announced that the country was scrapping plans for new coal-fired power plants, while in February 2020 Bangladesh announced the cancellation of nine new coal-fired power plants.

Impacts of climate actions

In 2020, nations were called upon to submit their second Nationally Determined Contributions (NDCs), which are intended to represent an increase in ambition over previous commitments to reduce national emissions and adapt to the impacts of climate change. In early 2021, only a handful of Asia-Pacific economies had submitted updates to their first NDC commitments. Most of these simply reiterated existing targets and did not raise the country's obligations, although some offered evidence of expanded supportive policies and planning that would focus on increased energy efficiency, renewable energy, transportation and industrial planning.

In a positive sign, pledges towards carbon neutrality by three major economies – China, Japan and the Republic of Korea – demonstrate a growing desire to accelerate the sustainable energy transition. China has announced that it will adopt more vigorous polices and measures that will allow the nation's emissions to peak before 2030, and achieve carbon neutrality before 2060. The goal will be realized through a series of actions[70], such as eliminating coal power around 2050, boosting wind, solar, and nuclear power, and adopting carbon storage. As China is the world's largest energy consumer and carbon emitter, this has significant implications for global sustainable energy and climate-related goals. According to one estimate[71], if China achieves these decarbonization targets, global warming projections would be lowered by around 0.2 to 0.3°C. Japan, the region's second largest economy and fourth largest emitter, has announced a goal of achieving carbon neutrality by 2050. The Republic of Korea, ranking as the fourth largest regional economy and fifth largest emitter, has since declared a similar goal that will be achieved through investing in 'green new deal' projects such as electric and hydrogen-based transport, and shifting from coal towards renewable energy.

These plans are not yet fully detailed and still fall short of the 2044 net-zero carbon target recommended to keep the global temperature rise below 1.5°C[72]. However, they are positive indications of a significant shift in the energy sector and the rapidly expanding role of energy efficiency and renewable energy in future policy and actions.

[68] UN ESCAP
https://www.unescap.org/kp/2021/coal-phase-out-and-energy-transition-pathways-asia-and-pacific
[69] Philippines Department of Energy
https://www.doe.gov.ph/press-releases/doe-sec-cusi-declares-moratorium-endorsements-greenfield-coal-power-plants?ckattempt=1
[70] https://www.bloomberg.com/news/articles/2020-09-28/china-s-top-climate-scientists-lay-out-road-map-to-hit-2060-goal
[71] https://climateactiontracker.org/press/china-carbon-neutral-before-2060-would-lower-warming-projections-by-around-2-to-3-tenths-of-a-degree/
[72] https://www.ipcc.ch/sr15/

COVID-19: CHALLENGES AND OPPORTUNITIES

The COVID-19 pandemic has diverted the focus of governments throughout the world and introduced uncertainties to energy systems that will have profound impacts for years. This is a complex picture, and the full scale of effects is not yet fully understood. New opportunities may yet emerge as conventional structures and systems are strained, and momentum builds for greener, more equitable paths forward.

The industrial, transport and commercial sectors all experienced drastic reductions in energy demand due to the pandemic, while the residential and building sectors showed an increase in energy consumption. Renewable energy projects were delayed due to supply chain disruptions affecting the availability of components. Strict lockdowns, travel bans, and related uncertainty produced massive fluctuations in oil prices which, along with lower power demand and payment delays by end-consumers, had detrimental effects on the energy supply chain. The combination of challenges has resulted in energy investments falling by 20%[73].

However, despite the slowdown in renewable energy deployment, renewable energy capacity grew in 2020, while coal generation was diminished by the merit order effect. Energy demand reductions were not matched by the decrease in economic activity, resulting in greater energy efficiency and productivity across the economy. Governments seeking to reinvigorate their economies are now finding substantial benefit in green stimulus, as clean energy investments create three times more jobs than equivalent investments in fossil fuels.

PRIORITY AREAS FOR ACCELERATED ACTION: POLICY IMPLICATIONS AND RECOMMENDATIONS

The Asia-Pacific region's progress towards the objectives of SDG 7 is mixed. Greater efforts are needed to put the region on track, especially given the setbacks that economies face due to the COVID-19 pandemic.

Access to electricity: The benefits of electricity access are derived from its utility. The COVID-19 pandemic has shown the enormous contribution that electricity can make to resilience by enabling services such as telecommunications and modern health care, but has also created new challenges to the achievement of universal access by 2030. In order to keep the Asia-Pacific region on track for provision of universal access to electricity by 2030, and to ensure that the benefits are delivered equitably, it is essential to include access to electricity – from renewable energy technologies – in national recovery plans. Policy makers must also ensure that the supply is of sufficient quality and reliability to deliver the full range of potential benefits and to facilitate better recovery from the impact of the COVID-19 pandemic. To close the electrification gap, greater efforts are needed to provide affordable and sustainable energy solutions to rural, remote and island populations where energy systems are more costly to install and may be more vulnerable to extreme weather events and the challenges to maintaining reliable service are greater.

Clean cooking: Some countries of Asia and the Pacific will face major challenges in delivering the SDG 7 target of universal access to clean cooking fuels and technologies by 2030. This is both an equity and a public health issue, as a lack of access particularly affects women and children – through their exposure to poor-quality air, and due to the time lost in collecting conventional cooking fuels and cooking using traditional means.

[73] https://www.iea.org/reports/world-energy-investment-2020

The key barriers to the uptake of clean cooking options relate to reliable access, affordability and behaviour change. Research has shown that innovative, bottom-up approaches that are driven by the community have had the greatest success. Policy makers need to prioritize clean cooking access, and should look at successful examples in the design of interventions to rapidly increase uptake.

Clean energy and the phase-out of coal: Transitioning to energy systems with high levels of renewable energy and energy efficiency offers long-term economic advantages, while also supporting progress across a wide scope of interlinked development objectives. The pace of renewable energy deployment is increasing across Asia and the Pacific, particularly in the power sector. Likewise, great strides are being made on energy efficiency, and the region is on track to achieve its energy intensity improvement target under SDG 7.

However, a serious challenge remains for decarbonization: an unsustainable level of coal-fired power generation continues to operate, and more new ones are being planned. With the business case now favouring renewable energy over coal, this presents an economic threat on top of the sustainability challenge, as new investments in coal-fired power are likely to become stranded assets.

Policy makers should develop long-term plans for investors and other decision makers that clarify the pathway through the inevitable energy transformation, including setting policies and targets for the phase-out of coal.

Responding to the COVID-19 pandemic: While COVID-19 has exacted an enormous economic and health toll and presented a wide range of development challenges, the region's emergence from the pandemic marks an opportunity for nations to 'build back better'. This means delivering a green recovery, which will improve energy resilience and accelerate a low carbon transition, better serving the economic and social needs of the region's people.

In some areas, the pandemic actually presented the possibility of moving towards a greener energy system because it brought a period of reduced energy demand (and commensurate lower energy prices) during which fossil fuel subsidies could be lowered without exposing consumers to price increases.

However, in most places the pandemic revealed vulnerabilities within regional energy systems. Meanwhile, the additional threats to critical infrastructure presented by climate change continue to grow, and the energy transition is introducing a new set of challenges related to cybersecurity and the supply and management of critical raw materials.

Nevertheless, there is enormous potential for green stimulus to help drive the economic recovery. There are many shovel-ready investments available that can accelerate the deployment of renewables, take advantage of the 'low hanging fruit' of energy efficiency, and deliver energy access to improve the prospects and economic participation of the region's people most in need. Along with economic and climate advantages, these opportunities would deliver substantial immediate benefits in jobs, as well as the long-term payoff of energy supplies to feed the future needs of the economy.

SECTION 4.3

ADVANCING SDG 7 **IN THE ARAB REGION**

CONTRIBUTING ORGANIZATIONS:
ESCWA, FAO, PERMANENT MISSION OF THE UAE TO THE UN

Summary/Key Messages

PROGRESS TOWARDS ACHIEVING SDG 7

The Arab region is falling short in its efforts to achieve SDG 7, which – without course correction – will lead to reduced social, economic, and environmental outcomes for its residents.

In several Arab countries, conflicts and instability are crippling progress. But in others, given high levels of government subsidization of energy and rising oil prices, there are strong economic forces incentivizing governments to promote energy efficiency – and therefore reduce their budget demands. Market forces are already driving a sharp uptick in new solar projects and efficiency efforts across the region.

COVID-19 has exacerbated the vulnerabilities of the Arab region with respect to the sustainability of their energy systems and their ability to support socio-economic growth. But the recent crisis also provides opportunities to accelerate the energy transition and formulate policies to capture the cost savings of renewables and support future economic growth, especially through cross-sectoral approaches involving water, food, and end-use sectors.

Access to energy

Access to modern energy reached 90% in 2019, representing a 4% increase over the past decade. The Arab region is one of the most electrified regional groups. However, access is not uniform, and LDCs account for almost all the deficit, with only 79% access. Rural populations in LDCs are still far behind the urban areas, where access is nearly universal.

Even with widespread access to electricity, unplanned service disruptions continue to plague several countries in the region, regardless of people's income levels, or urban/rural locations, particularly in those countries affected by conflict and displaced populations.

Access to clean fuels and technologies for cooking (CTFs) also remained high in the Arab region, with an average of 87%. Thirteen countries have full or almost full access. But, again, the picture is quite different in the LDCs, where 96% of the CFT deficit is concentrated, and where three countries have less than 10% access.

Energy Efficiency

Despite a decline in overall energy intensity over the past decade, the Arab region is not on track with global energy efficiency targets. By comparison to other regions in the world, the region's energy intensity is one of the lowest, but the rate of decline in energy intensity is only -1.6%. This is particularly of concern in the transportation sector, where energy intensity is among the highest in the world.

Renewables

Renewable energy in the Arab region is around 13% of the energy consumption mix. Two countries alone account for 72% of the region's renewable energy consumption, and this includes traditional renewable sources such as solid biofuels, which represent 86% of renewable energy in the Arab region. However, solar power and wind systems are beginning to build momentum, as the costs of these technologies are now below, or competitive with, conventional sources.

Priority actions

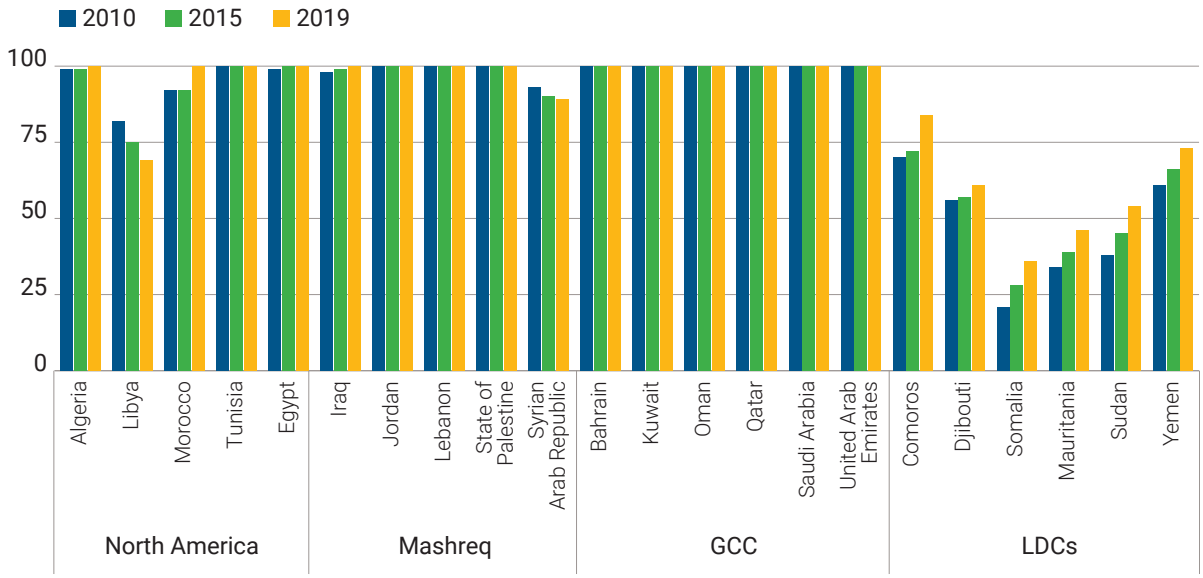
Over the next four years

- Undertake structural economic diversification, boost energy productivity, and redirect energy subsidies to mobilize sustainable energy technologies, particularly in remote and vulnerable communities.
- Promote responsible energy consumption, and reorient policies toward large-scale energy efficiency programmes across all the sectors in the economy.
- Leverage the shifts in residential consumption to encourage greater levels of telecommuting, and reduce the high energy intensity in transportation.
- Develop greater regulatory transparency and consistency to remove barriers for private sector penetration, and accelerate the penetration and adoption of clean energy technologies and local content manufacturing.
- Strengthen monitoring and evaluation tools to improve the availability and quality of energy-related data, which is needed to formulate effective policies that address civil society and gender equality issues.

Towards 2030

- Integrate sustainable energy action plans into development strategies with clear SDG targets, and ensure long-term commitments.
- Make necessary policy and regulatory reforms for integrating energy, climate and environmental goals more closely into socio-economic development targets, and for developing the required implementation mechanisms.

FIGURE 1. SHARE OF POPULATION WITH ELECTRICITY ACCESS IN THE ARAB REGION, 2010, 2014 AND 2019 (%)



Source: World Bank (2021).

- Ensure that health facility energy needs are appropriately articulated in the context of national energy plans and strategies, particularly those aimed at addressing critical industries and end-users of energy services.
- Enhance inter-regional cooperation for greater resource mobilization, including through trade and grid interconnections and transfer of best practices.
- Build institutional capacity, transparency and accountability, and strengthen local governance and communication.

PROGRESS TOWARDS ACHIEVING SDG 7

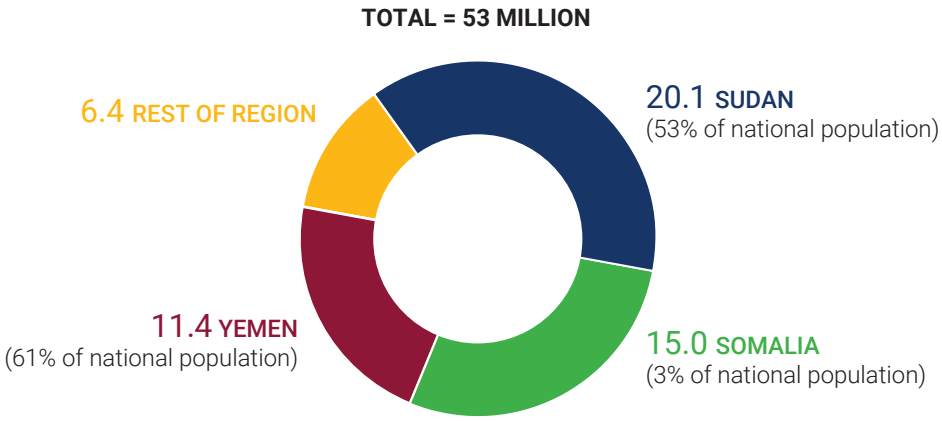
Electricity

Access to electricity remained on par with population growth rates, signalling a positive momentum towards universal access. The share of people with access to electricity increased from 86% in 2010 to 90% in 2019, spurred by notable progress in Morocco and key Arab LDCs, bringing the total number of people without electricity to 45 million.

Investment in the power sector – Capacity in the Arab region's electricity sector is expected to keep pace with projected demand. A pattern of raising finance through bond issuance and government-backed guarantees has ensured that critical projects in the sector get completed.

Key deficit countries –The region's electricity access deficit is still dominated by LDCs and countries in conflict. More than 83% of the region's deficit is concentrated in Yemen (7.9 million), Somalia (9.9 million), and the Sudan (19.8 million) which has one of lowest electricity consumption levels in the world.

FIGURE 2. THE ARAB REGION'S CLEAN COOKING ACCESS-DEFICIT IN POPULATION NUMBERS, 2019 (MILLIONS)



Source: World Health Organization (2021).

Urban–rural distribution – The electricity access deficit is predominantly a rural issue. In 2019, LDC's rural access was 41% overall (and as low as 12% in Somalia) compared with 82% in the urban population. Access to modern energy has been a key parameter in reducing the access deficit, with technologies such as solar stand-alone systems offering important access avenues to households, farmers and small enterprises.

Electricity reliability – Service disruptions are prevalent in countries affected by ongoing conflicts that have damaged national infrastructure, as well as in countries accepting refugees, such as Lebanon and Jordan, which host over 1.5 million refugees[74] and have to cope with higher electricity consumption.

Electricity is not equally affordable everywhere – Jordanians, Moroccans, Palestinians and Tunisians pay on average more than 20 times the average bill in Kuwait,and with risks of higher unemployment raising concerns on the affordability of (quality) electricity services. Many off-grid solutions, such as mini-grids, that offer access to remote settlements remain relatively more expensive.

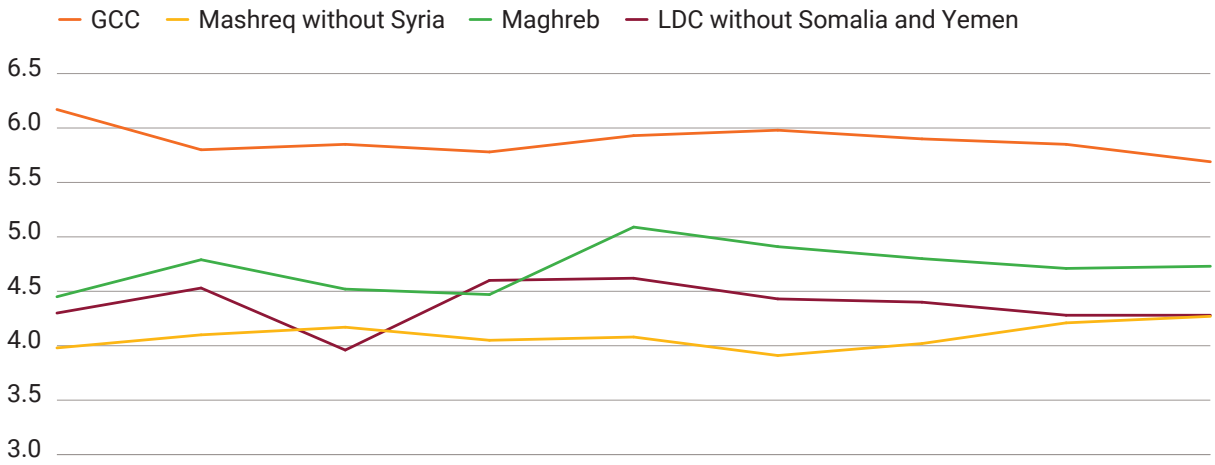
Clean Cooking

Access to clean cooking technologies (CFTs) largely mirrors access to electricity. Overall, the region has relatively high access to CFTs (around 87%). However, there are 53 million people in the region who lack access, 96% of them in LDCs, where access to CFTs is only 46%. Progress on CFTs has not kept pace with improvements in electrification, having increased only 2.4% between 2010 and 2019, largely in the Sudan. However, these estimates do not consider refugee populations and some people in conflict areas, meaning the overall numbers are likely to be higher. Despite improvements in Somalia (2%), Djibouti (3%) and Comoros (5%), access to CFTs in these countries remains at 10% or less.

