ACCELERATING SDG 7 ACHIEVEMENT

SDG 7 POLICY BRIEFS IN SUPPORT OF THE HIGH-LEVEL POLITICAL FORUM 2019

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HIGH-LEVEL POLITICAL FORUM
ON SUSTAINABLE DEVELOPMENT

ACCELERATING SDG 7 ACHIEVEMENT

SDG 7 POLICY BRIEFS in support of the High-Level Political Forum 2019

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Ministry of Foreign Affairs of the Netherlands

Ministry of Foreign Affairs, Pakistan

Ministry of Infrastructure, Ports, Energy and Labour, Saint Lucia

Ministry of Foreign Affairs, UAE

African Union Commission

European Commission

Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ) GmbH

UN Association of China

REN 21

Clean Cooking Alliance

FIA Foundation

1 The following list includes members of the Multi-Stakeholder Technical Advisory Group on Sustainable Development Goal 7 (SDG7-TAG) and the lead and collaborating organisations that contributed to the policy briefs and action briefs included in this publication.

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International Institute for Applied Systems Analysis (IIASA)

ITAIPU Binacional

Moving Energy Initiative

PowerForAll

Practical Action

Rocky Mountain Institute

SEforAll

UN Foundations

TERI School of Advanced Studies

International Energy Agency (IEA)

International Renewable Energy Agency (IRENA)

Latin American Energy Organization (OLADE)

African Development Bank

Islamic Development Bank

United Nations Economic Commission for Africa (UNECA)

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

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

United Nations Economic and Social Commission for West Asia (UNESCWA)

United Nations Economic Commission for Europe (UNECE)

Food and Agriculture Organization (FAO)

International Labour Organization (ILO)

International Organization for Migration (IOM)

United Nations Development Programme (UNDP)

UN Environment

UNEP DTU Partnership

United Nations Framework Convention on Climate Change (UNFCCC)

United Nations Human Settlements Programme (UN-Habitat)

The UN High Commissioner for Refugees (UNHCR)

United Nations Children's Fund (UNICEF)

United Nations Industrial Development Organization (UNIDO)

United Nations Institute for Training and Research (UNITAR)

Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and the Small Island Developing States (UN-OHRLLS)

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World Health Organization (WHO)

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PREFACE

Energy lies at the heart of both the 2030 Agenda for Sustainable Development and the Paris Agreement on Climate Change. Advancement in SDG 7 has the potential to spur progress across the other SDGs—on poverty eradication, gender equality, climate change mitigation and adaptation, food security, health, education, sustainable cities and communities, clean water and sanitation, jobs, innovation, transport, and the treatment of refugees and other displaced people.

Yet progress on SDG 7 is falling short. There is still much to do to ensure universal access. Despite increases in electrification over the last 2 years, about 840 million people still lack access to electricity. Meanwhile, around 3 billion people rely on wood, charcoal, animal and crop wastes, or other solid fuels to cook their food and heat their homes, and the rate of progress towards cleaner fuels and technologies in fact slowed down between 2009 and 2017. Significant improvements have been made in energy efficiency, but global progress is still not on target to reach our goals. Renewables are becoming well-established in the electricity sector, but lag behind in heat and transport end uses.

2019 is a special year, as it marks the mid-point of the UN Decade of Sustainable Energy for All (2014-2024), which was declared unanimously in resolution 2012/67/215 of the General Assembly. We should use this mid-point to take stock and mobilise efforts to accelerate progress on SDG 7, and implementation of the global plan of action for this Decade.

This year's High-Level Political Forum (HLPF) in July represents another opportunity to strengthen interlinkages between SDG 7 and other SDGs. The HLPF will review SDG 4 (quality education), SDG 8 (inclusive economic growth and jobs), SDG 10 (reduced inequality), SDG 13 (climate change), SDG 16 (peace, justice and strong institutions), and SDG 17 (partnership for the goals).

The policy briefs in this compilation focus on the interlinkages between SDG 7 and these SDGs, aiming to inform the discussions at both this year's HLPF in July as well as the SDG Summit in September, which review of progress towards all 17 Sustainable Development Goals.

Interlinkages between SDG and SDG 13 on climate change are of particular importance. In April of this year, the United Nations Department of Economic and Social Affairs (UN DESA) and the United Nations Framework Convention on Climate Change (UNFCCC) secretariat co-organised the first global conference on synergies between sustainable development and climate action in Copenhagen. The energy transitions envisaged in SDG 7 related to sustainable energy for all will contribute significantly to lowering greenhouse gas emissions relative to business-as-usual pathways, thereby contributing to the objectives of the Paris Agreement. The findings of the Copenhagen conference, together with these policy briefs, are intended to inform the September Climate Action Summit to be convened by Secretary-General António Guterres in New York, which will support efforts to implement the Paris Agreement and to promote ambitious climate action.

As the secretariat for the High-Level Political Forum, UN DESA convened the multistakeholder SDG 7 Technical Advisory Group (SDG7-TAG) in 2018 to support the forum's review process, bringing together representatives from governments, UN entities, international organisations and other stakeholders. This second 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.

UN DESA will continue to support and strengthen the SDG 7 Technical Advisory Group and to assist the UN development system in delivering simultaneously on the 2030 Agenda and the Paris Agreement.

刘振民

LIU Zhenmin

Under-Secretary-General for Economic
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FOREWORD

We strongly believe that we could still achieve SDG 7, but only if we all take immediate action to scale up our efforts.

We have been witnessing tremendous progress in the adoption of renewable technologies, along with rapid cost declines and strategic shifts in policies that are transforming energy systems in many parts of the world. Though we have strong momentum, we must continue to mobilise greater political will and cooperation, as well as higher levels of public and private investments in a sustainable energy future.

The Global Agenda for Accelerated SDG 7 Action, which was put forward by the multistakeholder SDG 7 Technical Advisory Group in last year's Policy Briefs, represented a collective response to tackling these global challenges. It aimed to help all stakeholders step up, focus, and scale up their actions towards the achievement of SDG 7. As we received an overwhelmingly positive response to our first edition of Policy Briefs as a body of analytical work assisting policy makers and practitioners effectively, we decided to repeat the exercise this year as well.

We are proud to present the second edition of the Policy Briefs to inform this year's critically important gatherings: the Mid-point Conference on the UN Decade of Sustainable Energy for All in May, the High-Level Political Forum in July, and the SDG Summit and Secretary-General's Climate Summit in September.

We are very grateful to all the members of the Technical Advisory Group, who worked together diligently as part of this inclusive, multistakeholder and multisectoral process to provide detailed recommendations for expediting progress on meeting the SDG 7 targets. Their collaborative work, with careful analysis based on operational experience, and a diversity of expertise and viewpoints, provides a model for strengthened coordination and coherence, within and beyond the UN development system. They have produced compelling arguments detailing how urgently the world needs to move forward towards a sustainable energy future.

We sincerely hope that Member States and all stakeholders—including the international organisations, multilateral development banks, businesses and civil society groups—will find the analysis and recommendations useful as they review and renew their commitments to achievement of the SDGs.