Urban-rural divide. The access deficit for CFTs is concentrated in rural areas. In Somalia, Djibouti and Comoros, access to CFTs is negligible, and almost entirely in urban areas. Sudan has seen the most promising improvements in rural access over the past 10 years. However, urban access in Mauritania

[74] https://data2.unhcr.org/en/situations/syria

FIGURE 3. ARAB SUBREGION ENERGY INTENSITY TRENDS FROM 2010–2018 (MJ/2011 PPP US$)



Source: IEA (2021).

has actually regressed, highlighting the need to increase and maintain momentum in CFT finance as a critical enabler of universal access.

Political conflict has contributed to slower progress on access to CFTs. As demand for liquid fuels has increased, resulting in shortages and higher prices, a larger number of households are having to resort to more polluting fuels. Many women are cooking with plastic, which severely affects indoor pollution. These conditions are exacerbated by the continued impacts of COVID-19.

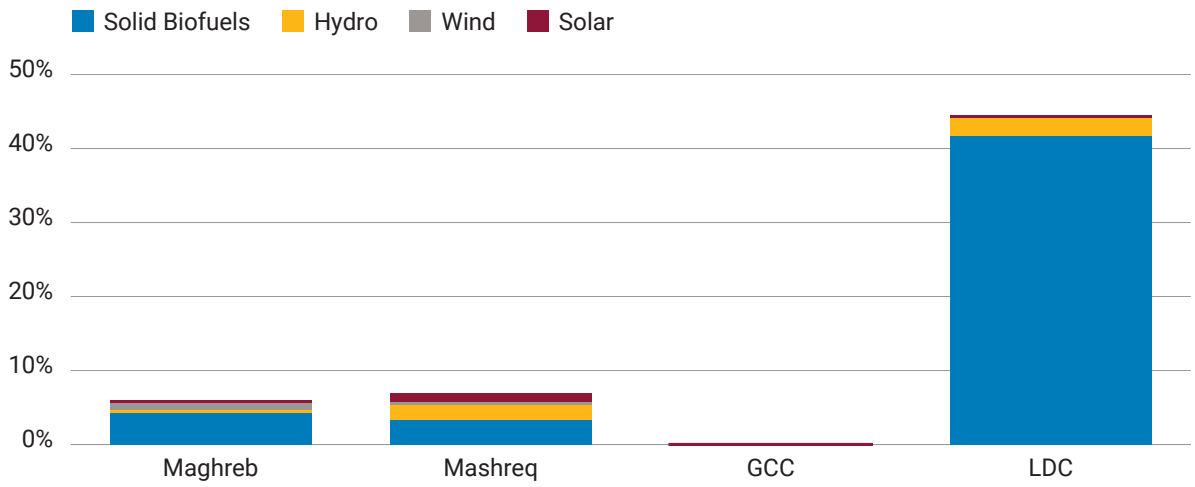
Energy Efficiency

Energy intensity in the Arab region has improved recently. Overall energy intensity declined from 5.14 MJ/US$ 2017 PPP in 2010 to 5.06 MJ/US$ 2017 PPP in 2018. Given the relative weight of the GCC energy markets, structural shifts and energy efficiency have broadly driven the declines in energy intensity in the Arab world, despite a 4.5% total increase in energy intensity in the Mashreq region since 2015.

Energy intensity in transport in the Arab region has historically been the highest of the world's regions, accounting for 30% of total final energy consumption (TFEC) in 2018. There has been little progress with regard to public transportation. However, a series of lockdowns due to COVID-19 resulted in lower transportation activity, prolonged periods of telecommuting, reduced international travel, more home-schooling and e-learning, and greater reliance on door-to-door services. These developments could be leveraged to drive more sustainable mobility models.

Agriculture (1%) and services (6.9%) account for a smaller share of TFEC in the Arab world than transport but have also historically experienced the steepest declines in energy intensity. Both sectors are important elements of the economies of several Arab countries, including Egypt, Morocco, Tunisia, the Sudan, Lebanon and Jordan. Changing weather patterns, and the impacts of climate change, are expected to disrupt the productivity and energy intensity of these sectors, which are critical to food security and trade.

FIGURE 4. SHARE OF INDIVIDUAL RENEWABLE ENERGY SOURCES IN TOTAL FINAL ENERGY CONSUMPTION, BY ARAB REGION, 2018



Source: International Energy Agency (2021).

Building energy intensity is growing in the Arab region, though from a low starting point by global comparison. With rising temperatures there is a greater need for air conditioning systems, and the COVID-19 pandemic has highlighted the importance of cold chains for vaccines and medicines.

Renewable Energy

The share of renewable energy has not changed dramatically since 2010, remaining at around 13% of the Arab region's TFEC, though many countries are now setting aggressive targets based on the falling cost of solar and other renewable energy power sources. Total installed renewable capacity (excluding biomass) increased by more than 3GW to reach 21GW in 2019, with recent additions primarily in solar.

Solid biofuels continue to account for the largest share of renewable energy consumed in the Arab region—around 86% of total renewable energy consumption—with over 90% of the region's total consumption concentrated in Egypt, Morocco, Somalia and the Sudan. Most of the region's solid biofuel is traditional biomass, and is largely used for cooking, heating and even lighting, with low efficiency levels and adverse health effects due to indoor air pollution.

Together, solar and wind energy account for a little over 5% 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 have the highest shares of solar in their mix relative to other countries in the region. Morocco is leading the way in wind energy, accounting for 60% of the region's consumption. Unlike solar, wind resources are unequally distributed in the region, but wind power is gaining ground in several countries, including Egypt and Jordan.

There have been significant cost reductions for utility-size solar and wind power projects, driven by recent policies designed to remove market barriers and encourage private sector investment. These

polices have established a positive investment climate for utility-scale solutions, and attractive financing rates, which in the GCC resulted in record-breaking tenders for PV, first in Qatar in January 2020, followed by Abu Dhabi in April that year.

POLICY IMPLICATIONS AND RECOMMENDATIONS

Formulate appropriate and transparent policies and create a wider business-friendly environment in which markets, rather than government-directed projects, drive structural change. More than attractive terms, private sector investors rely on transparent and consistent regulatory regimes that will provide assurance on the absence of future potential distortive policies and ad-hoc changes, and which in turn will drive down prices for clean technologies.

Integrate sustainable energy programmes with wider socio-economic policies, such as addressing income poverty, gender parity, access to health, and availability of credit facilities, and develop implementation capacity critical to the success of these policies. The long-term trend of declining prices for renewable energy and energy efficiency technologies should encourage governments to make progress with subsidy reforms and reallocate funds towards essential public services.

Develop new financial and commercial models that allow for better risk management. Encourage greater levels of finance, especially for energy efficiency measures and scaling up ESCOs, to drive down energy intensity in industry and ensure the sustainability of the energy sector.

Expand regional and international cooperation to enhance the resilience of energy systems. An integrated trade liberalization strategy is needed that coordinates with other sectors, including health and agriculture, in order to facilitate regional value chains and pave the way for global value chains.

Support credible institutions and effective mechanisms for monitoring and enforcement. Institutions must be given the mandate to carry out their work effectively and be staffed by appropriately trained and paid professionals. Strong institutions benefit from an increased government focus on transparency and accountability, which are aspects of good governance practice that deserve much greater focus in the Arab region.

Promote knowledge creation, informed citizens, and effective public debate. Societies need to be able to evaluate whether current policies are working, and whether they address root problems, such as income poverty and access to health care in the case of access to modern energy, or affordability in the case of more energy efficient appliances.

Build policies through consultation, engagement and collaboration. Implementation of the SDGs can be best advanced by involving stakeholders – business and household decision makers, as well as social, religious and environmental interest groups – in a grassroots engagement that shapes a more sustainable and just future.

[73] https://www.iea.org/reports/world-energy-investment-2020

REFERENCES

Arab Petroleum Investments Corporation, MENA Power Investment Outlook 2020-2024: Between fighting a pandemic and managing renewables.

https://www.apicorp.org/mena-region-holds-strong-potential-for-low-and-zero-carbon-sources-of-energy

International Renewable Energy Agency, Global Landscape of Renewable Energy Finance 2020.

https://irena.org/publications/2020/Nov/Global-Landscape-of-Renewable-Energy-Finance-2020

United Nations Economic and Social Commission of Western Asia, Tracking SDG7: Energy Progress Report Arab Region

https://www.unescwa.org/publications/energy-progress-report-arab-region

United Nations Economic and Social Commission of Western Asia, Energy Vulnerability in the Arab Region.

https://www.unescwa.org/publications/energy-vulnerability-arab-region

United Nations Economic and Social Commission of Western Asia, Policy Brief: Best Practices for the Implementation of Sustainable Energy Action Plans. https://www.unescwa.org/sites/www.unescwa.org/files/page_attachments/pb_best_practices_for_implementation_of_sustainable_energy.pdf

SECTION 4.4

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

CONTRIBUTING ORGANIZATION:
ECE

Summary/Key Messages

PROGRESS TOWARDS ACHIEVING SDG 7 IN THE UNECE REGION

The UNECE region continues to fall short in its progress towards attainment of SDG 7. There is 100% access to electrical power and clean cooking fuels, but significant challenges remain in terms of the quality of service, and affordability.

There has been some progress on energy efficiency, but much more remains to be done. The rate of progress in improving energy intensity is insufficient to meet the 2030 goal.

Although there also has been an increase in installations of renewable energy systems in the region, investments need to more than double to achieve the 2030 target. The UNECE region as a whole has an increasing share of renewable energy in final energy consumption, while certain sub-regions have low, and declining, investment rates.

Significantly, there are countries within the UNECE region that export large quantities of fossil fuels, and also have some of the world's highest levels of energy intensity. Their national incomes are based on fossil fuel energy, and the livelihoods of large numbers of people depend on it. Achieving a transition to sustainable energy across the region will therefore require major changes in these economies and societies.

PRIORITY ACTIONS

Bold action in three areas will deliver concrete, near-term outcomes and longer-term contributions towards achieving the goals of the 2030 Agenda for Sustainable Development and the Paris Agreement on climate.

1) High-Performance Buildings

Achieving superior performance in buildings can deliver improvements in health, quality of life, employment conditions, affordability, access to technology, and social equity. Clean energy installations can also increase buildings' resilience to climate change impacts, and lower carbon emissions from building operations. In addition, sustainable construction materials would also reduce the levels of 'embedded carbon' in new buildings, while environmentally sensitive planning, zoning and design factors would take into account sustainable management of land and water resources.

2) Methane Management

As methane is a very powerful greenhouse gas, reducing methane emissions offers significant climate benefits, especially in the near term, and in the long term can help support a just and sustainable energy transition. There is a large potential for quick reductions, using cost-effective mitigation technologies that are readily available. Managing methane also delivers important improvements in air quality and safety, and can help enhance the uptake of sustainable hydrogen.

3) Sustainable Resource Management

A comprehensive framework for responsible resource management would benefit communities worldwide, and provide assurances to an investment community calling for tightened environmental, social, and corporate governance.

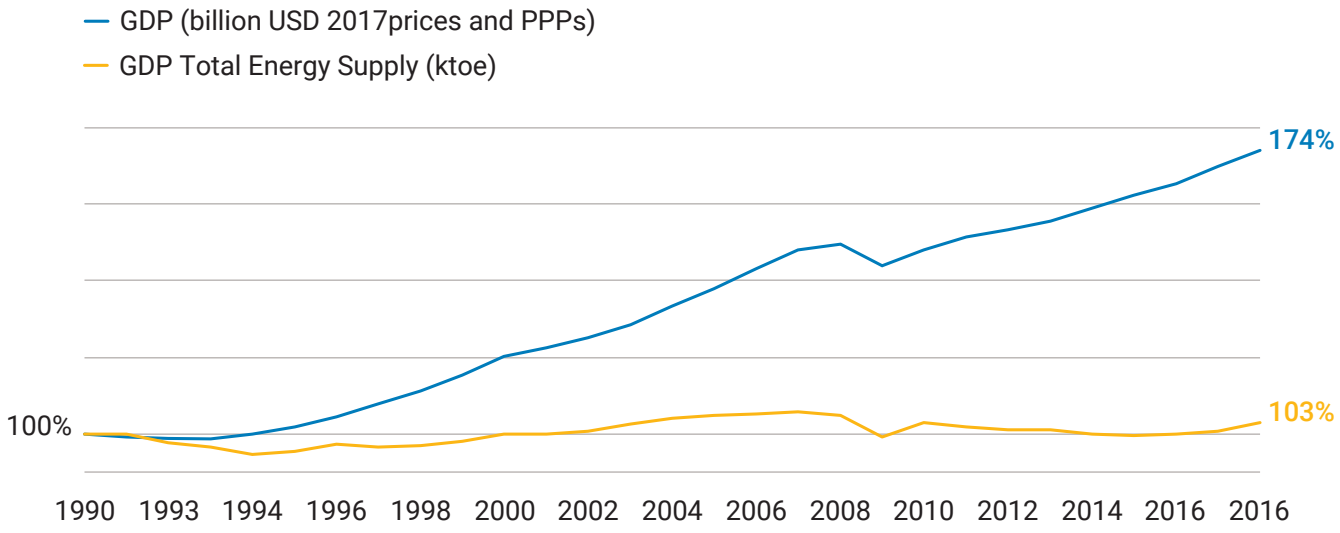
PROGRESS ON ACHIEVING SDG 7 IN THE UNECE REGION

Energy Access

Although the UNECE region has achieved near-universal household electrification in terms of physical access, issues related to ageing infrastructure, a lack of supply diversity, and increasing costs often lead to poor power quality and, for some, unaffordability or energy poverty.

Non-electric energy sources are widely used to provide heat, and human comfort and safety depend on substantial heating services that are not reflected in the statistics on access to electricity networks. A number of households spend more than 10% of their income on energy, thereby falling within the definition of energy poverty. Climate policies that do not address the combined challenges of energy affordability and access to alternative forms of delivered energy could exacerbate energy poverty in the region. There is a need for systematic tracking and reporting of a broader set of indicators for energy access, including non-electric energy consumption, quality of service, and cost of service/affordability. In the ECE region, 100% access to clean fuels and technology for cooking has been achieved.

FIGURE 1. RELATIVE CHANGES IN TOTAL ENERGY SUPPLY AND GDP GROWTH IN THE ECE REGION, 1990-2018 (PER CENT, 1990=100)



Source: UNECE, based on data provided by custodian agencies, March 2021.

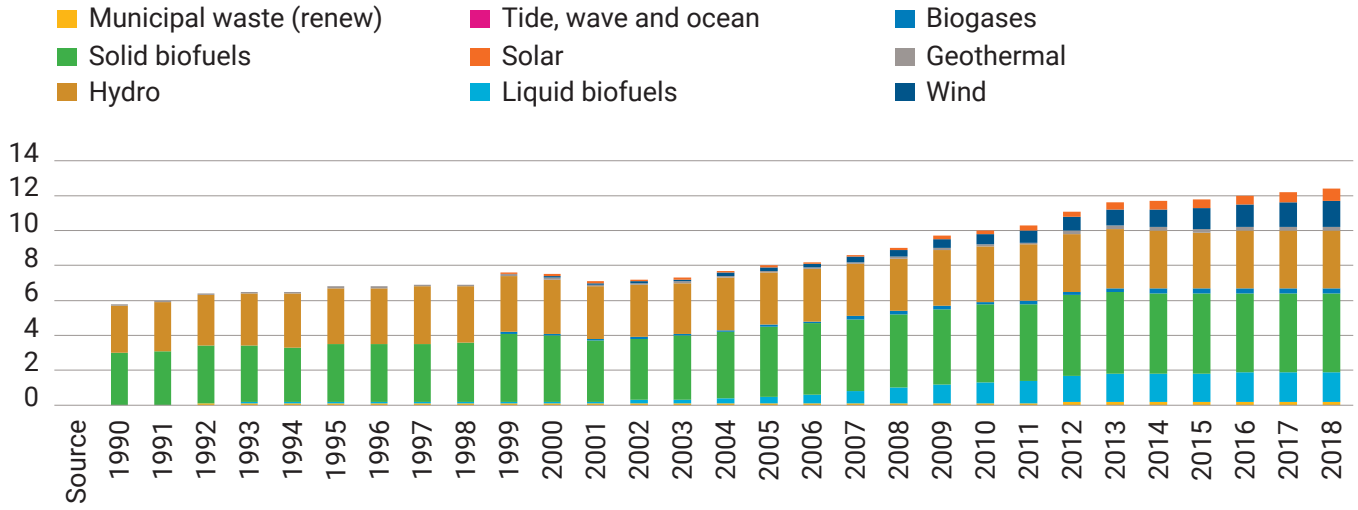
Energy Efficiency

Energy intensity is a proxy indicator for progress on improving energy efficiency (SDG 7.3). Energy intensities vary significantly across the subregions in the ECE region. Over the period 1990–2018,energy intensity declined 41% for the region as a whole, or by 2.9 megajoules per US$[75] (from 7.14 to 4.22). The average rate of decline over the period was 1.85% per year. Over the period, growth in total energy supply (TES) was decoupled from that of gross domestic product (GDP). GDP in the UNECE region increased by 74% (from 31 trillion US$ in 1990 to 54 trillion US$ in 2018, while TES increased by only 2.9% during the same period (from 5.3 Gtoe in 1990 to 5.4 Gtoe in 2018) (see Figure 1).