The time to act is now. It is critical that the Global Agenda for Accelerated SDG 7 Action be translated into concrete, time-bound action plans and partnerships to move this work forward quickly, and the SDG 7 Technical Advisory Group will strengthen its efforts towards this end. We are counting on everyone to work together to make the achievement of SDG 7 a reality.

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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 United Nations 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.
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The development of each policy brief was led by a group of organizations, who 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 and composed of David Koranyi, Bo Fu, Isabel Raya, Nadine Salame, under the overall guidance of Alexander Trepelkov, O.I.C. of DSDG at DESA. The Capacity Development Office at UNDESA provided overall support during the process. Special thanks are extended to Gail Karlsson and Becca Hunziker who provided invaluable edits to the policy briefs and the summary for policymakers, ensuring accuracy, consistency and readability.

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KEY FACTS BY THE NUMBERS

CURRENT STATUS

ELECTRIFICATION

153 million people gained access to electricity annually in 2016 and 2017.

840 million still remain without electricity access.

CLEAN COOKING

3 billion people still cook by burning polluting fuels.

3.8 million people die prematurely from illnesses attributable to smoke from polluting open fires or simple stoves, majority are women and children.

RENEWABLES

The share of renewables in total final energy consumption reached **17.5 %** in 2016.

1/4 of the global electricity generation comes from renewables, thanks to the rapid expansion of solar PV and wind.

EFFICIENCY

Global energy intensity has been improving at an accelerating rate of **2.3%** per year between 2010 and 2016.

Going forward, an annual improvement of **2.7%** is required to meet the global target.

FINANCING

US$ 1.3-1.4 trillion per year is required to meet SDG 7, i.e. twice the current level at about a half trillion dollars.

Off-grid solar solutions are the lowest-cost option for about **50%** of the future connections in sub-Saharan Africa.

INTERLINKAGES

CLIMATE

Energy-related CO2 emission in 2018 hit a historic high of **33.1 Gt**.

IPCC report on "Global Warming of 1.5 °C" determines that renewables are projected to supply **70 - 85 %** of electricity in 2050" in 1.5 °C pathways.

EDUCATION

Only **69%** of primary schools have electricity access, leaving over **230 million** children without any electricity at school, mostly in sub-Saharan Africa, South Asia and Latin America.

EMPLOYMENT

10.3 million employment in the renewable energy sector, with **3.4 million** solar PV jobs, in 2017.

Women represent **32%** of the labour force in renewable energy sectors.

SITUATIONS OF DISPLACEMENT

About **90 %** of over 65 million people worldwide forcibly displaced from their homes have no access to electricity.

US$ 1.2 billion, i.e. about 5% of the total humanitarian agencies' expenditure went to diesel, petrol and associated costs in 2017.

REGIONAL STATUS

ASIA & PACIFIC

Over **245 million** people still have no access to electricity, more than 5% of the region's population. In particular women and children, rural populations bear a disproportional burden of energy poverty.

2 billion people, nearly half the population, rely on polluting and unhealthy cooking fuels and technologies.

LATIN AMERICA AND THE CARIBBEAN REGION

12 million people still without access to electricity in 2017.

Renewables represent **27.6%** of total final energy consumption.

SIDS

The disparities in electricity access between urban and rural and remote areas remain wide: **95%** in urban and 61% in rural areas, in 2017.

In 2017, **17.6%** of the electricity in SIDS was derived from renewable sources. However, large part of this is from hydropower and to an even greater extent the traditional use of solid biofuels and most of the renewable energy potential of SIDS remains untapped.

AFRICA

Significant progress with electrification, from **38%** in 2015 to **44%** in 2017, while only 17% had access to clean cooking in 2017.

Modern renewable energy will increase four-fold to **22%** of Africa's total final energy consumption by 2030.

ARAB REGION

92.5% in the Arab region is electrified.

Renewable energy only accounted for some **10%** of the region's final energy consumption in 2016.

UNECE REGION

Energy intensity is improving but not fast enough: **1.6%** (Southeast Europe) and **2.6%** (Western and Central Europe) per year during 2015-16.

LLDCs

56.3% in LLDCs had access to electricity in 2017, an increase from 49.5% in 2014.

Despite the potential that renewable energy has for LLDCs, the share of renewable energy has remained rather constant, with only **1%** increase between 2010 and 2016.

FUTURE PERSPECTIVES

DIGITALIZATION AND THE FUTURE OF ENERGY SYSTEMS

Digitalization could cut energy use by about **10%** by using real-time data in buildings, while saving around **US$ 80 billion** per year in the power sector globally.

MULTI-TIER FRAMEWORK

Six tiers to measure of the reliability and affordability dimensions of the energy services, ranging from Tier 0 (no access) to Tier 5 (full access) for electricity and clean cooking.

Through the Multi-Tier Framework, Ethiopia established a new baseline electrification rate at **44.3%** in 2018 (recognizing Tier 1+ level of services including off-grid energy solutions), compared to the historically underestimated rate of 20 %.

KEY MESSAGES FOR POLICY MAKERS

These Key Messages were prepared to inform the review of progress on the 2030 Agenda for Sustainable Development at the High-Level Political Forum on Sustainable Development in July 2019. Under the theme of "Empowering people and ensuring inclusiveness and equality", the HLPF will review SDGs 4 (quality education), 8 (inclusive economic growth and jobs), 10 (reduced inequality), 13 (climate action), 16 (peace, justice and strong institutions), and 17 (partnership for the goals). The Key Messages, including on the interlinkages between these SDGs and SDG 7, are drawn from and build on the Policy Briefs developed by the multistakeholder SDG 7 Technical Advisory Group convened by UN DESA and presented in this publication.

Launched at the May 2019 High-level Dialogue on the Implementation of the UN Decade of Sustainable Energy for All 2014-2024: A Mid-Point Review, the Key Messages presented below will also contribute to a series of inter-governmental discussions in September 2019, including the SDG Summit, the UN Climate Action Summit, and the High-Level Review of the SAMOA Pathway, as well as the 2019 High-Level Midterm Review on the implementation of the Vienna Programme of Action for the Landlocked Developing Countries.

1. **The global energy transformation must be accelerated to achieve both the 2030 Agenda for Sustainable Development and the Paris Agreement on climate change.** The world is not on track to meet the SDGs, or to keep global temperature rise this century within 2°C above pre-industrial levels, let alone to limit the temperature increase to below 1.5°C. Accelerated SDG 7 action to harness the cross-sectoral interlinkages and maximise co-benefits and synergies will significantly contribute to closing the gap towards the climate goals, and help enable a just and equitable transition to a climate-safe future by advancing the other SDGs.

2. **Significant progress has been recorded in several SDG 7 targets.** The global population without access to electricity fell from about 1.2 billion in 2010 to around 840 million in 2017. Global energy intensity improved at an accelerating rate of 2.3% per year between 2010 and 2016. The share of renewables in final energy consumption increased from 16.6% in 2010 to 17.5% in 2016.

3. **But progress has been largely uneven, and urgent reinforced action is needed to achieve SDG 7 by 2030.** Three billion people still remain without clean cooking solutions, resulting in about 3.8 million premature deaths annually, particularly affecting women and children. This situation requires an urgent, completely revamped approach with increased funding. Further acceleration is required to achieve universal electricity access, especially in sub-Saharan Africa. Despite growth of the share of modern renewables in the power sector, deployment is lagging in end use sectors, particularly transport, industry, heating and cooling. Energy efficiency improvements must increase to a rate of 2.7% per year to meet the global target.

4. **Closing the energy access gap to serve the remaining unserved people will be challenging.** Maintaining and extending the pace of progress will require strong political commitment, long-term energy planning, stepped-up private financing and adequate policy and fiscal incentives. It will also be crucial to promote grid and off-grid electricity access solutions (including solar lighting, solar home systems, and mini-grids), clean cooking fuels and technologies, and productive uses of energy. In addition, current costly energy practices in humanitarian assistance will need to be addressed through concerted efforts to deliver sustainable energy solutions to those in need.

5. **Current financing levels are significantly below what is required.** US$ 1.3 to 1.4 trillion per year is required to meet SDG 7, more than twice the current level. Investment is not currently spread equally, and is leaving out many developing countries, in particular least developed countries, landlocked developing countries and small island developing states. Enabling environments, integrating policies, de-risking

instruments, direct financial incentives, and digital finance solutions are critical in all sectors.

6. **Over 230 million children go to primary schools without any electricity, compromising educational and development outcomes (SDG 4).** Electrification at primary schools stands at a mere 69%. Enabling policies are needed to incentivise and facilitate a more coordinated approach, along with investments in sustainable and clean energy and education infrastructure and services, in order to close the electricity access gap in education, and also drastically improve girl-to-boy ratios in schools.

7. **Energy efficiency and renewable energy investments continue to act as robust socio-economic drivers, including through net employment gains (SDG 8).** Employment in renewable energy stood at 10.3 million in 2017, and could potentially reach about 24 million by 2030. However, we need to ensure that the global energy transformation is accompanied by policies enabling a just transition that will take into account fossil fuel sector jobs loss, and leave no one behind. There are also significant opportunities for achieving a greater gender balance in the global energy transformation. Gender considerations must be mainstreamed into job creation efforts, including through building enabling environments for women entrepreneurs.

8. **Ensuring access to affordable, reliable, sustainable and modern energy for all is a key condition for reducing inequalities, achieving the principle of "Leaving no one behind" and ensuring a just and inclusive energy transition (SDG 10).** Policy makers should address the interlinkages between energy, climate change, poverty and inequality by promoting productive uses of energy, while enhancing gender equality and health equity, acknowledging the special vulnerability of women, addressing conditions of "fuel poverty", and also supporting renewable energy and energy efficiency investments by low-income households.

9. **Updated Nationally Determined Contributions (NDCs) due in 2020 should fully reflect countries' ambitious goals for renewable energy and energy efficiency (SDG 13).** Decarbonisation of the world's energy systems and attainment of the targets of SDG 7, including ensuring universal access to modern energy, are mutually reinforcing and must be advanced at the same time. A unified approach, including on finance, is required to achieve SDG 7 and the Paris Agreement simultaneously. The rapid deployment of renewables, coupled with energy efficiency, can achieve most of the emission reductions and decarbonisation in the energy sector needed by 2050, while at the same time advancing economic growth and development. Special emphasis should be placed on mainstreaming gender considerations into all SDG energy related actions, including responses to climate change. Renewable energy targets at the country level should also be linked to their adaptation strategies.

10. **The potential benefits from the global energy transition will contribute to greater peace and security by fostering more inclusive, climate-resilient and sustainable societies (SDG 16).** The global energy transformation will have new and far-reaching geopolitical implications, which will need to be carefully managed. Developing effective, accountable and transparent institutions at all levels can help achieve the potential benefits of this transformation.

11. **Strengthening cooperation at the regional and sub-regional levels is critical** to effectively address different areas' unique challenges, and to promote innovation, investment, enhanced cross-border connectivity, capacity building, south-south cooperation and synergetic actions to advance energy, climate change, environment and other SDGs simultaneously.

12. **Catalytic actions and partnerships for SDG 7 are needed in vulnerable countries.** These are particularly important in African countries, least developed countries, landlocked developing countries and small island developing states, and should be promoted in the context of the Mid-Term Review of the SAMOA Pathway and the High-Level Midterm Review on the implementation of the Vienna Programme of Action

for the Landlocked Developing Countries in 2019.

13. **Innovative tracking instruments, such as the Multi-Tier Framework (MTF) for Energy Access, can enhance decision-making.** The MTF data analysis (on reliability and affordability of access to electricity and clean cooking solutions) offers useful input for policy formulation, investment strategies, project design, utility performance accountability, and evaluations of project impacts.

14. **Digitalisation could fundamentally transform the global energy system by breaking down sectoral boundaries, increasing flexibility and enabling integration across systems.** Well-designed policies are crucial to unlocking the full benefits of digitalisation in achieving SDG 7, while managing potential risks around security, privacy, and rebound effects.

15. **We call upon all stakeholders to drive change by forming transformational partnerships toward the Climate Action Summit and the SDG Summit.** Multistakeholder initiatives, including those presented in the Action Briefs, play a central role in raising collective ambition and accelerating realisation of the SDGs, and the goals of the Paris Agreement, to achieve a better, more prosperous life for all people on a healthy planet.

POLICY BRIEF #1

ENERGY, CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT

Developed by

The German Federal Ministry of Economic Cooperation and Development (BMZ), The World Bank Energy Sector Management Assistance Program (ESMAP), the UN Framework Convention on Climate Change, Denmark, Norway, UN DESA, and the European Union Commission

In collaboration with

The Netherlands, REN21

Key Messages

The energy sector must play a critical role in any efforts to reduce emissions and mitigate climate change, thereby achieving SDG 13, because energy accounts for two-thirds of total greenhouse gas emissions and 80 per cent of carbon dioxide (CO_2)emissions (IEA, 2018). Achieving universal access to electricity and clean fuels and technologies is not necessarily in conflict with achieving climate objectives, but higher energy demand to support additional productive uses of electricity for economic development in underserved areas can lead to corresponding increases in emissions if that demand is not met exclusively by renewable energy.

The rapid deployment of renewables, coupled with energy efficiency, can achieve around 90 per cent of the emission reductions in the energy sector needed by 2050, while at the same time advancing economic growth and development. Energy-related CO_2 emission growth from 2014 to 2016 was flat, but estimated emission levels increased by 1.7 per cent in 2018 to reach a historic high of 33.1 Gt, with the power sector accounting for nearly two-thirds of the emissions growth (IEA, 2019).

Currently, the world is not nearly on course to meet the well below 2°C climate objective, and even further from attaining the aspirational target of limiting warming to 1.5°C. Only through the consistent use of renewable energy and energy efficiency measures, including the implementation of SDG 7, can SDG 13 be met. Therefore, we need to create a framework to massively expand renewable energy and widely integrate energy efficiency measures.