Improving energy efficiency is one of the most cost-effective options for meeting growing energy demand. Energy efficiency also helps to ensure rational use of energy, promote economic well-being and an improved quality of life, contribute to a better environment, and build energy security. The key challenge is mobilizing the investments needed to enhance energy efficiency and energy productivity. Analysis for the UNECE region indicates that energy sector investment requirements range from between 24 and 29 trillion US$ between 2020 and 2050, of which 6% to 16% would be to improve energy efficiency. Saving energy and improving productivity are critical imperatives. Operational, technical, and economic improvements are required in the production, transmission, distribution and consumption of energy – before investments are made in new energy supply infrastructure. Such improvements would address energy affordability challenges as well as the growing pressures on energy supply and operational efficiency in the UNECE region.

[75] Constant 2017 PPP GDP.

FIGURE 2. RENEWABLE ENERGY SHARE IN TFEC IN THE ECE REGION BY TECHNOLOGY (%)



Sources: IEA, World Energy Balances (2020); UN Statistics Division, Energy Balances (2020)

Renewable Energy

The UNECE region includes countries with well-established renewable energy markets and well-developed infrastructure for deploying renewable energy. The uptake of renewable energy is progressing, though major differences in renewable energy expansion exist between countries.

With an installed renewable electricity capacity of 869 GW, the UNECE region accounts for almost half of the 1,971 GW installed worldwide. Hydropower is the most established renewable energy technology for generating electricity, making up 412 GW (388 GW from LHP) of total renewable electricity capacity. Generating capacities from renewable energy sources have grown substantially in the UNECE region over the last few years because of the rapid expansion of wind energy and photovoltaics (PV) in the Ukraine and Kazakhstan (wind energy), and Russia and Turkey (PV). Although wind and PV markets are growing the most rapidly of all renewable electricity markets in the region (with compound annual growth rates of 7.6% and 10.3%, respectively, between 2011 and 2014) they are only the second and third largest markets overall (with installed capacities of 254 GW and 140 GW, respectively).

The share of renewable energy in the UNECE region's energy mix has increased progressively from 1990 to 2018, doubling its share in total final energy consumption (TFEC) from almost 6% to just over 12%. (See Figure 2.) While TFEC increased slightly from 1998 to 2018 in absolute terms, its distribution among the main sectors of electricity consumption, transport and heat has shown a notable increase of renewable energy in transport over the last two decades. In terms of investment, the eastern reaches of the UNECE region lag global developments and have recently witnessed a decline in renewable energy investments. Barriers to investment continue to exist, but previous experiences with investment, and current government plans, suggest that there is a strong potential for future growth.

CHALLENGES FOR THE UNECE REGION

Post-COVID Economic Recovery and Resilience

The health, social, and economic repercussions of the COVID-19 pandemic have been severe, and it is unclear how long they will last nor how deep they will go. Beyond the tragic loss of life, the enduring repercussions include the implosion of many economic sectors with associated job losses, changes in lifestyles, and fraying of social psychology. Ongoing restrictions intended to slow the progress of the pandemic will strain all sectors of the economy, including provision of food, energy and water.

Global pandemics such as the current health crisis will be more frequent as the climate destabilizes. Anticipating them requires systematic, coordinated preparation and investment in resilience, including in the energy system. The crisis has presented an opportunity to pivot to a sustainable economic and energy model by re-orienting demand, supply, and investment conditions to sustainable outcomes.

Fossil Fuel Dependence

Fossil fuels dominate the region's energy mix and underpin today's energy access and economic development. As a result, there is an underlying tension between achieving SDG 7 targets and other SDGs, such as those related to poverty, hunger and inequities. Often an industrial and urban ecosystem has emerged over time in support of, and because of, the primary energy production. The associated physical and social infrastructure is a political obstacle to transformation and change. Removing that barrier requires application of a just transition to avoid creation of industrial and urban socio-economic ghettos. Accelerating the transition to a sustainable energy system by modernizing and optimizing the existing fossil fuel-based infrastructure, and integrating renewable energy-based infrastructure, is essential to achieving sustainable development. Achieving a just transition will require managing methane accumulations, ensuring efficient energy production, improving industrial and end-use energy efficiency, optimizing resource management, and enabling introduction of renewable energy technology to enhance local environmental, social, and economic performance in line with the 2030 Agenda.

Climate Commitments

Given the region's dependence on fossil fuels, meeting the 2030 Agenda's climate objectives must be integrated with the remainder of the SDGs to achieve the desired decarbonization of the future energy system. Integrated solutions require a clear understanding of the climate-related impacts of energy in connection with the development-related opportunities that energy represents. The two most relevant GHGs from the energy sector are carbon dioxide (CO2), mainly from the combustion of fossil fuels, and methane (CH4) emissions from coal and gas production and distribution. The UNECE region is falling short on the relevant indicators for these emissions.

Increasing the Contributions from Renewable Energy

Many countries of the UNECE region continue to face challenges in deploying renewable energy. These challenges include inadequate legal and regulatory frameworks, price distortions caused by subsidies, a lack of energy market liberalization, absence of public acceptance, and/or low awareness or capacity regarding the potential for application of renewable energy. UNECE countries can overcome these barriers and substantially increase the market uptake of renewable energy both through country-level actions and strengthened regional cooperation.

Sustainable Resource Management

The current patterns of resource production and use are unsustainable. A global, principles-based, sustainable resource management system is needed, along with a comprehensive financial reporting framework for extractive industries, if the world is to meet its climate objectives and deliver a better quality of life. Such an architecture for responsible extractive industry management would benefit communities worldwide, and provide assurances to a market and investment community that is calling for tightened environmental, social, and corporate governance aligned with the 2030 Agenda.

The UNECE proposes actions for securing sustainable resources for the future, including:

- A comprehensive 'Socio-Environmental-Economic Contract to Operate' that integrates quality of life, a just transition, climate change mitigation and adaptation, and environmental stewardship.
- Common sustainable finance taxonomy and principles to support funding in line with environmental, social and corporate governance (ESG) principles.
- A shared 'Principles-based, Integrated, Sustainable Resource Management Framework' through the existing UN Framework Classification for Resources (UNFC) and the UN Resource Management System (UNRMS), which is under development.
- A comprehensive framework for traceability, transparency, and sustainability in supply chains.
- Strategic environmental assessments of government plans and programmes.

High-Performance Buildings

UNECE's High-Performance Buildings Initiative aims to transform how buildings are conceived, built, operated, and maintained. Buildings are responsible for 40% of global CO2 emissions by virtue of the energy services they require. They also represent an important share of 'embedded carbon', that is, emissions that occur when making the materials used in buildings. Transforming the built environment can drive sustainability and deliver quality of life in the broadest terms. It also can impact the effectiveness of the world's responses to multiple environmental, social, health, and economic crises. High-performance buildings enhance the resilience of occupants in the face of all of these types of crises.

SECTION 4.5

ACHIEVING SDG 7 IN LATIN AMERICA AND THE CARIBBEAN

CONTRIBUTING ORGANIZATION:
ECLAC

Summary/Key Messages

PROGRESS TOWARDS THE ACHIEVEMENT OF SDG 7

The region continues to make progress in 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. 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

The region has been steadily increasing people's access to electricity. Overall, coverage is about 99%, according to the Latin American Energy Organization (OLADE) but rural areas remained disadvantaged, with coverage of only around 95%. As of 2019, around 18 million people still did not have access to electricity (OLADE, 2020). 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 Haiti, Guatemala, Honduras, Paraguay, Nicaragua, Guyana, Peru, Dominica, Belize, Bolivia, Jamaica, and Mexico, more than 10% of the population does not have access to clean technologies for cooking. Around 57 million people within the LAC region still lack access to such sources (WHO Household Energy

Database, 2019), and due to the slow advancement, 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 region has continued to make significant progress on incorporating renewable energy. Installed capacity of hydro energy increased from 227.6 GW to 236.7 GW between 2018 and 2019 (IRENA, 2020). However, its share of the energy mix has decreased due to greater use of wind and solar energy. Wind energy has become the largest source of variable renewable generation, increasing from 20.8 GW in 2018 to 22.5 GW in 2019. Solar energy sources are also registering significant progress, increasing from 7 GW in 2018 to 8.6 GW in 2019. Bioenergy sources grew from 19.5 GW in 2018 to 19.8 GW in 2019, and that trend will continue as government policies promote the use of renewable energies.

Energy efficiency

The LAC region has historically had the lowest energy intensity in the world. However, 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 (ECLAC, 2019).

Priority Actions

- Strengthen the role of governments in ensuring basic access to energy services, which are particularly critical in a crisis periods, such as the COVID-19 pandemic. Reinforce the active role of governments as facilitators of the development of the energy sector in order to allow each country's advantages (endowments of natural resources) 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. 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, are key to achieving economic stability after COVID-19.

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

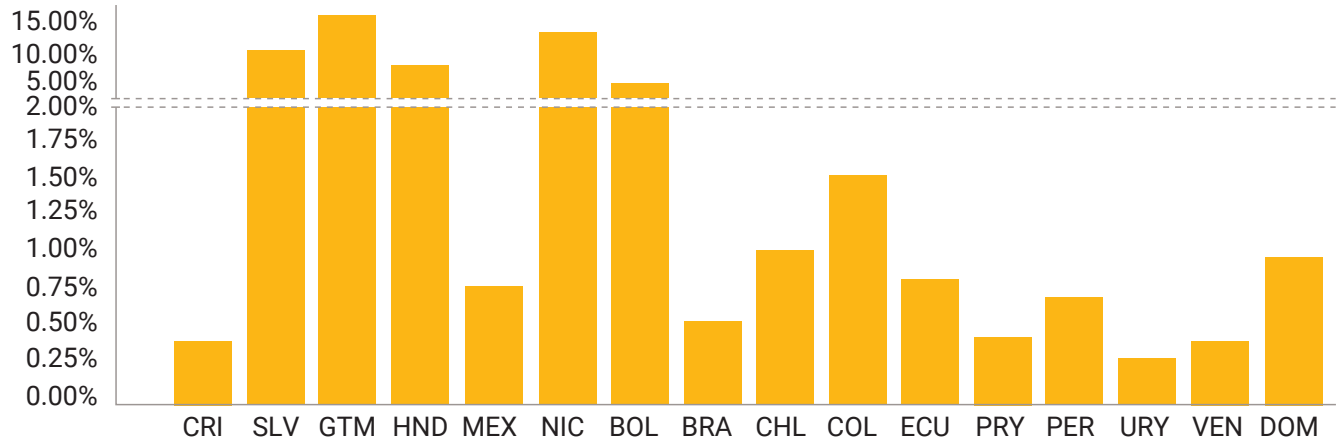
- Deepen the implementation of national programmes to promote the use of efficient and clean stove technologies, and support the replacement of traditional biomass in cooking and heating uses by modern sources and increased electrification.

- Promote the development of National Energy Efficiency Plans that define goals, and provide instruments and resources necessary for implementation.

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

The region continues to make progress in 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. 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.

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



Source: UNECE, based on data provided by custodian agencies, March 2021.

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 18 million in 2019. At the country level, in Haiti, Honduras, Guyana, Suriname, Bolivia, Belize, Guatemala, Panama and Nicaragua, more than 5% of the people lack electricity coverage (OLADE, SIELAC, information based on country sources).

The urban-rural electrification gap narrowed between 2000 and 2019. To further address this gap, urgent policy action is required to promote decentralization of electricity generation, and to continue to incorporate renewable energies. Since they do not require networks fed by centralized generation sources, renewable energy systems make it possible to use local energy resources (ECLAC, 2019).

However, access to electricity alone 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 certain Central American countries, the proportion of households lacking the various socio-economic benefits related to electricity services is higher than in the rest of the region – in Guatemala (16.5%), Panama (14.8%), Nicaragua (14.3%), El Salvador (11.8%) and Honduras (9.6%). 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 28.6% for Nicaragua and 18.9% for Honduras.

In South America, the same phenomenon is observed in the case of Peru and Bolivia, with 18% and 14% of the populations without access to electricity in rural areas, respectively. The northeast portion of South America also has three countries with low access rates: Guyana, Suriname and French Guiana, where 8% of households are without electricity.

Figure 1 provides quantitative information for some countries on people without access to electricity in their dwellings.

Access to Clean Fuels and Technologies for Cooking (CFT)

The region has advanced steadily in the last decades in terms of access to CFT, which increased from 78% in 2000 to 89% in 2018 (WHO, 20019). However, in Haiti, Guatemala, Honduras, Paraguay, Nicaragua, Guyana, Peru, Belize, Bolivia, and Mexico, the participation rate is below the overall average of 89%, and in some other countries, access is much lower. Nicaragua, Honduras, and Guatemala have rates of access to CFT between 46% to 55%, while in Haiti it is only 6%.

The common issue for countries with low CFT access is the difficulty of providing alternatives to firewood in rural areas. Low-emission cooking technologies, such as those using LPG or natural gas, or electricity, require investments in special equipment and distribution systems that may be unavailable or too costly for people in rural areas. In the case of Peru, for example, 79% of households in rural settlements report using firewood for some energy services. However substantial efforts have been made in Latin America and the Caribbean, and many countries in the region are on the road to a transition away from inefficient solid fuels for cooking. It is reasonable to expect that by 2030 most of the countries in the region will be able to reach the objective outlined in SDG 7.1. However, countries such as Haiti will have to make radical changes and 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 incorporating renewable energy. Installed capacity of hydro energy increased from 227.6 GW to 236.7 GW between 2018 and 2019 (IRENA, 2020). However, its share of the energy mix has decreased due to greater use of wind and solar energy. Wind energy has become the largest source of variable renewable generation, increasing from 20.8 GW in 2018 to 22.5 GW in 2019. Solar energy has also registered significant progress, increasing from 7 GW in 2018 to 8.6 GW in 2019. Bioenergy sources grew from 19.5 GW in 2018 to 19.8 GW in 2019, and that trend will likely continue as government policies promote more use of renewable energies.

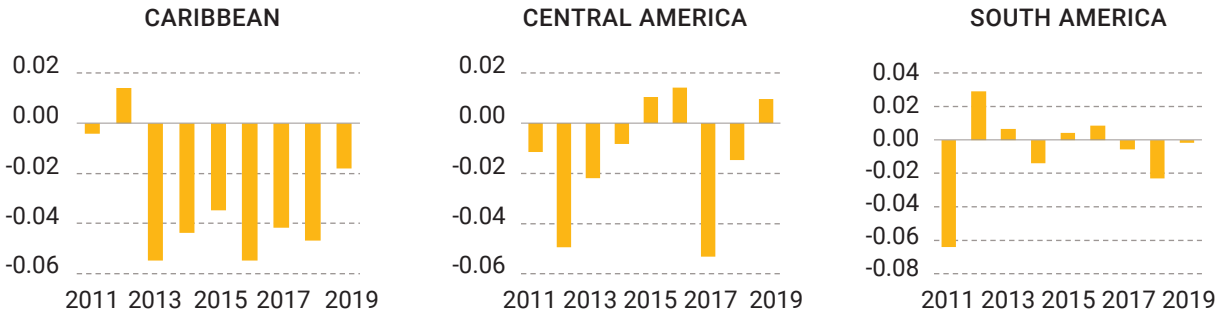
Capacity expansion rates for installed renewable energy have shown significant increases from 2014 onwards, and this trend is expected to continue due to mechanisms that facilitate bidding and auctions of renewable energy projects, tax benefits for importing renewable energy technologies, and accelerated depreciation of assets.

However, not all countries are following the same pathway. Recently Mexico released a new power policy that modifies some of the goals of the 2013 energy reforms, particularly 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 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 foreign dependency and protect them from 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 is moving ahead for excluding coal-fired generation sources.

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. Wind energy average costs reached 0.050 US$/KWh in South America and 0.061 US$/KWh in Central America (IRENA, 2019b).

FIGURE 2. ANNUAL CHANGE IN PRIMARY ENERGY INTENSITY (CEPAL, 2020)



Source: UNECE, based on data provided by custodian agencies, March 2021.

Data on foreign direct investment in renewable energies show that from 2010 to 2018 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. These 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 18.5 GW of installed capacity from 2015 to 2018. Brazil contributed around 68% of the new hydro capacity installed in this period. 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. Out of the total 247 GW of accumulated renewable installed capacity, 191.2 GW comes from hydro, representing 77.5% of total renewable capacity. Wind energy has made significant progress in terms of installed capacity, adding 11 GW of power, to reach 25 GW installed.

The installed capacity of renewable thermal energy (biomass) is 20.6 GW, while solar is 8.7 GW and geothermal is 1.3 GW.

Despite the positive trend observed in recent years, these levels are still far from what is needed for achieving the goal of SDG 7.2. However, the great dynamism observed in the development of non-conventional renewable energies, and also hydroelectric capacity, generates favourable expectations of being able to achieve significant progress in increasing levels of participation of modern renewable energies.

Energy Efficiency

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

Despite efforts made by all the countries in the region during the last decade, there is still a lot of need for improvement. However, reducing energy intensity 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 minimum possible energy consumption.

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 only be achieved by accelerating the rates of reduction in energy intensity. Improving efficiency will require additional efforts beyond those that have been made so far for the region to achieve the objective.

POLICY IMPLICATIONS AND RECOMMENDATIONS

An analysis of indicators to monitor the implementation of SDG 7 clearly establishes the urgent need to intensify efforts. One of the greatest challenges is achieving greater commitments to bolder policies, and the willingness to adopt such policies.

A major constraint in the region is access to increased financing, and this has been further impacted by the COVID-19 pandemic. At the same time, the COVID-19 pandemic has also heightened the urgency of accelerating progress on access to electricity. Therefore, achievement of the SDG 7 targets can be seen as an opportunity to support the post-pandemic recovery of the regional economy, for example by investing in new infrastructure aimed at reducing the access gap on electricity. According to the latest studies, investing 1% of the regional GDP per year from 2021 to 2032 will be sufficient to transform the regional electricity matrix to over 80% renewables (ECLAC, 2020b). This cannot be done 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.

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

Chile, Mexico, Brazil 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 its endowment of natural resources to provide access to clean and accessible energy.

Finally, from the analyses carried out in the previous section, we can see some general guidelines on where energy policies should focus in most countries.

- **Access to electricity:** The bulk of the electricity access gap is in poorer settlements and remote, hard-to-reach places, where new connections are generally more expensive. In order to achieve universal access to electricity, particularly after the impacts caused by COVID-19, it is urgent to improve the flow of economic resources to close the access gap in the region, whether from public or private funds, multilateral banking or international cooperation. Governments must also generate appropriate institutional and regulatory frameworks and develop human and organizational capacities that make an efficient allocation of resources possible, and secure the basic energy needs of the poorest.

The inclusion of non-conventional 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, with 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 an adequate allocation of resources, it is essential to move towards convergence between energy prices and production costs. The application of subsidies as public policy instruments should be done through mechanisms that guarantee that they are specifically targeted. Their potential impact on poor households depends on such targeting, as well as 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. In order to achieve the desired SDG 7 results, it is imperative that these policies be sustained over time. Furthermore, in order 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 with great opportunities to increase the share of renewable energies. An integrated approach to the problem could have excellent results in favour of 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 in 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 this 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. In addition, 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 (Mexico, Cayman Islands, Bahamas, Ecuador, Brazil, Bolivia and Chile), while in the other thirteen 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. For its part, Argentina was ahead of the rest of the region by installing a referential standard in 1996, followed by Uruguay in 2004 and a group of eleven Caribbean countries that adopted referential standards in 2016. Due to this late incorporation of norms or standards in the region, in a number of countries thermal insulation in houses 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.

REFERENCES

ECLAC, 2019. Sostenibilidad energética en América Latina y el Caribe: reporte de los indicadores del Objetivo de Desarrollo Sostenible 7. https://www.cepal.org/es/publicaciones/44686-sostenibilidad-energetica-america-latina-caribe-reporte-indicadores-objetivo

ECLAC, 2020, Seguridad hídrica y energética en América Latina y el Caribe: definición y aproximación territorial para el análisis de brechas y riesgos de la población. https://www.cepal.org/es/publicaciones/46408-seguridad-hidrica-energetica-america-latina-caribe-definicion-aproximacion

ECLAC, 2020b, Construir un nuevo futuro: una recuperación transformadora con igualdad y sostenibilidad. https://www.cepal.org/es/publicaciones/tipo/documentos-posicion-periodo-sesiones-comision ECLAC, 2021, Pobreza energética en ALC (reporte en proceso de publicación)

IRENA, 2020. Renewable Capacity Statistics 2020 https://irena.org/publications/2020/Mar/Renewable-Capacity-Statistics-2020

IRENA, 2020b. Renewable Power Generation Costs in 2019
https://www.irena.org/publications/2020/Jun/Renewable-Power-Costs-in-2019

OLADE, SIELAC Database. http://sielac.olade.org/

OLADE, 2020. Energy Outlook for Latin America and the Caribbean

http://www.olade.org/en/publicaciones/energy-outlook-of-latin-america-and-the-caribbean-2020/

OLADE, 2019. Panorama Energético de ALC 2019
http://biblioteca.olade.org/opac-tmpl/Documentos/old0434b.pdf

World Bank, 2021. Access to clean cooking technologies https://data.worldbank.org/indicator/EG.CFT.ACCS.ZS?locations=MX

SECTION 4.6

ADVANCING SDG 7 IN LEAST DEVELOPED COUNTRIES, LANDLOCKED DEVELOPING COUNTRIES, AND SMALL ISLAND DEVELOPING STATES

CONTRIBUTING ORGANIZATIONS:
OHRLLS, IRENA, FAO, UNIDO AND ROCKY MOUNTAIN INSTITUTE

Summary/Key Messages

To achieve the SDG 7 targets, there is an urgent need for enhanced international cooperation and increased investments in sustainable energy in the 91 most vulnerable countries – the 46 Least Developed Countries (LDCs), 32 Landlocked Developing Countries (LLDCs) and 38 Small Island Developing States (SIDS).

Most LDCs, LLDCs and SIDS have adopted ambitious national and/or regional targets on energy access, renewable energy and energy efficiency, but the implementation progress remains limited and unequally distributed. The countries' individual energy transition pathways face many barriers, which need to be addressed simultaneously and in a cross-sectoral manner. Accelerating access to affordable clean energy can help these countries forward in their overall development trajectory.

The COVID-19 crisis is likely to heighten the risk of energy insecurity in these countries. In addition, resources needed for pandemic responses may further constrain the already limited fiscal capacities of LDCs, LLDCs and SIDS and thus potentially derail investments in sustainable energy.

There is an opportunity to align green COVID-19 recovery measures with increased financial flows to sustainable energy, following the key development priorities of the LDCs, LLDCs and SIDS – as outlined in the Vienna Programme of Action (VpoA), the SAMOA Pathway, and the preliminary deliberations in preparation for the Fifth United Nations Conference on LDCs, where the new programme of action for the LDCs will be adopted.

Access to electricity

- In 2019, 53% of the people in LDCs, 58% in LLDCs and 83% in SIDS had access to electricity. Across the 33 African LDCs, where two-thirds of the people live in rural areas, only 19% of the rural population had access to electricity. Even though 15 LDCs are in the top 20 access deficit countries in the world, the 46 LDCs in total attracted only 20% of international commitments in support of clean energy to developing countries.

- With population growth and rapid urbanization in these countries adding to the pressures on existing old electricity grid systems, there is an urgent need for investments in power generation, along with grid reinforcement and upgrading of technology, in order to provide modern and sustainable energy to all, and to reduce transmission and distribution losses. In addition, there is considerable scope for LDCs and LLDCs to engage in transboundary projects involving South-South cooperation in regional power pools to address grid stability issues, supply constraints, and efficiency.

- Increased deployment of distributed generation can help to close the access gaps, including through use of mini-grids and micro-grids, stand-alone renewable energy (RE) systems, rooftop solar PV and storage, and other technologies that can be directly linked to livelihood improvements and economic activities, especially in remote low-demand areas. The trend towards decentralization, variable renewable energy integration, and electrification of end-use sectors, requires a shift towards smart grids and digitalization. In addition, a number of SIDS and LDCs are starting to look into the option of electric mobility.

- Greater data collection is needed on the electricity needs of rural agriculture and the informal sector. Increased collaboration between the energy and agriculture sectors can generate win-win opportunities, and increase productivity and profitability, especially in the economies of LDCs and LLDCs that are based primarily on agriculture and the informal sector. Subsidizing utility service to poor rural smallholder farmers and small firms in the informal sector will be needed, whether through cross-subsidies by profitable utilities, subsidization by the national governments, or grants and low-cost financing from development agencies.

Renewables

- Even though LDCs, LLDCs and SIDS account for only a small amount of global pollution, they can directly benefit from deployment of renewables and implementation of energy efficiency measures as ways to minimize dependence on conventional sources of energy, thus reducing their over-reliance on energy imports. The pathway to net zero emissions requires a substantial increase in the share of renewable energy in all three main end-use categories: electricity, transport, and heating/cooling. However, despite the potential for scaling up renewables and the falling cost of these technologies, non-renewable capacity is growing faster than renewables in LDCs, LLDCs and SIDS.

- Governments and development partners could also extend public finance resources – including climate funds, concessional finance, guarantees, grants and subordinated debt – to address investment constraints facing the LDCs, LLDCs and SIDS, and spur private financing to scale up renewable energy deployment.

Building back better

- By placing renewable energy at the core of post-COVID green recovery plans, governments can signal long-term public commitments to the renewable energy industry, thus boosting investors' confidence and scaling up investments needed for renewable energy development. In addition, better environments for investment, plus regulatory and policy reforms, as well as innovative business models, are needed to overcome barriers to deployment.

- For LDCs, LLDCs and SIDS that are particularly vulnerable to the impacts of climate change, it is important for energy policy decisions and planning to be based on robust data, and factor in long-term scenarios and climate adaptation, in order to improve the assessed cost-effectiveness of renewable energy projects and help build resilience.

- Countries need well-trained and skilled people to work on energy projects in order to meet their renewable energy ambitions. LDCs, LLDCs and SIDS could support educational and training programmes, including digital capacity programmes on sustainable energy, to build local knowledge and capacity, and promote renewable energy projects.

- There is a need to better understand and communicate the job and value creation potential of a green COVID-19 recovery and sustainable energy transition in LDCs, LLDCs and SIDS.

CURRENT STATUS OF SDG 7 PROGRESS AND MAIN CHALLENGES IN LDCS, LLDCS AND SIDS

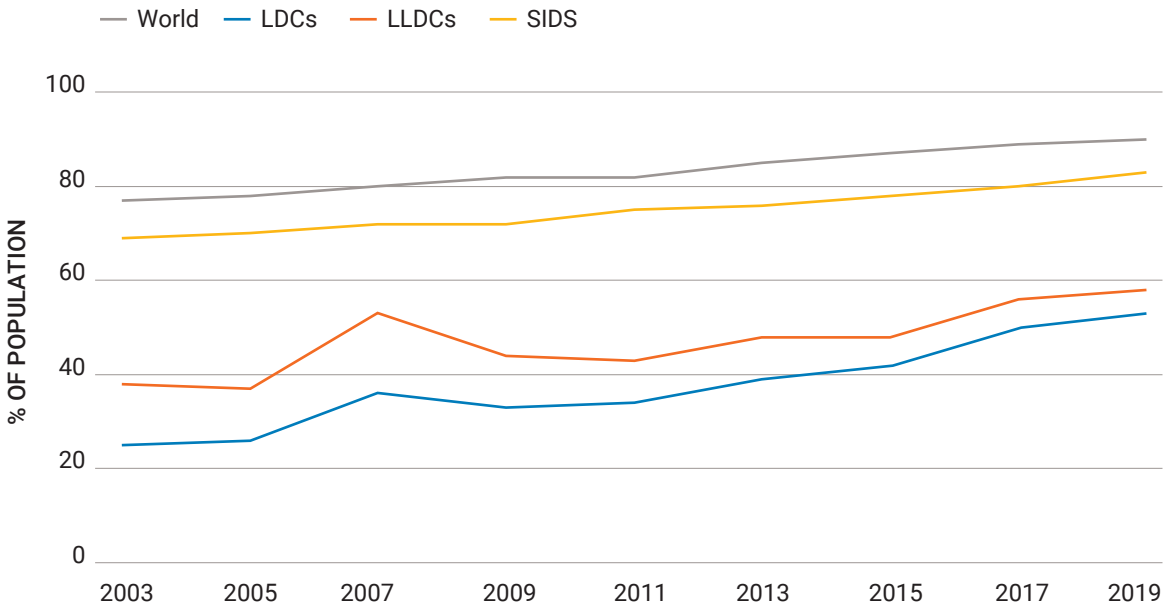
LDCs

The Least Developed Countries suffer most severely from lack of access to energy. In 2019, only 53% of the approximately 1 billion people living in LDCs had access to electricity – 488 million lacked access to electricity. While this is an improvement from 2010, when only 33% of the LDCs´ overall population had access to electricity, progress has been uneven and has slowed down recently. Most gains have been achieved by providing electricity to urban populations, which have an electricity access rate of 78%, compared to 40% for the rural population. Disparities also exist across regions. In 2019, the average access rate reached 87% in the 12 Asia-Pacific LDCs, while across the 33 African LDCs and Haiti, it was only 36% (World Bank, 2021a).

Of the 20 countries with the largest populations lacking access to electricity, 15 of them are LDCs. Ethiopia, which is both a LDC and LLDC, replaced India as the third largest access-deficit country in 2019, with about 58 million unserved people (SDG 7 Tracking Report, 2021).

Access to clean cooking also remains a major concern in LDCs, although it increased to 17% in 2019, up from 11% in 2010. It is noteworthy that the majority of the people in LDCs are living in rural areas, with access to clean fuel for cooking as low as 7% in 2019 (WHO, 2021). Seven LDCs (Democratic Republic of the Congo, Ethiopia, Madagascar, Mozambique, Niger, Uganda and United Republic of Tanzania) have overall access to clean cooking equal to or less than 5% (SDG 7 Tracking Report, 2021).

FIGURE 1. ACCESS TO ELECTRICITY LDCS, LLDCS AND SIDS



World Bank 2021a;2021c.

LLDCs

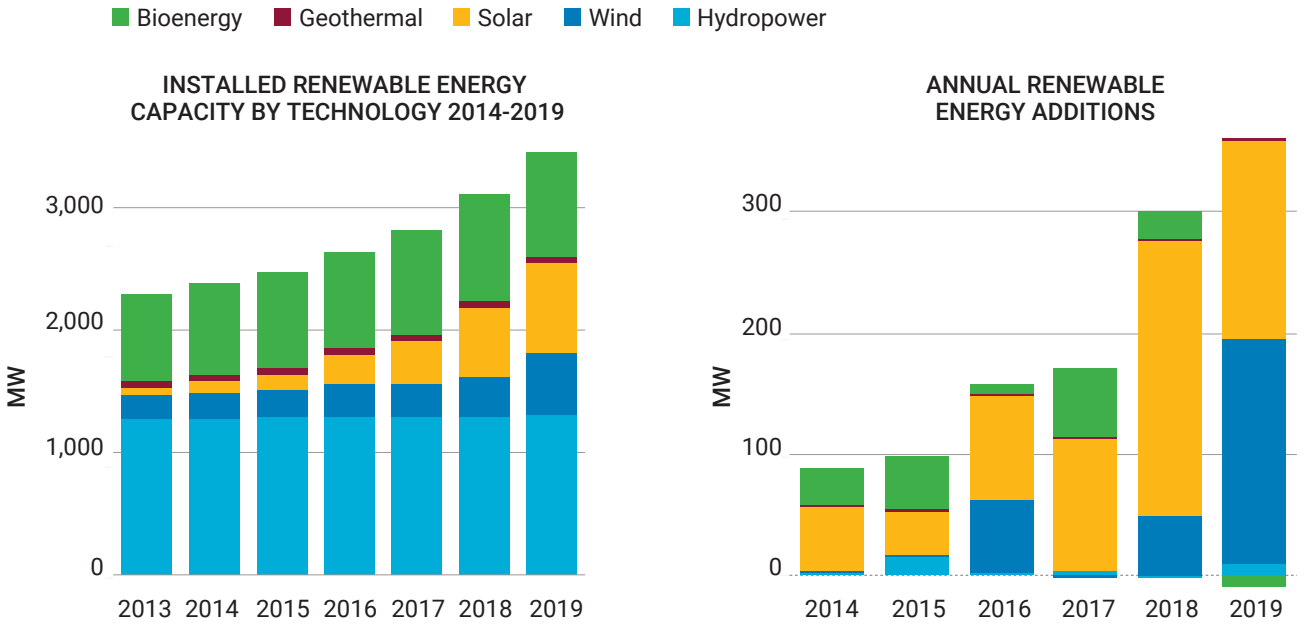
Across the 32 LLDCs, of which 17 are also classified as LDCs, average access to electricity grew from 45% in 2010 to 58% in 2019 (see Figure 1). A total of 219 million people in LLDCs were without access to electricity in 2019. A big disparity remains between urban and rural areas, with access rates of 87% and 45% respectively (World Bank, 2021a). The Political Declaration adopted by the High-Level Midterm Review of the Vienna Programme of Action (VpoA) for Landlocked Developing Countries highlights the importance of renewables in addressing the energy access challenge.

The share of the LLDCs overall population with access to clean cooking fuel only increased from 25% in 2010 to 28% in 2019. There is a significant access deficit in rural areas, which have a 15% access rate, compared with 57% in urban areas in 2019 (WHO, 2021). Reliance on burning biomass fuels such as wood and charcoal, has environmental impacts, as well as health implications that disproportionately affect women and children. There is an urgent need to enhance support to the poorest and most vulnerable households for accessing clean and affordable cooking solutions. This will require cross-sectoral approaches, and increased engagement with the power sector to fully integrate clean cooking with electrification planning.

SIDS

Of the 38 SIDS, 8 are classified as LDCs. A total of 11 million people in SIDS were without access to electricity in 2019. Even though the overall access rate in SIDS was 83%, the access rate in Papua New Guinea, the largest of the Pacific SIDS, was only 63%. The rural electrification rate in SIDS grew from 45% in 2010 to 64% in 2019, while the urban access rate improved from 92% to 95% for the same period. Access to clean fuel for cooking in SIDS was 40% in 2019, virtually unchanged since 2012 (WHO, 2021).

FIGURE 2. INSTALLED RENEWABLE CAPACITY BY TECHNOLOGY IN SIDS 2014 TO 2019



Source: IRENA, SIDS Lighthouse Initiative 2019.

The narrow economic base of SIDS, and over-reliance on a single sector such as tourism, makes them highly vulnerable to external shocks. A case in point is the pandemic-related global downturn in travel and tourism, which has been devastating for many SIDS economies.

The prolonged downturn in tourism and travel is expected to have a deepening impact on tourism-reliant economies, especially in the SIDS. With mounting external debts, and tighter access to capital markets, there is an urgent need for financing to support sustainable energy investments that can reduce SIDS' dependency on fossil fuels while simultaneously supporting climate ambitions, economic diversification, improvements to external and fiscal balances, and greater resilience.

According to the analysis of the International Renewable Energy Agency (IRENA), in the first round of Nationally Determined Contribution (NDC) submissions, 33 SIDS mentioned renewables in their NDCs and 33 SIDS set quantified renewable energy targets. Despite their ambitions to increase renewables in the energy mix, the average share of renewable energy in total final energy consumption (TFEC) fell to 18.1% in 2018, a substantial decrease from 25.4% in 2000 (IEA, 2020b; UNSD, 2020). Excluding traditional uses of biomass, the share of renewables in total final energy consumption was only 7.2% in 2018, down from 13.6% in 2010 (IEA, 2020b; UNSD, 2020). This decline in share is due to non-renewable capacity growth outstripping the positive growth trends in installed renewable capacity in SIDS from 2014 to 2019 (Figure 2).

Energy access, reliability, and affordability

SDG 7 goes beyond providing 'only' an electricity connection, as there is a big difference between simply having access and having the optimum Tier Five access, as defined by the Multi-Tier Framework for measuring energy access. **Moving up the 'energy-ladder'** and expanding reliable energy access, which is also critical for boosting uptake and enhancing economic impact, remains a challenge for LDCs, LLDCs and SIDS.

Where the grid is unreliable, customers are either forced to supplement grid power with noisy, backup generators using expensive and polluting diesel, or do without power (Lam, et al., 2019). In either case, the result dampens economic development and limits positive socio-economic outcomes.