Short term:

We want countries to establish long-term ambitious renewable energy and energy efficiency targets by:

- Setting up new initiatives as well as strengthening existing initiatives, that link energy and climate, stressing the importance of renewable energy and energy efficiency to limit climate change to 2°C (and ideally to 1.5°C)
- Setting up the enabling framework and policies needed to massively scale up renewable energy and promote energy efficiency, which will inter alia uplift private investments
- Aligning energy infrastructure investments with 1.5°C climate scenarios and ensuring their resilience to the expected impacts of climate change
- Revising countries' Nationally Determined Contributions (NDCs) under the Paris Agreement and including ambitious goals for renewable energy and energy efficiency in each NDC—quantitative goals as well as clear policy measures in particular, integrating national, sub-national and local level goals as well as the energy end-use sector

Mid term:

We want to achieve massive renewable energy expansion—and growth in energy efficiency—internationally. This requires the revision of SDG 7 indicators for 2030 and beyond:

- Integrating measurement of 'Energy Access for Productive Uses' (for low-emission economic development)
- Setting a renewable energy target for Agenda 2030 sufficient to achieve the Paris Agreement's climate goals
- Promoting measures to achieve the SDG 7 target for Energy Efficiency

Long term:

We want to reach close to 100 per cent decarbonisation of economies by 2050 through:

- Fostering innovation and digitalisation
- Promoting sector coupling: efficient use of electricity from renewable energy in heating, cooling, and the transport sector
- Applying not only top-down but also bottom-up approaches to ensure a just energy transition

Introduction

Energy is essential for any economic and social development. However, burning fossil fuels to generate energy is the biggest driver of climate change. It is a major cause of the increasing concentration of greenhouse gases in the atmosphere and the associated negative effects on our ecosystems. A sustainable energy supply must therefore, above all, be climate-friendly. We must overcome our dependence on fossil fuels and at the same time develop energy systems that provide people with climate-neutral energy in line with their needs.

Universal access to affordable, reliable, sustainable, and modern energy (SDG 7) is closely interlinked with measures to implement the National Determined Contributions (NDCs) of the Paris Accord. Only through the consistent use of renewable energy and energy efficiency measures, including the implementation of energy access for all in accordance with SDG 7, and hence the immediate fight against climate change and its effects, can SDG 13 be met. Without timely and effective implementation of a global energy transition, the SDG 13 sustainability objective will remain unattainable.

SDG 7 is furthermore of outstanding importance for achieving other sustainability goals of Agenda 2030, including but not limited to:

- for poverty reduction in all dimensions (SDG 1);
- for the promotion of productive employment and decent work for all due to inclusive and sustainable economic growth (SDG 8);
- for access to effective social, health and education systems (SDG 3, SDG 4); and
- for meeting the basic human needs such as adequate and safe housing (SDG 11) as well as safe drinking water and adequate sanitation (SDG 6).

The increased use of renewable energy also contributes to reducing the contamination of air, water, soil and land with hazardous chemicals (SDG 6, 14 and 15). It is also a key factor in the development of sustainable production and consumption (SDG 12).

Climate related effects of the universal access to affordable, reliable and modern energy (SDG 7.1)

According to International Energy Agency's (IEA) Energy Access Outlook 2017, providing energy for all generally does not have a significant impact on energy demand. The "Energy for All" case accounts for an additional increase of just 0.23 per cent in global energy demand in 2030. Accordingly, achieving universal energy access is not in conflict with achieving climate objectives at a first glance.

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

Climate related effects due to deployment of the conventional power sources (SDG 7.2)

SDG 7.2 calls for a substantial increase of renewable energy share in the global energy mix by 2030. Because energy accounts for two-thirds of total greenhouse gas emissions and 80 per cent of CO_2, any

effort to reduce emissions and mitigate climate change must include the energy sector.

The UN's "Sustainable Development Goals Report" (2018) indicates an only modestly growing share of renewables in final energy consumption (from 17.3 per cent in 2014 to 17.5 per cent in 2015). Yet only 55 per cent of the renewables share was derived from modern forms of renewable energy. The pace of global capacity additions in modern renewable energy, such as solar-PV and wind, is already not enough to successfully meet the goals of SDG 7.2, and even more so to comply with the Paris' climate goals. Based on current trends, the renewables share is expected to only reach 21 per cent by 2030. The recently published IPCC report on "Global Warming of 1.5°C" determines that in "In 1.5°C pathways with no or limited overshoot, renewables are projected to supply 70–85 per cent (interquartile range) of electricity in 2050."

Against this backdrop, urgent policy action is needed to scale up electricity generation capacity based on renewable energy as well as application of renewable energy in the end-use sectors. We need to refrain from the mode of modest increases immediately in favor of disruptive upscaling of renewable energy and start to think big for the future wellbeing and viability of humankind. At the same time, an interpectoral dialogue (Water, Energy, Food Security Nexus) is needed to increase renewable energy potential without negative impacts in other sectors (and their SDGs).

Emissions from the energy sector due to primary energy intensity and inefficient applications in the end use sector (SDG 7.3)

Goal 7.3 strives for doubling the global rate of improvement in energy efficiency by 2030. Improvements in global primary energy intensity, the ratio of energy used per unit of GDP, are critical to limiting emissions from fuel combustion. Furthermore, changes in energy demand are associated with improvements in energy efficiency and behavior change. According to the SDG7 Tracking Report (2018), the current rate of global energy efficiency progress falls short of the annual rate of 2.7 per cent that is needed between now and 2030. IRENA's Roadmap to 2050 report (2018) states that by 2050 the global economy needs to reduce energy intensity by 2.8 per cent per year on average, compared with the 1.8 per cent annual fall achieved in recent years.

In order to achieve this decline, urgent fiscal measures to promote energy efficiency and efficient energy applications in the end use sector are needed.

Linking renewable energy and energy efficiency to NDCs.

NDCs set out the actions that countries plan to undertake to achieve the Paris agreement's objectives, focused on limiting the rise in average global temperatures to well below 2°C, ideally to 1.5°C. NDCs will be revised or updated by 2020, and every 5 years thereafter—with each revision aimed at being more ambitious than the previous one.

According to IRENA (2017), as of today, **most countries have included renewable energy in their NDCs.** Of the 194 Parties to the UNFCCC that submitted NDCs, 145 referred to renewable energy action to mitigate and adapt to climate change, while only 109 Parties included some form of quantified target for renewables.

Most NDCs treat renewable energy deployment primarily as a mitigation measure. However, renewable energy deployment can contribute to adaptation efforts, for example, by promoting the diversification of the power supply and by building resilience through improved energy access. Larger numbers of countries have the opportunity to broaden the scope of their future NDCs and to include renewable energy targets as part of their adaptation strategies.

Only 53 countries mention building energy efficiency in their NDCs, indicating its importance to our climate future. Government policies and measures (e.g. energy efficiency Standards for Appliances, Building Codes, and Vehicle Emission Standards), including mandatory energy efficiency regulations, can

drive many improvements in energy. Nevertheless, energy efficiency is still not broadly seen as one of the major measures to combat climate change in the NDCs. Energy efficiency and energy demand reduction are fundamental to reach renewables based energy supply.