Operational inefficiencies in **providing access in rural areas** result in many low-revenue rural customers being bypassed in electrification projects. These customers frequently represent the foundation of LDCs and LLDCs economies, particularly in agricultural areas. Subsidizing utility service to poor, rural smallholder farmers and small and medium agribusinesses, including in the informal sector, will be needed to bridge the last mile.[76]

At the same time, there is relatively limited data on the electricity needs for rural agriculture across these countries. User and appliance-level electricity consumption data is limited, particularly for rural areas, and food chain actors.

Deployment of decentralized renewables, such as off-grid and mini-grid solutions, will be essential to reach the last mile. Grid-connected mini-grids can increase power system resilience and reliability, while facilitating the integration of solar and wind power. Meanwhile, renewable mini-grids far off from the main grid can provide reliable electricity access for remote areas and islands. However, they need to be supported by comprehensive standards, testing, certification and accreditation, along with ongoing monitoring to reduce the risks.

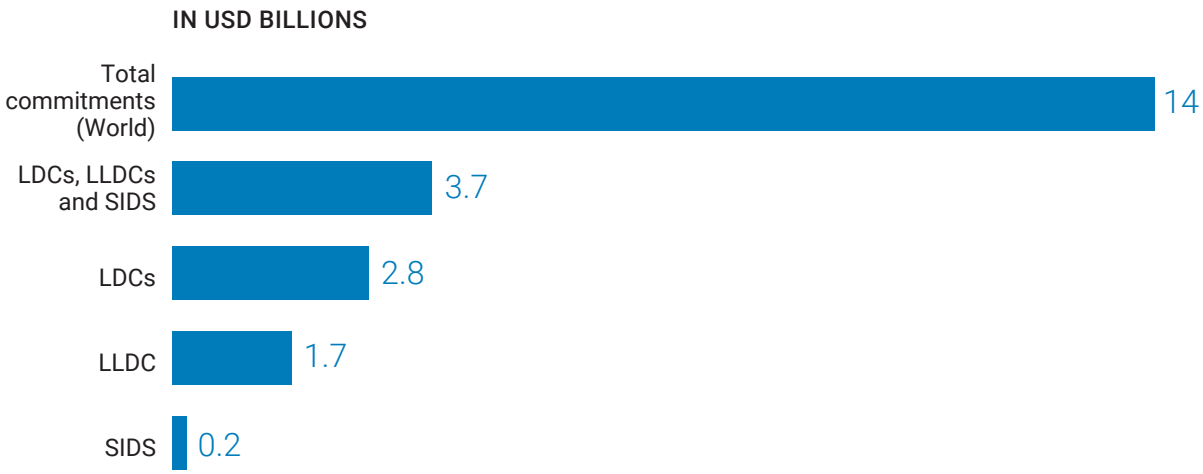
High-quality infrastructure improves project financing, reduces legal, regulatory and performance uncertainty, strengthens mini-grid markets and helps to reduce electricity costs. Through the SIDS Lighthouses initiative, IRENA has published a report entitled Quality Infrastructure for Smart Mini-Grids. The report highlights the crucial role of quality infrastructure for the development of smart renewable mini-grids (IRENA, 2020).

COVID-19 AND ITS IMPACTS ON SDG 7

The COVID-19 pandemic has highlighted the acute importance of access to uninterrupted electricity supplies in order to power health facilities, water distribution and IT infrastructure. The health crisis, and the associated economic downturn, have further heightened the risk of energy insecurity and lack of access to clean cooking solutions in the most vulnerable countries. Governments have been forced to shift limited resources to address the emergency crisis in the health sector, plus a significant pandemic-related rise in poverty.[77] Due to lack of employment, or income-generating opportunities, many households simply cannot afford to purchase energy.

[76] Davies, Gabriel, Building the grid of the future, today. Brookings Institute blog, 2017.
[77] https://blogs.worldbank.org/opendata/updated-estimates-impact-covid-19-global-poverty-looking-back-2020-and-outlook-2021

FIGURE 3. INTERNATIONAL FINANCIAL FLOWS IN SUPPORT OF CLEAN ENERGY COMMITMENTS TO LDCS, LLDCS AND SIDS, 2018



Source: World Bank 2021b; 2021c.

Lockdown measures have also affected the energy demand profile of countries. For example, in SIDS the shutdown of the tourism sector has substantially decreased commercial and industrial electricity consumption, creating new challenges for governments and utilities.[78]

Furthermore, private companies deploying decentralized energy solutions like solar home systems and mini-grids have faced operational and financial challenges because of the pandemic. In large countries like Ethiopia, lockdown measures have affected distribution chains, and reduced sales by 20% in the first half of 2020 compared with the same period last year, according to the latest data gathered by the Global Off-Grid Lighting Association (IEA, 2020b).

FINANCIAL CHALLENGES

While major economies are set for extended periods of very low borrowing costs, the pandemic response is likely to further constrain the already limited fiscal space of LDCs, LLDCs and SIDS, and the financing available for energy investments.

Public finance remains a significant source of global investments in renewable energy, and is key to leveraging private finance. While LDCs account for most of the energy deficit countries in the world, in 2018 they only attracted 20% of the total public financial flows to developing countries.

Financial flows remain far short of what is needed to reach universal energy access by 2030. Of the US$ 14 billion commitments to developing countries in support of clean energy in 2018, US$ 2.8 billion, US$ 1.7 billion, and US$ 0.2 billion were allocated to LDCs, LLDCs and SIDS respectively (World Bank, 2021b). (See Figure 3.)

[78] https://newenergyevents.com/coronavirus-the-caribbean-is-the-first-domino-to-fall-but-there-is-hope/

In addition to further leveraging international resources, governments and utilities can focus on improving the governance and management of their operations to increase profitability, and enhance their creditworthiness to leverage public resources for an energy transition. There is also a need for financial and technical cooperation for project preparation and capacity building to scale up the energy transition in the LDCs, LLDCs and SIDS.

GETTING ON TRACK TO ACHIEVE SDG 7 IN LDCS, LLDCS AND SIDS

While progress is uneven both across and within countries, LDCs, LLDCs and SIDS all face the challenge of meeting increased demand for energy. The need to strike a balance between the costs of energy services and power affordability will continue to shape decision making about generation technologies in these countries.

Recovery plans that harnessing opportunities for sustainable energy would offer a range of benefits. By tapping into their natural endowments, LDCs, LLDCs and SIDS could take advantage of the falling costs of hydropower, solar PV, thermal, and wind energy options. A major shift in government policies oriented towards renewables would provide a solid foundation for addressing macro-level issues such as inclusive growth, market reforms, sustainable trade and investment policies, and employment creation.

Short-term crisis responses aimed at protecting jobs and boosting economic recovery need to be coupled with longer-term, strategic goals for reducing fossil fuel subsidies, mitigating climate change and shoring up climate change adaptation and resilience.

Regional collaboration could play an important role in accelerating and equalizing progress among countries, creating economies of scale through harmonized product and service markets, and supporting joint learning. In this context, most LDCs, LLDCs and SIDS have started to coordinate their efforts through regional utility organizations and regional sustainable energy centres (such as ECREEE, SACREEE, EACREEE, CCREEE, PCREEE, REEECH, and RCREEE) attached to the regional economic communities (ECOWAS, SADC, EAC, CARICOM, SPC, and ICIMOD).

The upcoming 2021 High-Level Dialogue on Energy provides an opportunity for transformative action to achieve SDG 7, focusing on addressing the challenges of the most vulnerable countries, with the aim of leaving no one behind.

CASE STUDIES/BEST PRACTICES ON ACCELERATING AN ENERGY TRANSITION IN THE LDCS, LLDCS AND SIDS

It is clear that without transformative action the LDCs, LLDCs and SIDS will not be able to achieve SDG 7 targets by 2030. However, there is immense potential for growth in the energy sector and acceleration of the energy transition in these countries. This section highlights some of the national and regional best practices for transforming the energy sector in LDCs, LLDCs and SIDS.

Building resilience to climate change impacts on hydropower - Malawi

An integrated generation model designed by the Rocky Mountain Institute (RMI), illustrates how energy policy decision and planning can be informed with a robust evidence base, including long-term scenarios and climate change implications.

FIGURE 4. POWER GENERATION INSTALLED CAPACITY IN 2030 (MW)

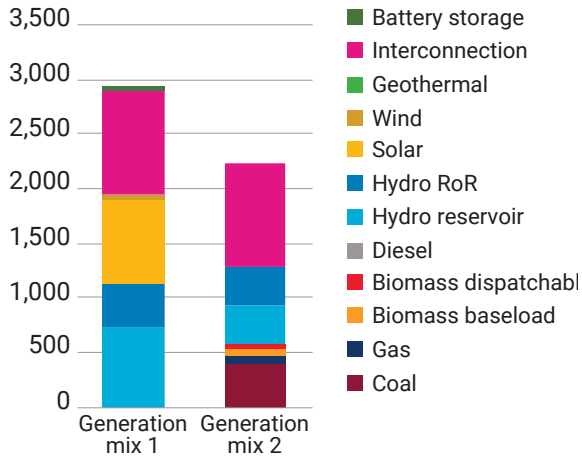
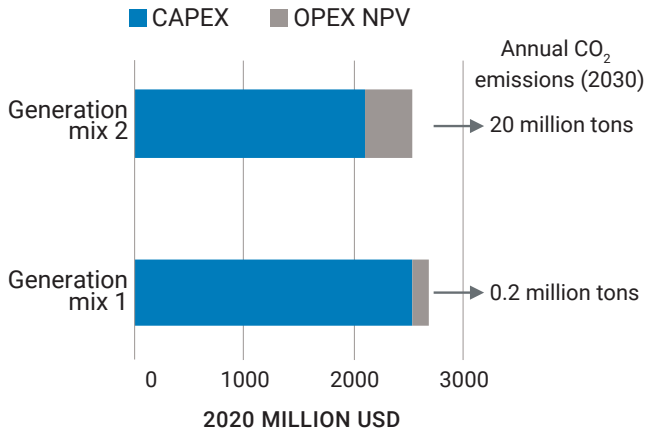


FIGURE 5. NVP COMPARISON



Source: IRENA, SIDS Lighthouse Initiative 2019.

This software tool compares the reliability and costs of different generation options in Malawi, and aims to support grid expansion planning. The model analyses generation expansion options for the Malawi grid, comparing reliability and cost metrics for different grid mixes. This user-friendly tool offers possibilities to adjust the demand forecast or select river flow options, to assess the generation scenario's resilience to climate change impacts on hydropower.

Hourly dispatch analysis demonstrates that at current river levels, an optimized solution using renewables and hydro can reliably meet the projected demand. If water resources decrease due to low rainfall, electricity imports from neighbouring countries are incorporated to ensure supply until river levels are restored or new capacity commissioned.

Generation mix 1 represents this optimized renewable solution in Figures 4 and 5, while Generation mix 2 shows an optimized fossil fuel solution.

Figure 5 highlights a renewable heavy generation mix offering a slightly higher net present value than a fossil heavy mix. However, a fossil fuel heavy mix incurs additional costs of fuel transport, fluctuation risks of fuel import price and forex use, and stranded asset risks. Moreover, large fossil fuel plants may lock the country into a path with less flexibility in case of changes in demand. Alternatively, a renewable heavy mix will require investments in building out power transmission.

Building grid resilience to extreme weather events in Caribbean SIDS

In 2018, Cyclone Gita hit the Pacific islands of Vanuatu, Fiji, Wallis and Futuna, Samoa, American Samoa, Niue, and Tonga. In Tonga, Gita left more than 80% of the homes without power, and economic damages totalled US$ 164 million, 40% of the island's GDP. Solar PV systems can provide lower-cost energy that is more resilient and reliable than imported fuels on many islands. As the frequency and intensity of weather events increase, policy makers can ensure best practices for solar photovoltaic systems are in place to minimize the damage to the energy infrastructure, which can in turn help to reduce economic losses.

The Rocky Mountain Institute and the Clinton Climate Initiative sent expert structural engineering teams to the Caribbean region in 2017 to investigate why some PV systems survived virtually unscathed while others suffered extensive damage. The teams then developed a list of recommendations and provided a set of best practices regarding specifications for equipment and procedures to increase the reliability and survival rates of PV systems in hurricanes, and ensure resilient and reliable power for grids, homes, businesses, and critical facilities.[79]

Digital capacity building programme on sustainable energy island solutions

A successful energy transition of SIDS to renewable energy and energy efficiency requires a critical mass of qualified professionals in the private and public sector. However, due to limited educational capacities, young experts face barriers to access training programmes tailored to the requirements of island energy systems. Due to COVID-19 travel restrictions, prospective engineers face additional challenges to study abroad or at regional universities.

Therefore, in December 2020, the Global Network of Regional Sustainable Energy Centres (GN-SEC) launched the Online Capacity Building Programme on Sustainable Energy Solutions for Islands. Composed of nine modules, it provides in-depth knowledge and practical exams on the following energy issues and technologies: solar photovoltaics, solar thermal, ocean energy, bioenergy, energy efficiency and thermal optimization in buildings, mini-grids, energy storage, e-mobility and climate change.

The courses are free of charge, and island experts can participate either through self-learning or conducted trainings. Currently, the programme is available in English, Spanish and Portuguese. It also applies a train-the-trainer approach, which helps national institutes to incorporate the tool into their curricula.

The programme was jointly developed by the United Nations Industrial Development Organization (UNIDO), the Small Island Sustainable Energy and Climate Resilience Organization (SIDS DOCK) and the Spanish Centre for Research in Energy, Environment and Technology (CIEMAT). It is disseminated through the GN-SEC centres, which cover most of the SIDS.

The programme has been an important contribution to SDG 7 (sustainable energy), SDG-9 (ICTs) and SDG-13 (climate change) as well as SIDS-SIDS cooperation in line with the SAMOA Pathway.[80]

Regional policy frameworks to accelerate island transitions to electric mobility and smart grids[81]

In their efforts to decouple industrial development from fossil fuel import dependency and GHG emissions, most of the SIDS are heading towards smart and integrated power systems combining renewable energy, battery storage, electric mobility and innovative digital business models. However, currently most SIDS do not have suitable policy and regulatory frameworks in place to make this vision a reality in the near future.

To ensure equal progress and economies of scale, UNIDO, in partnership with the Caribbean Centre for Renewable Energy and Energy Efficiency (CCREEE) and the Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE) have developed regional policy frameworks for electric vehicle integration.

[79] https://www.un.org/ohrlls/news/solar-under-storm-policymakers-2020
[80] www.training.gn-sec.net
[81] www.gn-sec.net, www.pcreee.org and www.ccreee.org

The Regional E-Mobility Policy for Pacific Island Countries and Territories, and the Regional Electric Vehicle Strategy Framework for the Caribbean, were discussed and finalized in 2020.

Both centres will provide implementation support “from the region for the region” and ensure a harmonized approach among the countries. UNIDO will facilitate SIDS-SIDS knowledge exchange on electric vehicles through its Global Network of Regional Sustainable Energy Centres (GN-SEC). The initiative was supported by the Governments of Austria, Norway and Germany.

REFERENCES

Borgstein, Edward, Scarlett Santana, Becky Li, Kester Wade, and Eric Wanless, 2019. Malawi Sustainable Investment Study. Rocky Mountain Institute

IEA (International Energy Agency), 2020a. The Covid-19 crisis is reversing progress on energy access in Africa, https://www.iea.org/articles/the-covid-19-crisis-is-reversing-progress-on-energy-access-in-africa¬

IEA, 2020b. World Energy Balances. International Energy Agency: Paris

IEA, IRENA, United Nations Statistics Division, World Bank; WHO, 2021. Tracking SDG 7: The Energy Progress Report 2021.

IRENA, SIDS Lighthouse Initiative, 2019. https://islands.irena.org/RE-Progress/Progress-Data

IRENA, 2020 Quality Infrastructure for Smart Mini-grids, International Renewable Energy Agency, Abu Dhabi

Lam, N. L., et al., 2019. The Dirty Footprint of the Broken Grid: The Impacts of Fossil Fuel Back-up Generators in Developing Countries. International Finance Corporation

OHRLLS, 2017. Promoting Investment for Energy Access in Least Developed Countries

Stone, Laurie, Christopher Burgess, and Justin Locke, 2020. Solar Under Storm for Policymakers: Select Best Practices for Resilient PV Systems for Small Island Developing States, www.rmi.org/insight/solarunder-storm-for-policymakers

World Bank, 2021a, Access to electricity dataset

World Bank, 2021b, Access to Financial Flows to developing countries dataset

World Bank, 2021c, Population Statistics

World Health Organization, 2021, Access to clean fuels for cooking dataset

United Nations Statistics Division (UNSD), 2020. Energy Balances.

[41] In India, implementation and enforcement of all buildings-related policies occurs at the city level but is, to a large extent, guided by model regulations and rules provided by the national and state authorities (WRI India, 2019).

SECTION 5

TOWARDS A **SUSTAINABLE AND EQUITABLE ENERGY FUTURE**

- **THE MULTI-TIER FRAMEWORK MEASURING ENERGY ACCESS: TRACKING SDG 7.1 AND BEYOND - YEARLY UPDATE**
- **REGULATORY INDICATORS FOR SUSTAINABLE ENERGY (RISE)**
- **PROMOTING ENERGY TRANSPORTATION INFORMATION NETWORK (ETI) INTEGRATION TO ADVANCE INTERLINKAGES WITH THE SDGS**

SECTION 5.1

THE MULTI-TIER FRAMEWORK MEASURING ENERGY ACCESS: **TRACKING SDG 7.1 AND BEYOND – YEARLY UPDATE**

CONTRIBUTING ORGANIZATION:
THE WORLD BANK

Summary/Key Messages

- Data collection was completed for 16 first-round countries, and 11 country reports have been published to date. New Multi-Tier Framework (MTF) surveys are under implementation in seven countries. The MTF team has been supporting various research initiatives, as well as focusing on technical support to countries and national statistical offices, and MTF data was used in the preparation of World Bank clean cooking projects in Myanmar, Rwanda, and Uganda.

- The new countries aim to use MTF data for a number series of purposes, including to: engage governments with the access agenda by assessing the extent of the access deficit; prioritize investments in electricity access and inform national rural electrification strategies; quantify demand for solar energy; inform future operations aiming to enhance electricity grid service provision by analysing data on the performance of the grid; and evaluate electricity use through consumption and appliance ownership.

- MTF data were used to estimate the global population with access to Modern Energy Cooking Services (MECS), as well as access to improved cooking services in the 2020 State of Access to Modern Energy Cooking Services report, and to validate and improve the thresholds set for four attributes (Convenience, Safety, Affordability, and Availability).