Recommendations

Current commitments to renewable energy and energy efficiency are not sufficient to achieve the Paris Accord and the 2030 Sustainable Development Agenda, therefore governments should implement radical measures. There a numerous potential synergies and trade-offs between climate action and sustainable development. These synergies and trade-offs can still be managed in order to deliver the best possible outcome.

In the short term, countries should establish ambitious renewable energy and energy efficiency targets.

- Set up new initiatives as well as strenghthen existing initiatives, which link energy, climate, and hence sustainable development, stressing the importance of renewable energy and energy efficiency to achieve growth and to limit climate change to 2°C, ideally to 1.5°C

Initiatives with a strong governmental support promoting national, subnational, and local action can raise attention and mobilize substantial funding for the common goal. Such initiatives as African Renewable Energy Initiative (AREI) activate inclusive effort to accelerate and scale up the harnessing of the continent's huge renewable energy potential.

- Set up the enabling framework and policies to massively scale up renewable energy and energy efficiency and uplift private investments in this area, aligning energy infrastructure investments with 1.5°C

There are numerous direct and indirect fiscal mechanisms for upscaling of renewable energy and energy efficiency. Capacity building and skills development should go hand in hand with this scale up.

Carbon pricing. The carbon price stimulates clean technology and market innovation, fueling new, low-carbon drivers of economic growth. There are two main types of carbon pricing, namely Emission Trading System (ETS) and Carbon Tax. The choice of the instrument should depend on national and economic circumstances and ensure that the pricing does not penalize the poorest population.

As in February 2019, 46 national jurisdictions and 28 subnational jurisdictions are putting a price on carbon.57 carbon-pricing initiatives are implemented or have been scheduled for implementation (Carbon Pricing Leadership Coalition, 2019). These carbon-pricing initiatives would cover 11 gigatons of carbon dioxide equivalent ($GtCO_2e$) or about 20 per cent of global GHG emissions.

Efforts to phase out fossil fuel subsidies. Fossil fuel subsidies are still substantial, and even growing, and have adverse effects, according to climate friendly incentive structures. According to IEA WEO 2018, the value of global fossil-fuel consumption subsidies in 2017 is estimated at more than US$ 300 billion, significantly higher than the estimate for 2016, which was around US$ 270 billion. Strategic alliances for phasing out of fossil fuel subsidies, such as the World Bank's Energy Subsidy Reform, can facilitate the path towards sustainable future.

The direct mechanisms as well as complementary policies to uplift the renewables and energy efficiency include:

- renewable energy support mechanisms, such as tendering and net metering
- performance standards for buildings, including for lighting, windows, ventilation, and heating and cooling systems
- fiscal instruments such as tax exemptions or tax breaks for appliances and energy efficiency improvements

- renewable portfolio standards, which require electricity providers to include a minimum share of clean energy in their output mix
- trade policies, e.g. cutting tariffs on green goods such as solar panels, wind turbines, and energy-efficient light bulbs.

Making concessional finance available at a greater scale to developing countries through MDBs and other channels is furthermore important. According to IRENA (2017), the decarbonisation of the energy sector would require a total of US$ 25 trillion to be invested in renewables up to 2050, or on average more than US$ 700 billion per year.

- Revise NDCs and include ambition goals for renewable energy and energy efficiency in each NDC, including quantitative goals and clear policy measures

According to IRENA (2017), the inclusion of renewable energy components in NDCs can help attract additional investment in the renewable energy sector. In fact, over US$ 1.7 trillion would be needed by 2030 to implement renewable energy targets contained in NDCs.

Planning and implementing NDCs requires coordination across sectors, complex laws and policies, new sources of finance, and sophisticated monitoring and evaluation. The NDC Partnership has a unique insight into the successes and challenges as countries plan and implement their NDCs. Energy experts of NDC partnerships, such as IRENA and the Word Bank, can facilitate the dialogue and promote smooth integration of renewable energy and energy efficiency targets across all NDCs. They can help broadening the scope of renewable energy components in NDCs by including renewable energy targets for end use sectors (transport, heating and cooling) as well as by including renewable energy targets for adaptation.

National, sub-national and local level goals as well as the energy end-use sector should be integrated into NDCs, Inclusion of renewable energy into countries' mitigation strategies can build up more resilient systems.

In the short- to midterm, both international community as well as national governments should further promote integration of climate change and sustainable development goals as those are inextricably linked.

In the mid term, the international community should revise SDG 7 indicators for 2030 and beyond by creating more ambitions targets linked to other SDGs. The mid-term measures to fully exploit the contribution of the energy sector to achieve Paris Accord and Agenda 2030 goals forsee the revision of SDG 7 goals. For 7.1, it is essential to integrate productive use, hence to abstract from the idea of having energy access only as a key for economic development. For 7.2, the target for renewable energy deployment should be set. For 7.3, the pathways to achieve an adequte energy efficiency supply should be displayed.

In the long term, those efforts should strive for 100 per cent decarbonization of economies by 2050. In the long run we should start **thinking big**: climate neutral development pathways are feasible and competitive. Low Carbon resilient infrastructure is now more cost effective than conventional infrastructure and avoid risks of stranded assets. 100 per cent decarbonisation is technically and economically viable and will require innovation, a higher degree of digitalisation, and sector coupling by integration of renewable energy into the transport, heating, and cooling sectors coupled with energy storage. Intersectorial planning is the key for achieving the Agenda 2030 and thus, we need to consider the close linkages between water, energy, and food security for sustainable development.

In order to **leave no one behind**, not only the top down but also bottom up pathways for **just transition** should be developed.

The Paris Agreement invites Parties to formulate and communicate long-term low greenhouse gas emission development strategies by 2020. Against the pressing need outlined in this policy brief, the argument could be made that rather than developing abstract high-level national strategies, it is most important to focus

on specific sectors, working toward a single end point—for example, a decarbonised energy sector in 2050.

Beyond NDCs, clear long-term strategies aligned with the Paris goals are key to avoid locking in high-carbon technologies and losses associated with stranded assets. 2050 pathways are not forecasts but backcasts that establish a 2050 objective and ask what steps are needed to get there. Backcasting helps to indicate transformational decisions and significant barriers.

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POLICY BRIEF #2

A 4-YEAR STOCK-TAKING AND WAY FORWARD FOR SDG 7 WITH A FOCUS ON ACCESS, RENEWABLES AND EFFICIENCY

Developed by

The International Energy Agency (IEA), the World Bank, IRENA, the UN Statistics Division, and the World Health Organization (WHO)

In collaboration with

REN21, European Commission and UN Environment

Key Messages

Significant progress has been recorded towards all SDG 7 targets, but additional targeted engagement is needed across all regions and sectors. Recent improvements in electrification rates and energy efficiency are very promising, while proven technologies are showing great potential for providing access to clean cooking and increasing deployment of renewables.

Access to electricity

Since 2010, there has been significant progress in increasing access to electricity, driven largely by accelerated electrification in Asian countries, with a global increase from 83 per cent in 2010 to 89 per cent in 2017. Nonetheless, about 840 million people remain without access to electricity, primarily in sub-Saharan Africa. Adopting comprehensive regulatory frameworks, leveraging private sector financing, and harnessing the potential of decentralised renewable energy solutions are three priority actions that could foster electrification in the remaining period.