- The MTF team has been supporting various research initiatives, including country-specific impact evaluation studies, cross-country comparative analysis, and work on creating a harmonized multi-country MTF dataset to facilitate the manipulation of MTF data by external researchers and practitioners.

- Along with leading the implementation of MTF surveys in new countries, the MTF team will increasingly focus on providing technical support to countries that plan to manage the survey themselves. The MTF team will also support national statistical offices to integrate a short energy module into national household surveys to foster the sustainability of MTF data collection.

INTRODUCTION

The MTF is a prominent tool for setting SDG 7.1 targets and tracking progress toward achieving them (United Nations, 2020). It was developed by the World Bank's Energy Sector Management Assistance Program (ESMAP), in consultation with international partners, and goes beyond the binary measurement of energy access currently used to track SDG 7.1 progress. It offers a clear definition of what affordable, reliable, and modern energy access means, and it proposes measurable indicators for each aspect, as well as a method for combining them into a single indicator to facilitate tracking.

The MTF captures the multidimensional nature of energy access at the end-user level, along with the vast range of technologies that can provide such access, while accounting for the wide differences in user experience. The richness of MTF data has been useful in providing valuable market intelligence for the private sector, and helping to deepen sector dialogue with governments and inform policies and investments to meet ambitious access targets.

2020 UPDATE

Data collection was completed for all 16 first-round countries, and 11 Country Diagnostic Reports have been published, including for Honduras in 2020.[82] The second round of MTF surveys is ongoing in Burkina Faso, Burundi, Sierra Leone, and Zimbabwe. Due to the COVID-19 pandemic, phone surveys will be conducted, instead of in-person interviews, in Burkina Faso and Zimbabwe. Phone surveys are significantly shorter than in-person surveys but cover all the main MTF dimensions. MTF surveys are also being prepared for Eswatini, Pakistan and Papua New Guinea, and early interest has been expressed by Benin and Sudan.

The MTF data analysis offers useful input for policy formulation, investment strategies, project design, utility performance accountability, and monitoring and evaluation. The new set of countries conducting MTF surveys are planning to use MTF data for multiple purposes:

- In Burundi, the MTF data will help the government and donors prioritize investments in electricity access and inform the country's upcoming rural electrification strategy. The MTF data will help the World Bank Solar Energy in Local Communities project (World Bank, 2020a) to quantify demand for solar energy across the country and size the grants provided to solar systems distributors. This will

[82] For all documents related to MTF country surveys, please go to https://energydata.info.

involve reporting electricity access rates by technology,[83] assessing households' willingness to pay for solar devices, and measuring households' spending on coping solutions such as candles and other lighting fuels. In addition, MTF data on the performance of the grid (availability, reliability, quality, etc.) will inform future investments aiming to enhance electricity grid service provision.

- In Eswatini, the MTF survey results will help evaluate the impact of the country's rural electrification programme and policies to close the electricity access gap. While the electrification programme has been effective in connecting around 80% of the households, the performance of the electricity supply (availability, reliability, quality, etc.) and the level of electricity use, still need to be evaluated. In addition, the MTF data will inform investment decisions aiming to electrify the remaining 20% of the households, by measuring current spending on coping solutions (such as candles and lighting fuels) and assessing willingness to pay for solar solutions. The MTF data will also feed into the geospatial platform that will be developed under the recently approved Eswatini Network Reinforcement and Access Project (P166170).

- In Pakistan, the MTF data will be used to measure the level of electricity access of households around the country and examine how electricity is used, assessing the penetration of different types of appliances, as well as affordability and willingness to pay. The data collected will also inform the upcoming least-cost electrification study.

- In Papua New Guinea, the MTF data will assess the current energy access status and inform upcoming energy access projects. In-depth information on households' wealth level, willingness to pay for off-grid solar solutions, and current energy expenditure patterns will assist in the design of World Bank operations aiming to improve electricity access in the country.

- In Zimbabwe, the MTF data will provide a foundational building block for understanding the energy access situation in the country and will make the case for stronger government engagement with the access agenda. Along with the GIS study, the MTF data will inform the national electrification programme, by assessing the extent of the access deficit, and will contribute to estimating demand and setting targets for different electrification strategies.

Three MTF enterprise survey reports have been finalized and are expected to be published by mid-2021. MTF enterprise surveys, encompassing formal and informal sectors, were conducted in Kenya and Nepal in 2018, and Sao Tome and Principe (STP) in 2019. The results show that the national grid is typically the primary electricity source for enterprises. However, grid penetration varies by country, ranging from 95% in Kenya (99.9% for formal and 90.3% for informal enterprises) to 60.6% in STP (83.9% for formal and 37.2% for informal enterprises). Grid-connected enterprises suffer from poor reliability and quality of service, which negatively affects their activities. Reliability of service (unscheduled interruptions) was one of the main constraints reported: 65% of enterprises in Kenya, 52% in Nepal and 68.7% in STP reported having between 4-14 service interruptions a week. Quality of service (low or fluctuating voltage) was a constraint for 19.5% of enterprises in Kenya and 38.8% in Nepal. To cope with these issues, enterprises use backup energy solutions, which generate extra costs and reduce their overall profits.

The State of Access to Modern Energy Cooking Services Report, launched in September 2020, used MTF data to provide a detailed analysis of household behaviour and demand for clean and improved cooking services across countries (ESMAP, 2020). The report examined emerging trends across MTF countries and provided insights on household behaviour with regard to fuel and stove usage, fuel and

[83] Technologies for electricity access include the national grid, as well as off-grid solutions using a mini-grid, rechargeable battery, generator, solar lantern, solar lighting system, or solar home system).

stove stacking, affordability, convenience, fuel availability and women's use of time. MTF data were also used to validate and improve the thresholds set for four attributes: Convenience, Safety, Affordability, and Availability.[84] The report provided definitions for access to Modern Energy Cooking Services (MECS) and access to Improved Cooking Services that used the MTF matrix and tier levels.

In the 2020 State of Access report, MTF data from five countries were used to calculate an 'archetype ratio' – the proportion of each primary-fuel population in rural and urban settings that meets the MECS criteria (Tiers 4 and 5) and improved cooking services criteria (Tiers 2 and 3). The archetype ratios were then applied to the global fuel mix country data through archetype identification based on similarities in fuel mix, income, region, fuel affordability, urbanization, electrification, and other factors to match country data with respective MTF archetypes.

The report also estimated investment needs for countries to achieve universal access by 2030 with two scenarios: transition to MECS and transition to Improved Cooking Services. The data sets and models developed through this report will be made available to the public in an online planning tool for policy makers. Additionally, data on technologies and fuels from MTF country datasets and field preparation work will be compiled into an online, publicly available catalogue for World Bank country teams, as well as external stakeholders and researchers.

In Rwanda, the team used the MTF data to prepare the first Clean Cooking Fund co-financed project – the Energy Access and Quality Improvement Project – which is the largest World Bank investment project in clean cooking in Africa (World Bank, 2020b). The MTF data is also being used in the preparation work for Uganda and Myanmar.

The MTF team has also been supporting various research initiatives, including country-specific impact evaluation studies, cross-country comparative analysis focused on specific technologies, and in-depth research on gender. In collaboration with the Schatz Energy Research Center (SERC),[85] the MTF team is working on creating a harmonized MTF dataset including 15 countries, to facilitate the manipulation of MTF data by external researchers and practitioners.

The Energy Access Project at Duke University,[86] which focuses on building knowledge to inform key decision making related to energy poverty, has been using MTF data in several applications. For example, the Energy Access Dividend (EAD) report uses the MTF electricity access tiers to quantify the double challenge that Honduras is facing (reaching last-mile households in remote, rural communities, and improving the quality and reliability of access for those already connected), and to differentiate the electrification benefits (such as monetary savings, time use changes, asset ownership, health benefits, etc.) that accrue to households in each tier, which can then be compared using monetized values (Marzolf et al., 2019).

The EAD report emphasizes the role of electrification in economic development and highlights the potential trade-offs across electrification strategies (in terms of technology, pace, and level). It also demonstrates the importance of detailed household-level survey data, such as the MTF data, for improving policy making. The team is working to apply the EAD approach to other countries with such data.

[84] The following amendments were made to the MTF: (i) For convenience, the Tier 1 and Tier 2 threshold for stove preparation time was reduced from 15 to 10 minutes per meal. (ii) For safety, an additional threshold was introduced in Tier 3 reflecting minor accidents caused by the stove over the past year. (iii) For affordability, fuel cost >=10% of household expenditure falls under Tier 0-2, fuel cost below 10% and >=5% of household expenditure falls in Tier 3 and fuel cost <5% of household expenditure falls in Tier 4-5. (iv) For availability, primary fuel availability <=80% falls in Tier 0-2, primary fuel availability >80% and <=90% falls in Tier 3, primary fuel availability >90% and <100% falls in Tier 5, and primary fuel availability at 100% falls in Tier 5.

[85] https://schatzcenter.org/

[86] https://energyaccess.duke.edu/

Another research project focuses on livelihood benefits, beyond health, that result from the use of clean cooking solutions, through the analysis of time use indicators in six countries in Asia and Africa. The MTF surveys collect sex-disaggregated data on time spent by household members on cooking-related activities, as well as care activities, studying or reading, entertainment and working outside the house. Findings from this research will help inform policy tools such as the BAR-HAP model developed by the WHO, which estimates the financial resources needed for transitioning to cleaner cooking solutions, and the value of the benefits resulting from such transitions (WHO, undated). This research can also support the case for development impact investment on cleaner cooking, which could bolster other sources of funding such as carbon finance.

MTF data are also used by the Access Insights Platform (AIP), which aims to provide last-mile distribution enterprises, governments, development partners, and investors with a tool to identify and analyse opportunities to expand access to electricity, clean cooking solutions, and other services critical to human development. The AIP is an interactive, open-source data visualization platform developed by Catalyst Off-Grid Advisors, that provides key insights on factors related to household and community level supply and demand for energy, plus demographics, and socio-economic trends. In partnership with the World Bank, the AIP has built a module that enables users to interact with, and visualize data from, the MTF surveys. In parallel, the AIP includes a geospatial module that utilizes predictive algorithms to visually depict hyper-localized population density data and key infrastructure (such as roads and electricity grids) and leverages country-level household survey datasets that are in the public domain. Where data is available it also maps health facilities, financial institutions, mobile network coverage, and other infrastructure relevant to last-mile distribution businesses and service delivery.

GOING FORWARD

Along with leading the implementation of MTF surveys in new countries, the MTF team will increasingly focus on providing technical support to countries – governments and operations teams – that plan to manage the survey themselves. Technical assistance will be offered for the design and customization of MTF surveys to meet country-specific data needs, as well as data collection and data analysis. This includes guidance on the sampling strategy for in-person and phone surveys, questionnaires, the CAPI (Computer-Assisted Personal Interview) programme, and the script for Tier calculations.

In addition, the MTF team will support national statistical offices to integrate a short energy module into national household surveys. This integration will be critical to collecting MTF data and energy-related information in a sustainable way. In partnership with the Living Standard Measurement Study (LSMS) team and the WHO, the MTF team has carefully selected Core Questions on Household Energy Use and developed a guidebook on the integration of such questions into national household surveys (World Bank and WHO forthcoming). Along with the publication of the guidebook, which is expected by mid-2021, capacity building workshops and training will be organized to help national statistical offices monitor progress toward SDG 7.1.1 and 7.1.2 indicators.

REFERENCES

Energy Sector Management Assistance Program (ESMAP), 2020. The State of Access to Modern Energy Cooking Services. Washington, DC: World Bank. License: Creative Commons Attribution CC BY 3.0 IGO

Marzolf, N.C., Pakhtigian, E.L., Burton, E., Jeuland, M., Pattanayak, S.K., Phillips, J., Singer, C.E., Taylor, H., Hallack, M.C.M., Cuervo, J. and Jacome, C., 2019. The Energy Access Dividend in Honduras and Haiti (Vol. 743). Inter-American Development Bank.

United Nations, 2020. Accelerating SDG7 Achievement in the Time of Covid-19. Policy Briefs in Support of the High-Level Political Forum 2020.

World Bank, 2020a. Burundi to Improve Access to Services and Opportunities for the Poor in Rural Areas. Press Release. February 28, 2020. The World Bank Group. Washington, DC.

World Bank, 2020b. World Bank Project to Boost Household Access to Affordable Energy. Press Release. September 17, 2020. The World Bank Group. Washington, DC.

World Bank and WHO, forthcoming. Measuring Energy Access: A Guide to Collecting Data Using the Core Questions on Household Energy Use.

WHO, undated. Benefits of Action to Reduce Household Air Pollution (BAR-HAP) Tool. https://www.who.int/airpollution/household/interventions/chest-module3-BAR-HAP-tool/en/

SECTION 5.2

REGULATORY INDICATORS **FOR SUSTAINABLE ENERGY (RISE)**

CONTRIBUTING ORGANIZATION:
THE WORLD BANK

Summary/Key Messages

- **Policies do matter.** RISE 2020 presents a wealth of evidence that the right policies and regulations are critical for countries seeking to attract new investment and grow towards a sustainable energy sector in line with SDG 7.
- **Globally, steady progress was made on sustainable energy policy in the period 2017–2019, but the pace was slower than in the past.** Progress on policies related to renewable energy and energy efficiency slowed by half compared with 2015–2017, whereas scores for electricity access and clean cooking maintained their advance and even accelerated during 2017–2019.
- **The countries that made the most rapid improvements were concentrated in Sub-Saharan Africa.** Of the top ten performers in RISE 2020, nine were in Sub-Saharan Africa, including South Africa, Benin, and Sudan. Kenya, Tanzania, and Chad were the fastest improving countries globally, increasing their RISE scores by more than nine points per year on average from 2017 to 2019. The increase was driven mainly by progress on electricity access and renewable energy, with Kenya also improving markedly on energy efficiency.

INTRODUCTION

RISE—Regulatory Indicators for Sustainable Energy—is a set of indicators intended for use in comparing the policy and regulatory frameworks that countries have put in place to support the achievement of Sustainable Development Goal 7. Reaching the ambitious SDG 7 targets on energy access, energy efficiency, and renewable energy will call for a rapid escalation of low-carbon energy and much more efficient use of

FIGURE 1. RISE INDICATORS TRACKING EACH SDG 7 TARGET

Pillar	Indicators			
ELECTRICITY ACCESS	• Electrification plan • Scope of the electrification plan	• Grid electrification framework • Framework for mini grids	• Framework for standalone systems • Consumer affordability	• Utility transparency and monitoring • Utility creditworthiness
CLEAN COOKING	• Planning • Scope of planning	• Standards and labeling • Incentives for clean cooking solutions		
RENEWABLE ENERGY	• Legal framework for renewable energy • Planning for renewable energy expansion	• Incentives and regulatory support for renewable energy • Atributes of financial and regulatory incentives	• Network connection and use • Counterpaty risk	• Carbon pricing and monitoring
ENERGY EFFICIENCY	• National energy efficiency planning • Incentives and mandates: Industrials and commercial end users	• Incentives and mandates: Public sector • Incentives and mandates: Utilities • Financing mechanisms for energy efficiency	• Minimum energy performance standards • Energy labeling system • Building energy codes	• Transport sector • Carbon pricing and monitoring

Source: World Bank RISE 2018.

existing energy resources. The clean energy agenda also highlights the importance of leaving no one behind, by insisting on universal access to affordable, reliable, modern, and sustainable energy for all by 2030.

Having effective supportive policies in place is essential for building robust enabling investment environments and working towards the SDG 7 targets. Focused and enforced policies and regulations will ensure the proper utilization of available financing for any country's energy sector to work toward SDG 7 targets, as well as help leverage additional funding for even more ambitious targets. It is important to track how well countries are doing in creating the kind of regulatory environment needed to enable and accelerate achievement of SDG 7.

RISE provides a global scorecard, by tracking adoption of good practice policies at the country level. The latest edition of RISE, released in December 2020, captures policies and regulations (from 2010 up to 2019) that enhance sustainable energy and presents them in the form of 31 indicators distributed among the SDG 7 pillars: access to electricity, clean cooking, renewable energy, and energy efficiency (see Figure 1).

The indicators, scored on a 0–100 scale, can be used to compare 138 economies that account for 98% of the world's population. A country's overall score is an average of its scores on the pillars for access to electricity[87], renewable energy, and energy efficiency. (The clean cooking pillar is only scored for 55 access-deficit countries.[88])

By measuring the level and ambition of policy adoption in these countries, the indicators can help policy makers benchmark their own national energy framework against those of regional and global peers. By providing empirical evidence of the support provided by policy frameworks, the RISE database helps countries attract investment in their sustainable energy sector.

RISE is also a valuable resource for private investors and developers, who can use it to carry out due diligence related to new projects, products, and services. For instance, unless countries have creditworthy utilities to partner with investors as energy off-takers and/or transmission service providers, they will find it difficult to attract investments in renewable energy or to expand grids to reach universal access. Similarly, by setting energy efficiency standards for appliances and buildings, governments can ensure that existing private sector investment decisions are directed towards the creation of more sustainable capital stock.

RISE scores are intended to illustrate how close or far away a country is from offering an attractive policy environment for investment projects in sustainable energy. It is also designed to identify gaps in policy and to promote reforms. However, these scores cannot be construed as thorough investment advice, e without further in-country due diligence.

Although it is relatively easy for countries to adopt policies on paper, only effective enforcement of these policies can bring about the desired results. As might be expected, countries tend to have higher scores on enacting policies on paper than they do on enforcing those policies in practice, which is beyond the scope of RISE. RISE assesses the presence of policies and regulations that have been approved and adopted in legislation on paper, along with monitoring and enforcement mechanisms associated with the adopted legislations. However, RISE cannot fully capture the quality and level of implementation of the adopted legislation in practice, which is highly context-specific and may produce subjective assessments. Some policies may not be completely relevant for all countries given their specific conditions, such as natural resources, strategies, and political choices. One example is electrification strategies, where some countries have elected to rely only on publicly-owned service providers or on grid expansion.

Over the past decade there has been sustained improvement in most countries on all areas of enforcement in the energy sector. This suggests that countries are paying greater attention to these issues, and that it is important to continue to monitor such progress through specific RISE indicators.

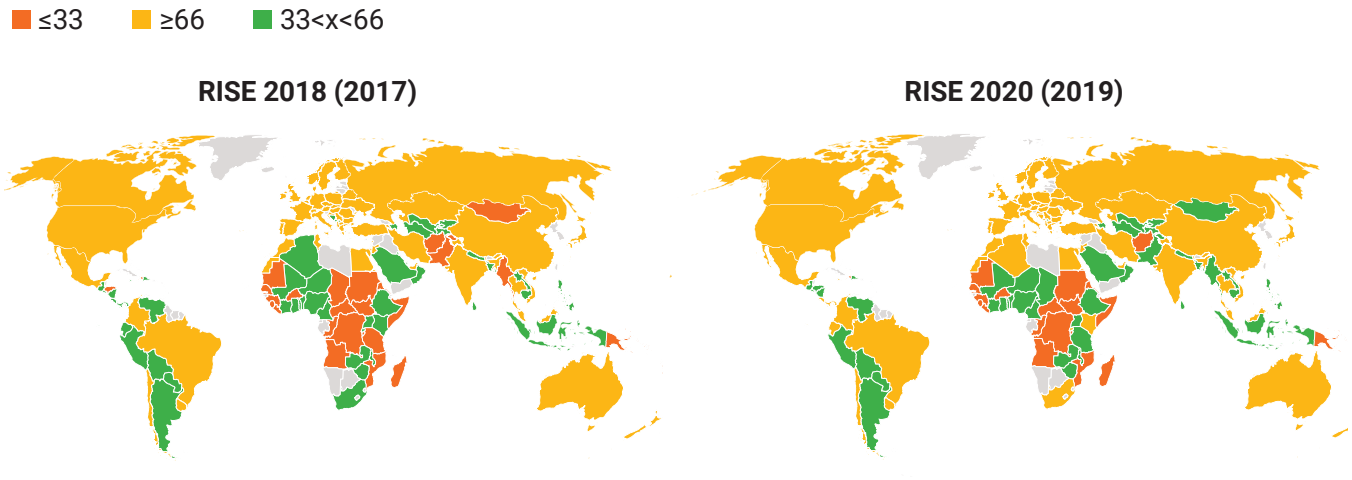
TARGETS, INDICATORS AND DATA

By 2019, 65 additional countries had built advanced policy frameworks for sustainable energy into their regulatory systems, including many emerging and developing countries, such as South Africa, Ecuador, Jamaica, and Kenya.

[87] 54 countries were surveyed for electricity access in 2019. Access deficit countries were selected if they had access rates under 90% or if there were over 5 million people lacking access to electricity in the country. Countries with no electricity access deficit were scored 100.

[88] The clean cooking pillar is scored for 55 access-deficit countries (as identified in IEA, IRENA, UNSD, World Bank, and WHO, 2020) and is averaged into the overall score for those countries only.

FIGURE 2. EVOLUTION OF RISE SCORES WORLDWIDE, 2017 VS. 2019



Source: World Bank, RISE 2020.

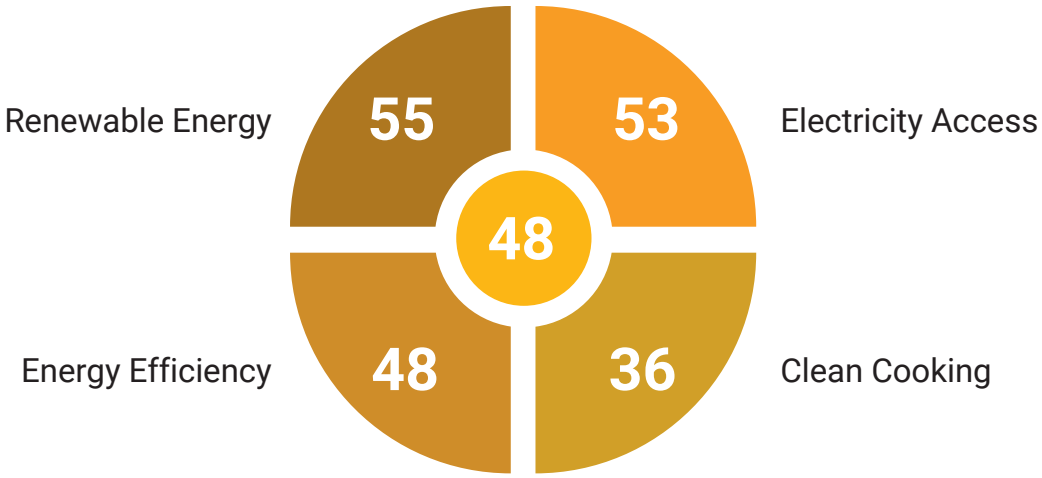
Across all dimensions of sustainable energy, average global scores suggest considerable scope to improve policy and regulatory frameworks. As noted, the overall RISE score reflects performance on four pillars of sustainable energy: access to electricity; access to clean cooking; renewable energy; and energy efficiency. As of 2019, the global average score did not exceed 60 in any of these areas, indicating an intermediate (yellow) level of performance in all cases.

RISE tracks each SDG 7 target with specific indicators to benchmark existing policies against good practices. For example, with respect to electricity access, frameworks to support mini-grid and standalone systems have made faster progress than on-grid electrification. Income is a predictor of outcomes of electrification policy efforts, with 67% of middle and upper-income countries having adopted comprehensive access frameworks by 2019, compared with just 13% of low-income countries. The steady progress of Bangladesh, Myanmar, and Cameroon is notable among countries with the largest access deficits in SDG 7.1.1. However, more than half the global population without access to electricity at the end of 2019 was in countries with weak regulatory frameworks.

FIGURE 3. GLOBAL AVERAGE RISE SCORE FOR EACH PILLAR AND ACROSS ALL PILLARS, 2019

Source: World Bank, RISE 2020. Note: Global scores for electricity access and clean cooking reflect the average scores for the access-deficit countries as identified in IEA, IRENA, UNSD, World Bank, and WHO (2020).

FIGURE 4. GLOBAL PROGRESS BY INDICATOR IN ELECTRICITY ACCESS – 2010, 2017 AND 2019



Despite continuous progress, electrification planning and scope indicators (covering targeted service, inclusion, and electrification of productive uses and public facilities) have still not reached an average score in the RISE green zone (the zone indicating advanced policy frameworks), even though they have become the needed first step for the design of efficient strategies (Figure 4).

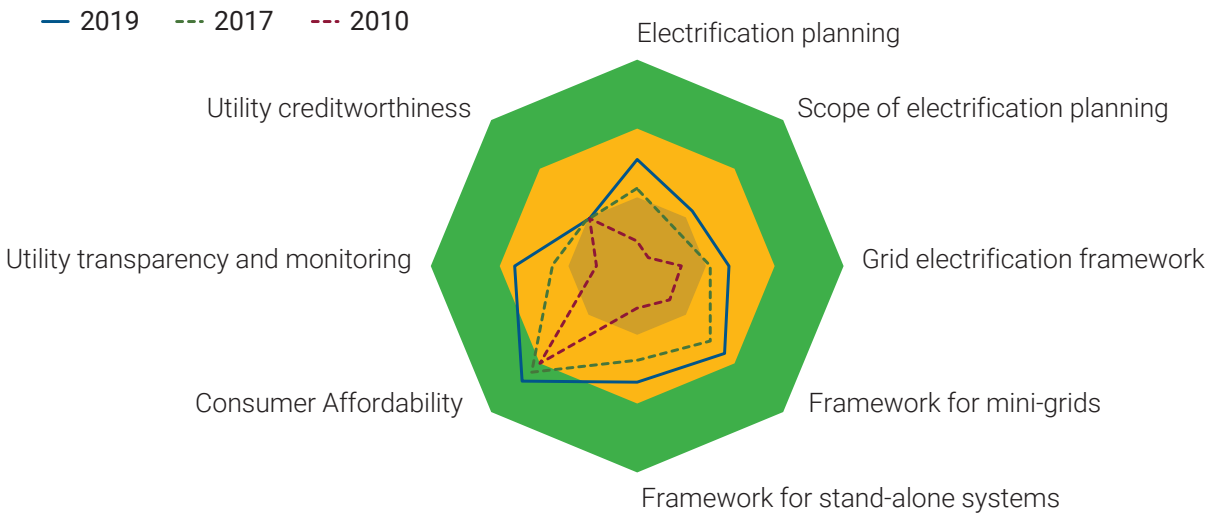
Grid electrification policy frameworks have also been steadily improving, but at a slightly slower pace. Over the past decade, affordability has improved consistently and rapidly in all access-deficit countries, a trend that reflects progress on implementing strategies that target the poorest populations without access.

Clean cooking is also an integral aspect of energy access, but of the four pillars of sustainable energy, clean cooking is the one most often overlooked when it comes to policy making. Less than a quarter of the 55 access-deficit countries that RISE monitors for clean cooking have advanced policy frameworks that score in the green zone. Those countries that do score in the green zone for clean cooking policies contain more than half of people without access to clean cooking. Among the eight countries currently scoring in the green zone, China, Ethiopia, India, Indonesia, and Kenya made particularly great strides to improve access, especially India which was the only country to score above 90. These countries are home to 1.4 billion people who lack access, more than half the global population in that situation.

There is an urgent need for policy interventions in clean cooking area in countries marked by fragility and conflict, where fuel-collection tasks not only expose women and girls to violence but also damage the environment. Yet the clean cooking agenda is largely ignored in this group of countries. Standards and labelling are particularly weak in fragile countries; average scores on this indicator are 15% lower than scores of non-fragile countries.

Clean cooking is a cross-sectoral issue. There is a need for an institutional champion to help coordinate clean cooking efforts across the sectors of energy, health, gender-inclusion, and climate change. Effective policy making and implementation must be shared by government and non-government actors, engaging multiple government ministries/departments.

FIGURE 5. GLOBAL PROGRESS BY INDICATOR IN CLEAN COOKING – 2010, 2017 AND 2019



RISE data shows that the majority of countries have built their awareness strategies on the health aspects of clean cooking, and half use income, geography, and gender in their campaigns. In many countries, the ministry of energy is involved in all aspects of policy making for clean cooking—from creating an action plan for uptake to setting standards and monitoring progress, emphasizing the need for a coordinating institution that can lead policy deployment.

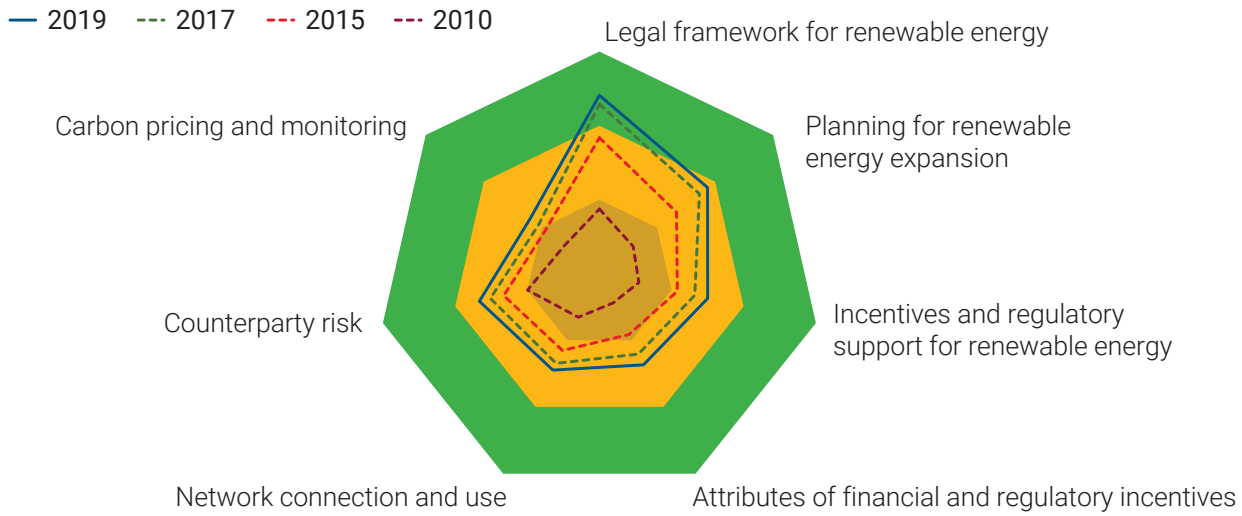
Bangladesh has demonstrated the effectiveness of having a coordinating institution. The Infrastructure Development Company Limited, a government-owned development finance institution, coordinates with non-governmental organizations to strengthen the commercial market for clean cooking solutions, acting as a hub for testing improved cookstoves and setting technical specifications.

Scaling up access on the ground depends on the finer aspects of allocating resources and planning implementation. In low-income countries like Uganda and Ethiopia, scale-up will require policy and regulatory signals to make the shift from artisanal production of biomass stoves toward cleaner and more modern cooking solutions (liquefied petroleum gas, biogas, and electricity). Since this transition is long-term, interim solutions (such as quality-assured biomass stoves) will help to mitigate the worst health impacts of charcoal and firewood.

With respect to increasing the share of renewables in the global energy mix, the earlier increase in renewable energy policies and regulations has lost momentum in recent years. RISE score improvements in the renewable energy pillar decreased by almost half during the most recent period (2017-2019).

This decline can be partially explained by market signals – the sharp decline in the cost of most forms of renewable energy generation has made renewable energy policy interventions less needed in mature markets. Yet it is important to continue monitoring progress in developing markets, especially in countries that can benefit from renewable energy generation to improve access deficits.

FIGURE 6. GLOBAL PROGRESS BY INDICATOR IN RENEWABLE ENERGY – 2010, 2015, 2017 AND 2019

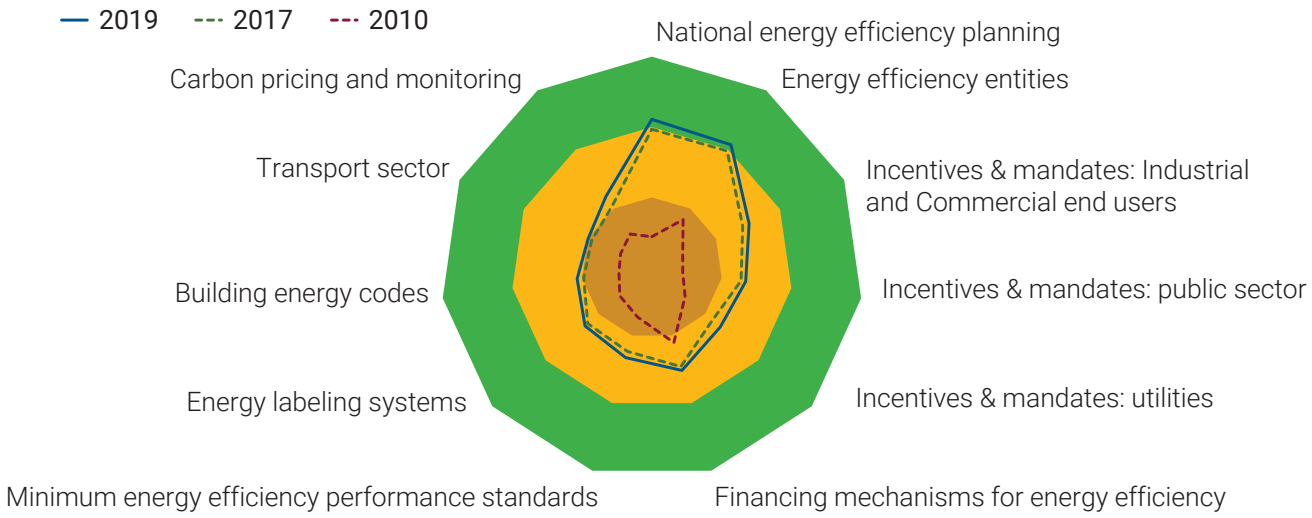


Compared with 2017, fewer countries scored in the red zone for renewable energy in 2019, although the red zone still contains nearly a quarter of all countries. The Sub-Saharan Africa region and Latin America and Caribbean, made the most significant progress between 2017 and 2019. Colombia—a top performer in 2019 and one of the fastest improvers between 2017 and 2019—gave renewable energy policies and regulations more attention, rising from 55 points in 2017 to 78 points in 2019. Colombia also set targets for renewables in electricity. In 2018, it began to offer small-scale producers long-term power purchase agreements for renewable electricity production. The following year, other direct fiscal incentives for renewable energy were introduced. Also in 2019, policies were adopted to encourage the transportation sector to adopt cleaner-powered modes of transport, to provide financial support for electric and hybrid vehicles, and to promote electrification of public transportation.

Among positive new developments in Sub-Saharan Africa, Chad and Tanzania improved their scores by 70 points and 30 points, respectively, between 2017 and 2019. In 2018, Chad established an action plan and a target for renewable energy, one that included measures to integrate renewable energy into electricity generation and transmission planning, as well as a legal framework for private sector ownership of generation facilities.

Although each region has shown different levels of improvement, it is encouraging to observe that 99% of the countries around the world have at least begun to establish a comprehensive legal framework for renewable energy. Yet important economic sectors still need prioritization. Globally, the gap between renewable energy development policies and regulations in the electricity sector and those in the heating and cooling and transport sectors has widened in the past two years. Only one-third of countries had a clear target or plan for renewable energy in heating and cooling, and only about half had one for renewables in the transport sector. These sectors, which account for more than two-thirds of global energy consumption, must receive more attention from policy makers in order to increase the use of renewable energy, as well as improve energy efficiency, particularly in the transport sector.

FIGURE 7. GLOBAL PROGRESS BY INDICATOR IN ENERGY EFFICIENCY – 2010, 2017 AND 2019



With respect to SDG 7.3, to double the improvement of energy efficiency, nearly 70% of the countries worldwide have now adopted legislation on planning for energy efficiency. However, with respect to policies targeting sectors that have a major impact on energy consumption (e.g., buildings and transport), a great deal of room remains for improvement.

OECD (high-income) countries are leaders in policy and regulatory frameworks for energy efficiency, with an average score of 79 in 2019. South Asia and Sub-Saharan Africa countries have average scores still in the red zone (33 or below), despite being among the fastest improving regions on average in the last two years, slightly behind Latin America's fastest rate of improvement. Panama improved its energy efficiency policies the most among Latin America and Caribbean countries, implementing, among other measures, mandates for small and medium-sized enterprises and binding energy-saving obligations for public buildings related to water supply, wastewater services, municipal solid waste, street lighting, transportation, and heating. Among Sub-Saharan African countries, Chad advanced the most by imposing penalties on utilities for noncompliance with efficiency requirements in generation, transmission and distribution networks, and demand-side management.