Access to clean cooking technologies

About 3 billion people (39 per cent) still rely on cooking solutions that are both highly polluting and harmful. This represents an improvement over the 43 per cent level in 2010, but progress has decelerated since 2008. Significant challenges remain, particularly in sub-Saharan Africa and developing Asia. The incremental gains seen in recent years are not enough to achieve the goal of universal access by 2030. More rapid progress will require particular attention to behavioural patterns, cultural norms, and regional variations, as there is no one-size-fits-all solution when it comes to clean cooking. This is because cooking practices are heavily dependent upon culture, cuisine, household dynamics, and gender roles, as well as the availability of socially acceptable and affordable fuels and technologies.

Renewables

While renewables accounted for 17.5 per cent of total global energy consumption in 2016, up from 16.6 per cent in 2010, progress is projected to fall short of the significant increase pledged by SDG 7.2. Optimistically, however, the latest estimations indicate continued growth in renewables 2017 and 2018. Renewables have been increasing rapidly in electricity generation, driven by the fast expansion of wind and solar technologies, but have made less progress in theheat and transport sectors. Renewables in the heating and transport sectors represented 9 per cent and 3.3 per cent respectively in 2016. Long-term targets and predictable policies are key to ensuring investor confidence and continued growth of renewable energy technologies in all end uses, including electricity, heat, and transport. A combination of policies is recommended for creating an enabling environment, incentivising greater cost-competitiveness, and tackling non-economic barriers and infrastructure challenges.

Energy efficiency

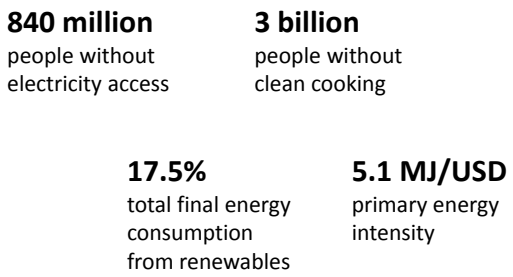
The total primary energy supply per unit of GDP improved at an annual rate of 2.3 per cent between 2010 and 2016. However, this progress falls slightly short of the SDG 7.3 target rate of 2.6 per cent. Reaching SDG 7.3 would require the target rate of improvement to increase to at least 2.7per cent, in order to compensate for this historic gap. Unfortunately, the latest estimations suggest that the pace instead decelerated for 2017 and 2018, with a rate of progress of only 1.3 per cent in 2018, suggesting that efforts need to be increased even further. Concerted government policy action will continue to be essential for realising the additional energy intensity improvements required to meet the target.

Latest analyses of the way towards SDG 7

SDG 7 was endorsed in 2015 as a global objective in order to ensure that energy is available to support inclusive and sustainable development across the world. Thanks to global support, this goal has attracted a lot of attention, guiding many projects and programmes.

The *Tracking SDG7 Report*, jointly produced by the SDG 7 custodian agencies (the International Energy Agency, International Renewable Energy Agency, United Nations Statistics Division, World Bank, and World Health Organization), provides annual tracking and analysis of the most recent progress for each sub-goal: SDG 7.1 on energy access (7.1.1 on electrification and 7.1.2 on clean cooking technologies and fuels), SDG 7.2 on renewable energy, and SDG 7.3 on energy efficiency. The latest estimates reveal that the world is making good progress but is still far from achieving SDG 7 by 2030 (see Figure 1). Maintaining and extending the pace of progress in all regions and energy use sectors will require much higher efforts across all goals, if we are to reach universal access to affordable, reliable, sustainable, and modern energy by 2030. Nonetheless, recent efforts in electrification and energy efficiency are very promising in terms of possibilities for quick improvement, while proven technologies show great potential for providing access to clean cooking and increasing the deployment of renewables, despite slow past progress.

Figure 1: Latest data for primary indicators of global progress towards SDG 7 targets



Source: IEA, IRENA, World Bank, WHO and UNSD, 2019

SDG 7.1.1 : Access to electricity

Recent progress

The global share of population with access to electricity rose from 83 per cent in 2010 to 89 per cent in 2017, at an average annual electrification rate of 0.8 percentage points. The global population without access to electricity fell from about 1.2 billion in 2010 to around 840 million in 2017. Encouragingly, 2015 to 2017 showed an increased rate of electrification at over 1 percentage point, or 153 million people electrified annually. Over the period, the population without access to electricity has fallen across all unserved regions, with sub-Saharan Africa emerging as the largest access deficit region in 2017. About 78 per cent, or 655 million, of those without electricity live in 20 countries, and progress (or lack thereof) there has a major influence on global SDG 7.1.1 outcomes. India, the Democratic Republic of the Congo, Ethiopia, Nigeria, and Pakistan all have over 50 million people without access to electricity. Although electrification in terms of population reached was greater in cities compared to rural areas between 2010 and 2017, the share of population with access levelled off at 97 per cent for the urban population, but improved from 70 per cent in 2010 to 79 per cent in 2017 for the rural population.

Are we on track for 2030?

The yearly average increase of electrification since 2010 falls short of the target rate needed to reach universal access by 2030. To make up ground, the electrification rate needs to increase globally to 0.86 pp annually from 2018 to 2030. If the access deficit countries sustain the accelerated pace of electrification seen between 2015 and 2017, universal access could be reached by 2030. However, 650 million people are projected to remain without access to electricity in 2030, and 9 out of 10 of them are in sub-Saharan Africa.

Key challenges

As electricity reaches different pockets of the world and global electrification inches closer to universal access, connecting remaining unserved populations becomes increasingly challenging. Governments must cope simultaneously with population growth and densification in urban settings while achieving the last mile in rural electrification and responding to increased climate risks and vulnerability. In addition, access to electricity does not maximise expected socio-economic benefits if the service is not clean, sustainable, reliable and affordable. It is therefore imperative to identify success factors that have enabled progress in electrification since 2010 and better target the instruments and levers that can pave the path to universal access to electricity that is affordable, sustainable, reliable and modern.

SDG 7.1.2: access to clean cooking

Recent progress

The share of the global population with access to clean fuels and technologies for cooking increased from 57 per cent [51 per cent and 62 per cent, respectively] in 2010 to 61 per cent [54 per cent and 67 per cent, respectively] in 2017. However, due to population growth outpacing annual access gains, the total population without access remained stagnant at around 3 billion between 2016 and 2017, showing only a 2.3 per cent increase since 2000. From 2010 onwards, global improvements were driven by gains in both Central and Southern Asia, and Eastern and Southeastern Asia, with an average annual increase of 1.2pp and 0.9pp, respectively. In Latin America, the proportion of people with access to clean fuels and technologies remained unchanged from 2016 to 2017, at around 88 per cent, with an average annual increase of 0.4pp [-0.1, 1] between 2010 and 2017. This increase was in large part due to expansion of the LPG and electricity infrastructure driven by national policy initiatives. In sub-Saharan Africa, the access-deficit population in the region increased from less than 750 million in 2010 to around 900 million in 2017.

Are we on track for 2030?