In terms of energy consumption in the electricity, transport, and heating and cooling sectors, the highest average RISE score was in the HVAC sector, with scores increasing by approximately 3 points per year between 2017 and 2019 to reach an average of 63 in 2019. More than three-quarters of the surveyed countries across all regions[89] adopted minimum HVAC energy performance standards and labelling measures, with roughly 60% making those measures mandatory. These findings are in line with the growing recognition of heating and cooling as vital priorities. The transport sector's energy efficiency policies scored the lowest, reflecting a lack of mandates and incentive programmes to support reductions in transport demand and widespread failure to shift to more energy-efficient modes for commercial and industrial use (such as freight rail and heavy-duty vehicles covered by mandatory fuel-economy standards).

[89] 103 countries (out of the 138 countries surveyed) have adopted these measures.

CONCLUSION

If the world continues to improve at the pace of growth achieved between 2017 and 2019, the average global RISE score will not reach the green zone until 2025. As SDG 7 presents global commitments to be achieved by 2030, this rate of progress will not be enough to reach the 2030 target, and the challenges for policy makers will grow over time. However, there will also be new developments in the coming years, given the rapid rate of technological progress in sustainable energy. The COVID-19 pandemic presents energy policy makers with unusual opportunities to support a low-carbon recovery, and also reorient countries' longer term energy strategies to align their policies with SDG targets.

Policies beyond those considered here will need to be put in place to cover emerging areas such as battery storage, digitalization of networks, and other innovations. Policies are often a prerequisite for other actions to follow; if the full suite of policy measures is not in place until 2025, this will leave little time to make progress toward global targets by 2030.

REFERENCES

AfDB and World Bank. 2020. "Benchmarking the quality of electricity regulation." https://africa-energy-portal.org/reports/electricity-regulatory-index-2020

Foster, V., and Rana, A. 2020. *Rethinking Power Sector Reform in the Developing World*. World Bank, Washington, DC.

IEA. 2020a. *World Energy Outlook 2020*. Paris. https://www.iea.org/reports/world-energy-outlook-2020

IEA. 2020b. *Sustainable Recovery: A World Energy Outlook Special Report*. Paris. https://www.iea.org/reports/sustainable-recovery

IEA, IRENA, UNSD, World Bank, and WHO. 2020. *Tracking SDG 7: The Energy Progress Report*. World Bank, Washington, DC.

World Bank. 2020. *"Regulatory Indicators for Sustainable Energy: Sustaining the Momentum"*. https://rise.esmap.org/data/files/reports/2020-full-report/RiseReport-010421.pdf

SECTION 5.3

PROMOTING ENERGY TRANSPORTATION INFORMATION NETWORK (ETI) **INTEGRATION TO ADVANCE INTERLINKAGES WITH THE SDGS**

CONTRIBUTING ORGANIZATION:
GEIDCO

Summary/Key Messages

Energy networks, transportation networks, and information networks (ETI networks) are like the circulatory, muscular, and nervous systems of the human body, together acting as the foundation for the development of modern economies and societies. However, the way that they have developed separately over the years has led to wasted resources, redundant construction work, high costs, and low efficiency. In order to foster a stronger COVID-19 recovery, and to revitalize the global economy, a new, more efficient and interconnected approach must be found.

ETI networks integration refers to the transition from the relatively independent development of each individual network to an integrated, shared and coordinated system of combined networks. In-depth coordination in form and function will maximize network advantages, forming a comprehensive infrastructure system that is widely interconnected, intelligent, efficient, clean, low-carbon, and consumer-oriented.

The fundamental, strategic and pioneering role of ETI networks in economic development makes their integration a matter of great urgency and significance. It would align the efforts of a number of different stakeholders and policy makers, catalysing technological innovation and industrial upgrading to green infrastructure, thereby attracting investments that would drive economic recovery, reduce greenhouse gas emissions, modernize infrastructure, incentivize technology leadership, create job opportunities and facilitate equity.

ETI integration would support SDG 7as well as SDG 9 on developing sustainable and resilient infrastructure, and SDG 13 on taking action to combat climate change. For example, through enhanced ETI integration, the world would be able to achieve net-zero emissions faster and control temperature rise. It would also support more decent working opportunities and stable economic growth, which would help reduce economic inequalities based on gender and social marginalization. ETI integration could not only promote achievement of the SDGs, but also offer solutions to other issues that restrict the realization of the goals.

It is imperative to advance cross-sectoral and cross-border coordination and cooperation in the development of infrastructure. It is recommended to include ETI networks integration into the working framework of United Nations and intergovernmental cooperation mechanisms. A mechanism for joint planning and construction should be established, especially in the fields of clean energy interconnection, transportation electrification, and digitalization. Moreover, it is crucial to have state support for integration of national and multinational ETI networks outlined in acts and laws.

NETWORK INFRASTRUCTURE: CURRENT STATUS

Combining the infrastructure for energy, transportation, and information networks is a critical factor in promoting high-quality and sustainable socio-economic development. As the demands imposed by society increase, the tasks and roles entrusted to network infrastructure have been growing in significance. At present, network infrastructure is booming yet undergoing challenges in terms of costs, service quality, and efficiency.

The cost of building a new facility for each network is very high, as it involves various types of permits, right of way approvals, and engineering designs for civil works, all while the networks are dealing with pressing needs for increased connection and complementarity.

Currently, there is insufficient sharing of resources and data. Having independent network facilities, each complying with its own design principles and operating rules, can lead to overlapping work in construction, resource wastage, and low utilization rates. The inter-system flow and sharing of information remains inhibited, hindering overall planning, dispatching and scheduling, and coordinated development of different systems.

The current individual network efficiency is very low. The transmission and allocation capacities of existing facilities have not been fully tapped. For example, the power grid networks in many countries and regions are operating with low load rates. Insufficient capacity for peak-load regulation, and structural problems concerning maximum versus average flow rates, can create problems in traffic, operation, and safety.

INTRODUCTION TO ETI INTEGRATION

Based on research and practices related to Global Energy Interconnection (GEI), and drawing on innovative ideas and advanced experience in transportation and information, the Global Energy Interconnection Development and Cooperation Organization (GEIDCO) has proposed a theoretical framework for Energy, Transportation and Information Network Integration (ETI Integration). ETI Integration refers to the transition from relatively independent development of each individual network to integrated, shared and coordinated development of the combined networks. This will provide in-depth coupling in form and function to form a comprehensive infrastructure system that is widely interconnected, intelligent, efficient, clean, low-carbon, open, and shared. It will also allow for more efficient coordination of energy, personnel/material, and information flows. With the implementation of necessary policies and financing, ETI Integration could support the development of each network and also create better synergies and resilience. The energy network could move towards large-scale development and use of clean energy through clean production and consumption, expanded electrification, and global interconnections. The transportation network would feature smart, efficient, clean, low-carbon and multi-modal global transportation interconnections. The information network would become highly intelligent, digital and secure.

The ETI integration framework has a five-layer structure (energy, infrastructure, database, application and paradigm).

Energy layer: The energy system keeps ETI networks running. Energy integration, by coordinating energy supply and demand systems with transportation and information networks, could support safe and efficient access to clean energy and replacement of kerosene and fossil fuels with clean electricity to accelerate green and low-carbon development.

Infrastructure layer: Many different devices and facilities are used in ETI networks. Infrastructure integration would promote the sharing of utilities, hubs, devices and terminals, thus avoiding the overlapping use of land and utility resources.

Database layer: Systems data, enterprise data and user data could all be shared across platforms.

Application layer: Optimization and efficient coordination of the various operations and services carried out under ETI networks would greatly improve the efficiency and performance of public services and enterprises.

Paradigm layer: This involves stakeholders, models and mechanisms. Cross-sector industry integration would eliminate industry barriers and create new business models to advance high-quality economic development.

There are four major driving forces behind ETI integration:

First, economic development and social transition requires reform of current infrastructure to create a clean and digital economy.

Second, innovations in technology, finance and business models will be the core driving force for ETI integration.

Third, efficiency is essential for high-quality economic development, which can be based on accelerated ETI integration to generate greater benefits with less investment and lower costs.

Fourth, national policies are necessary to smooth the transition for developing infrastructure to achieve ETI integration.

APPLICATION SCENARIOS AND CASE ANALYSIS

The energy network, the transportation network, and the information network each have their own functionality, but they are interlinked and can be integrated to maximize advantages.

Case 1

Infrastructure integration can be achieved through shared utilities or co-deployment. For example, in the United States the SOO Green HVDC Link is a 350-mile 2,100 MW, 525kV underground high-voltage direct current (HVDC) transmission line running along existing rail corridors from Iowa to Illinois. It is the first project to co-locate an HVDC transmission line underground, alongside the railroad right-of-way. It is also the first transmission project to connect the grids of the Midcontinent Independent System Operator (MISO) and the regional PJM, thereby increasing the transfer capacity on the existing grid, creating opportunities to satisfy growing customer demand for clean electricity in PJM with abundant and reliable renewable energy from MISO, and improving the efficiency of both markets.

The project was designed and will be constructed and operated to minimize environmental impacts typically associated with large-scale overhead transmission. The electric fields produced by the underground high-voltage lines will not harm humans, animals or plants, or interfere with railroad operations. The US$ 2.5 billion project has commenced permitting efforts with a number of federal, state, and local jurisdictions and is anticipated to be in service in Q4 2024.[90]

Case 2

NGI Consulting has proposed the idea of NextGen Highways as another ETI integration solution for the United States. On NextGen Highways, the right-of-way is used for strategic co-location of underground (and some overhead) power transmission, electric vehicle charging capacity and broadband/5G communications infrastructure.[92] In this way, clean energy would be aggregated to the highways to power electric vehicles, while data is flowing across applications to support transportation and energy services. This model reflects integration of energy, infrastructure, data, and operations.

In the United States, the existing federal highway system aligns well with the high-voltage direct current (HVDC) grid. NextGen Highways would co-locate a strong and modern electric grid in key transportation corridors to enable electric vehicle chargers, renewable energy generation stations, or even wireless

[90] https://soogreenhvdclink-os.com/about/

[91] Putnam, M., 2020. NextGen Highways: Co-Locating the Transport of Vehicles, Energy, and Information [White paper].

chargers to be more rapidly connected to the grid without expensive and time-consuming transmission upgrades. By combining siting and permitting with the construction of other infrastructure (highways and/or power transmission), NextGen Highways would reduce deployment costs and generally facilitate deployment of broadband infrastructure, thus mitigating the digital gap in rural and urban areas and ensure access to the digital economy.

It is estimated that for every dollar invested in a national HVDC grid, American households and businesses would receive one-to-two dollars of net benefits through lower electricity costs. Also, NextGen Highways would deliver a significant societal benefit by greatly reducing transportation sector greenhouse gas emissions. Assuming NextGen Highways led to a 20% absolute increase in transportation electrification over a 20-year period, NextGen Highways would deliver US$ 310 billion in societal benefits based solely on the carbon-reduction impact, using a social cost of carbon of US$ 50 per metric tonne.

Case 3

Smart transportation is an example of data integration, incorporating charging data, transportation data, user data, and electricity consumption. The State Grid Corporation of China (SGCC) is one of the most active electric companies in the electric transportation field. SGCC supports a 30,000-mile-long network connecting more than 457,000 electric vehicle (EV) charging stations and piles, which covered 85% of China's territory as of early 2020. To connect this expansive system, SGCC built a smart Internet of vehicles (IOV) platform, which enables information-sharing among different charging station equipment operators, and offers app-based products and services for end-use customers. The platform manages all data flowing through the charging station network, allowing for efficient charging, billing, ticketing, and fault monitoring at each stage. On the customer side, SGCC has successfully deployed an app with 5.6 million registered customers to create a positive and beneficial charging experience. This app provides customers with car charging payment options, allows customers to carpool in EVs, and supports EV rentals, offering navigation to nearby charging stations with 24-hour customer service and emergency repairs. SGCC considers the network as the basis for a future smart grid that would effectively coordinate and optimize grid operations as more distributed energy resources come online.[92]

Case 4

UN ESCAP has been promoting ICT infrastructure co-deployment for transportation and energy infrastructure in North and Central Asia, as another demonstration of ETI integration in developing countries.[93] The cost of building fibre-optic cable (FOC) infrastructure is very high, especially for landlocked countries. The wholesale bandwidth prices are 10 to 100 times higher in Central Asia than in America or Europe, so Internet subscription is not affordable to the majority of the population. Joint construction and sharing of infrastructure across sectors offer solutions for accelerating the development of FOC connectivity, thus reducing the digital gap in landlocked countries to better meet the SDGs.

FOC co-deployment along major roads, railways, power transmission lines and pipelines could save significant costs and resources, as it allows one-time investment in land acquisition and construction, and eliminates overlapping civil works. It also offers greater ease in obtaining rights of way and various other permits and approvals, minimizes disruptions to functioning of utilities, and streamlines maintenance and repairs.

[92] EEI, 2020. Global Emerging Energy Solutions For Customers

[93] UNESCAP, 2019. ICT Infrastructure Co-Deployment with Transport and Energy Infrastructure in North and Central Asia.

In Central Asia, winding the fibre-optic cable around power cables could be significantly cheaper and faster than other deployment options for network expansion, and would allow the energy sector to apply better smart grid management. A potential opportunity to promote cross-border FOC co-deployment along the electricity grid is through the Central Asia South Asia (CASA)-1000 project, a transmission line to export hydropower surpluses from Tajikistan and the Kyrgyz Republic to Pakistan and Afghanistan. Leveraging the existing transmission infrastructure to develop an integrated and coherent FOC network would allow for uniform quality of service and in-network repairs in the event of physical cable outages or instability in some areas. However, stakeholders would need to make efforts to collaborate and adopt effective legislation and regulations, and promote leadership in coordinating and implementing FOC co-deployment in this way.

OPPORTUNITIES AND CHALLENGES

Infrastructure is expected to play a key part in COVID-19 economic recovery measures in both emerging and developed markets. In 2020, more than 2,500 global infrastructure projects were announced, an increase of 5.5% from 2019. Over half of these were green infrastructure projects, such as wind and solar power.[94] Green infrastructure is on the rise as governments plan to stimulate economies and meet carbon reduction targets. The power sector had the highest number of projects announced in 2020, followed by transportation.

Telecommunications infrastructure has become more critical with the shift towards remote working during the pandemic. Developments in telecommunications are needed using fibre, broadband and data centres. However, the infrastructure investment gap remains significant. Network security and cyber security are big concerns. The existing energy, transportation and information networks are lacking in resilience to emergencies such as natural disasters, extreme weathers and incidents of sabotage. ETI integration would offer greater overall resiliency in the event of either direct attacks or cyber-attacks.

Increasing unified planning and interconnection of power grids would also increase grid resiliency and climate resiliency, providing reliable energy to support the transportation and information networks. It could deliver tremendous value for large-scale load transfers and blackouts. Also, it would allow load and generation to be averaged over a much larger part of a country or region and provide more reliable service, especially under locally extreme climate conditions. Through improved technology and management, network infrastructure could mitigate chain reactions and address safety challenges.

Smart grids and UHV (ultra-high voltage) grids provide technological support to ETI integration. Smart grids combine: artificial intelligence (AI) control, energy storage, power transmission and consumption, EVs and transportation with cloud computing, big data, and the Internet of things. They can help to promote use of clean energy in centralized and distributed manners, and support efficient cross-sector interaction and coordination among power sources, grids, loads, storages, and usages. UHV technology has significant advantages in terms of long-distance transmission, large capacities, high efficiency, low line loss, conserved use of land, and high levels of safety. It could tackle the supply and demand dilemma due to inverse distribution of clean energy endowments and major load centres, and discrepancies resulting from the volatility, intermittency or seasonal fluctuations of renewable energies. Despite the differences in industry standards and data standards, innovation in technical standards and technology for cross-sector integration could smooth the ETI integration process.

[94] Refinitiv. Global infrastructure development 2020 in revie.

Carbon mitigation in energy and transportation networks is crucial for coping with global climate change. To meet the climate change agreement's Nationally Determined Contributions, countries must increase their actions regarding a clean energy transition and transportation electrification. Many countries fall short in their long-term and systematic national plans for various network infrastructures.

'Fragmentation' in the planning, construction and operation of various network infrastructures results in duplicated construction, resource wastage and reduced efficiency. Especially for least developed countries in Africa, where infrastructure development is lagging behind, adopting integrated top-level planning and construction of ETI networks could save huge costs. Overall, there is a significant potential for the optimization of cross-sector network infrastructure to establish patterns allowing subsystems to complement one another and develop together. In addition, policy is insufficient on coordination of interests, risk management, financial mechanisms, policy integration, and dispute resolution.

POLICY RECOMMENDATIONS

It is recommended that the United Nations strengthen its leadership on infrastructure development to support ETI integration. It would make sense to include ETI integration in the working framework of intergovernmental cooperation, such as the G20-GICA (Global Infrastructure Connectivity Alliance), as the G20 Principles for Quality Infrastructure Investment aim to promote reliable, secure, and sustainable infrastructure systems. The G20 should support the creation and adoption of best practices guidelines in the life cycle of ETI integration development. Regional authorities, like the United Nations regional committees and the African Union, should take the lead to promote ETI integration. International multilateral funds, such as the UN Sustainable Infrastructure Investment Facility (SIIF) and the Multilateral Cooperation Center for Development Finance (MCDF), could mobilize to align public and private finance and support investment in green infrastructure.

Mechanisms for joint planning and construction should be established, especially in the fields of clean energy interconnection, transportation electrification, and digitalization. ETI integration projects involve multiple jurisdictions and cross-sector stakeholders, therefore it is important to implement an unbiased central institution and consensus-based cost-benefit sharing mechanism, taking into account social and environment costs and benefits. Organizations involved with international standards could work together to play a more proactive role in advancing cross-sector standard compatibility.

Formulating national ETI integration strategies would help advance cross-sector synergies. There should be national ETI integration policies to encourage public-private cooperation through sharing of information on existing and planned energy, transport, and ICT infrastructure. Regulations and governance should be introduced and outlined in acts and laws to support ETI integration. There is huge potential for the development of ETI integration in African countries. However, energy networks are lagging behind compared with the global information and transportation networks. Therefore promotion of global energy interconnections and electrification, along with a clean transition in the fields of transportation and information, should be prioritized.

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