To reach universal access to clean cooking by 2030 and to outpace population growth, especially in sub-Saharan Africa, the average annual increase in the proportion of households with access would need to increase from the 0.5 per cent rate observed between 2010 and 2017 to around 3 per cent. Under current and planned policies, as highlighted in the IEA's New Policies Scenario, 2.2 billion people are projected to be relying on polluting fuels and inefficient technologies in 2030 (IEA, 2018a).

Key challenges

Challenges, such as financing and the lack of demand or supply, remain in the three largest access-deficit regions: Central and Southern Asia, Eastern and Southeastern Asia, and sub-Saharan Africa. Each of these areas contains around one third of the total population without access. Progress will require particular

attention to behavioural patterns, cultural norms, and regional variations, as there is no one-size-fits-all solution when it comes to clean cooking (IRENA/IEA/REN21, 2018). In many places around the world, for example, a single clean cooking device fails to meet all the cooking needs of a household due to issues with affordability, cultural acceptability, or availability (World Bank, 2016). Cooking practices are heavily dependent upon culture, cuisine, household dynamics, and gender roles, as well as the availability of socially acceptable and affordable fuels and technologies. Because women are typically responsible for cooking, they often have a comparative advantage in reaching out to other end users of clean cookstoves (IRENA, 2019a).

SDG 7.2: renewable energy

Recent progress

The share of renewables in final energy consumption increased from 16.6 per cent in 2010 to 17.5 per cent in 2016, after a period of stagnation during the 2000s. In absolute terms, renewable energy consumption has grown by 14 per cent since 2010. The share of renewables in heat consumption remained the highest and reached 24 per cent in 2016, an increase of 0.5 per cent year-on-year. However, this includes the 'traditional uses of biomass[1]'. Excluding those, the share of modern renewables reached 10.2 per cent in 2016, up from 8.6 per cent in 2010. Out of three end-use sectors, the fastest growth continued to be in electricity where renewables increased by one percentage point to 24 per cent in 2016, thanks to the rapid expansion of wind and solar PV. The share of modern renewables in heat remained at only 9 per cent in 2016. The share of renewables in transport consumption remained the lowest at 3.3 per cent, although it has been steadily increasing since 2010.

Are we on track for 2030?

Based on the current trend, the share of renewables in total final energy consumption is expected to fall short of the substantial increase called for in the SDG target, which is also crucial for achieving SDG13 and others. Recent estimates from the IEA's Global Energy and CO_2 Status Report show that the annual growth in renewables demand increases in 2017 and 2018 (IEA, 2019). Similar to past trends, growth was led by use of renewables in electricity generation. IRENA's latest statistical data on capacity show a growth of 8 per cent per year in renewable capacity over the same period.

Renewable deployment in electricity should increase significantly by 2030 thanks to continued strong policy support, digital technologies and improving cost competitiveness for solar PV and wind technologies; however, electricity accounts for only one fifth of total energy consumption today. In the IEA's New Policies Scenario, which analyses current and planned policies, modern renewables use would increase only slightly in heat and transport end uses, to reach 10 per cent and 5 per cent respectively. Total renewables (including traditional use of biomass) would reach 21 per cent by 2030, with modern renewables moderately increasing to 15 per cent, leaving important untapped potential (IEA, 2018a). As a benchmark, the share of renewables in total energy consumption by 2030 in the IEA's Sustainable Development Scenario is 22 per cent, while the IRENA REmap Case scenario indicates an even higher share of 28 per cent (IRENA, 2019c).

1 The "traditional uses of biomass" refers to the use of local solid biomass resources by low-income households that do not have access to modern cooking and heating fuels or technologies. Solid biomass, such as wood, charcoal, agricultural residues and animal dung, is converted into energy through basic techniques, such as a three-stone fire, for heating and cooking in the residential sector, which is often inefficient and associated with negative impacts on human health and the environment. For this section, solid biomass consumption in the residential sector in developing countries is assumed to be used traditionally. Modern renewable energy consumption is total renewables consumption excluding the traditional uses of biomass.

Key challenges

Renewables still face persistent barriers related to technology, awareness and capacity, cost, finance, infrastructure and public acceptance, in addition to policy, regulatory, institutional and administrative ones. Policies have so far mostly focused on renewable electricity, while fewer countries have implemented policies on use of renewables for heating and transport. Greater ambition is still required to increase the share of renewables in the global energy mix to meet sustainable development goals.

Another challenge in tracking progress towards SDG 7.2 is that the current indicator includes traditional uses of biomass, which should be phased out as rapidly as possible due to their significant negative impacts on air quality, health, and the environment. In the future, countries may also consider setting quantitative targets for modern renewables, which would allow more targeted policy actions and facilitate monitoring progress.

SDG 7.3: energy efficiency

Recent progress

Global primary energy intensity, defined as the total primary energy supply per unit of global gross domestic product, was 5.1 MJ/US$ (2011) PPP in 2016. This was an improvement of 2.5 per cent over 2015 levels, but less than the 2.9 per cent rate of improvement observed in 2015. Since 2010 global primary energy intensity has improved at an annual rate averaging 2.3 per cent, a more sustained rate of progress than 1990 to 2010, when annual improvements averaged 1.3 per cent. However, this falls short of the 2.6 per cent average annual rate of improvement targeted by SDG 7.3.

The latest estimates from the IEA show that the slowing rate of global primary energy intensity improvement observed in 2016 is continuing, with progress of 1.9 per cent in 2017 and 1.3 per cent in 2018 (IEA, 2019), suggesting that energy efficiency engagement needs a greater policy push.

Rates of primary energy intensity improvement are variable across regions, with improvements in Asia now central to global progress. As a result of energy efficiency policy actions and changes in economic structure, the annual rate of primary energy intensity improvement since 2010 has risen in 16 of the world's 20 largest energy-using economies; China, India, Indonesia, Japan, and United Kingdom are leading the improvements.

In terms of end uses, industry and passenger transport have seen rates of improvement exceeding 2 per cent since 2010, while the services, agriculture, and residential sectors showed more than 1.5 per cent improvement. Freight transport lags behind, but a changing policy landscape following the implementation of fuel economy standards for trucks signals potential future progress.

Improvements in the efficiency of power generation, as well as reductions in electricity transmission and distribution losses, will also contribute to reaching the SDG 7.3 target. Increased gas-fired generation, deployment of more efficient coal generation, and grid modernisation in the world's largest electricity producing countries, including China and India, are leading to improvements.

Are we on track for 2030?

Due to the rate of primary energy intensity improvement since 2010 being below 2.6 per cent, improvement rates now need to average over 2.7 per cent until 2030 to meet the SDG 7.3 target. Looking forward, with current policy ambitions, energy intensity improvements are likely to fall short of the SDG 7.3 target, leaving a large portion of cost-effective energy efficiency potential untapped. Between 2017 and 2030, energy intensity improvements are projected to average 2.4 per cent per year given current and planned policies

(IEA, 2018a).

Key challenges

The major challenge to realising the potential benefits from energy efficiency is the slow progress on energy efficiency policy. Economic growth and subsequent increases in living standards will continue to drive demand for energy services (lighting, heating, transportation, etc.) and subsequently put upwards pressure on energy demand. Energy efficiency policies, including regulations, incentives, and information and capacity building measures, have been critical to limiting energy demand growth without compromising economic growth and improved living standards.

Global progress on energy efficiency policy has stalled in recent years. Nearly 65 per cent of global energy use is not covered by mandatory energy efficiency codes or standards, with growth in policy coverage driven overwhelmingly by existing policies rather than new measures. Similarly, many countries drive efficiency gains by placing an obligation on utilities to meet energy saving targets. These targets have not changed since 2014 in over half of the obligation schemes globally, further illustrating the slowdown in efficiency policy.

How to fill the gap to achieve Sustainable Development Goal 7:

Energy sector investment related to the SDG 7 targets will need to more than double from today's level in order to achieve its goals. Between 2018 and 2030, annual average investment needs to reach approximately US$ 55 billion for energy access, of which around 51 billion is required for universal electricity access and 4 billion for universal clean cooking access (IEA, 2018a). Additional investment should target sub-Saharan Africa, where projected investments are far less than what is needed. Investment in energy efficiency needs to reach around US$ 600 billion per year, an effort for which the policy landscape will be essential. According to scenarios by both IEA and IRENA, renewable energy sector investment will need to reach between US$ 660 and 730 billion per year (IEA, 2018a; IRENA, 2019c). While cost competitiveness of solar PV and wind will continue to stimulate renewable investments, strong policy measures will also play a major role in attracting investors.

Additional efforts will be essential in ensuring progress towards not only SDG 7, but also in eradicating poverty and meeting the broader sustainable development agenda. In particular, SDG 7 and climate change (SDG 13) are closely related and complementary, as well as the energy-food-water nexus.

Policy implications and recommendations

Policies will continue to play a key role in achieving SDG 7 as a whole, and in particular: political commitment and long-term sustainable energy planning to meet strategic goals (e.g energy access, poverty reduction, reduced pollution, climate change adaptation), stepped-up private financing, and adequate fiscal incentives to motivate faster deployment of existing sustainable technology options. Specific recommendations can also be put forward for each sub-goal:

- *Access to electricity*: Moving forward, the reinforcement of data-driven decision making through, for instance, a more detailed understanding of end user demand and geospatial planning, will help to better inform electrification strategies and policies. It is equally important to address the challenges posed to a resilient electricity system from climate change, stranded-assets and non-sustainable investments. To leverage private sector financing and increase investment flows, it is necessary to promote an enabling business environment with regulatory certainty, investment safeguards, and affordable

financing options. Harnessing the potential of decentralised renewable energy solutions which are fuelling a disruptive transformation of the power sector could enable further acceleration in scaling up electrification.

- *Access to clean cooking*: Clean cooking policies need to be integrated into the national policy landscape, thereby scaling up solutions, increasing public and private investment in clean cooking, and enhancing multisectoral collaboration. Furthermore, extending programmes to reach rural communities is critical to success. This is especially important given that the majority of people in sub-Saharan Africa reside in rural areas and lack the necessary infrastructure for clean cooking access. Clean cooking programmes have proven to be particularly successful when they focus on training women in the design, use, and marketing of clean cooking technologies. This is further complemented by programmes tailored to address behavioural patterns, cultural norm,s and regional variations.
- *Renewable energy*: Long-term targets and predictable policies are key to ensuring investor confidence and continued growth of renewable energy technologies in all end uses, with stronger policy focus needed on heat and transport.. As renewables become mainstream, policies need to cover the integration of renewables into the broader energy system and take into account socio-economic impacts affecting the sustainability and pace of the transition without leaving anyone behind. A wide combination of policies creating an enabling environment, incentivising greater cost-competitiveness by creating a level playing field, tackling non-economic barriers and infrastructure challenges is recommended. Direct incentives to de-risk investment and facilitate affordable financing are needed, as well as policies that issue clear signals to stakeholders (e.g., clearly defined long-term targets, environmental and climate policies, and regulations) and level the playing field for renewables (e.g., phasing out fossil fuel subsidies and introducing carbon pricing). Policies should consider technology and market maturity, which depends on the country situation. They should prioritise system integration of increased shares of wind and solar PV, ensure development of relevant infrastructure (e.g., transmission & distribution networks, smart EV charging, and district heating and cooling) and promote sector coupling. In addition, policies need to address sustainability, support labour-market needs for new skills, and address social acceptance challenges in all end uses. Policies should be inclusive, taking into account gender considerations in energy sector frameworks, education and training (IRENA, 2019a).
- *Energy efficiency*: The key actions that governments can take to realise the cost-effective energy efficiency potential that exists today include: strengthening mandatory energy efficiency policies, providing targeted fiscal or financial incentives, leveraging market-based mechanisms, and providing high quality information about energy efficiency. The spread of digital technologies will also create an active area of new ways to harness efficiency improvements—through improved devices and business models.

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POLICY BRIEF #3

FINANCING SDG 7

Developed by

United Nations Development Programme (UNDP)

In collaboration with

UN Environment, SEforAll, the International Energy Agency, UN DESA, International Renewable Energy Agency (IRENA), African Development Bank, Islamic Development Bank, and the World Bank

KEY MESSAGES

Status of financing for SDG 7

- Power generation accounts for around 40 per cent of the world's CO_2 emissions and hence, decarbonisation of the power sector is of critical importance. Energy-related emissions in 2018 experienced a 1.7 per cent increase, due to a 2.3 per cent growth in energy consumption (IEA, 2019a; IEA 2019b). This only reinforces the dire urgency to accelerate investments in sustainable energy.

- The overall financing requirement to meet SDG 7—across renewable energy, energy efficiency and universal access - is estimated at US$ 1.3 to 1.4 trillion per year until 2030 (IEA et al, 2019)[1]. While progress is being made to scale-up financing, current annual financing levels are significantly below this level, at approximately US$ 514 billion (IRENA & CPI, 2018; IEA, 2017b). Moreover, investment is not spread equally, with developed countries and some middle-income countries accessing finance while many developing countries are left out. In 2017, power sector investments in China and the United States were above US$ 100 billion, while investments in Sub-Saharan Africa, Southeast Asia, and the Middle East/ North Africa were well-below US$ 50 billion (IEA, 2018).

- With the annual energy financing gap in the hundreds of billions of dollars, the available volumes of public and blended finance are not sufficient to meet needs. Recent data indicates that in low income countries, for every $1 of MDB or DFI resources invested, only $0.37 private finance is being mobilized (ODI, 2019). Hence, interventions from public finance institutions must be targeted to support and mobilise creation of viable commercial markets, as the scale-up of private sector financing will play a central role in financing SDG7.

Priority actions over the next 4 years

- A priority area is ensuring universal access to electricity and clean cooking fuels. To deliver universal energy access by 2030, IEA estimates that decentralized[2] solutions are the least-cost option for 60 per cent of people currently lacking access (IEA, 2017a). In electrification—given fast-moving, recent developments in digital finance and private sector models for off-grid solar solutions (Pay-As-You-Go (PAYG) solar, mini-grids)—there is an immediate need in many countries to put in place enabling policy environments, and to provide financial de-risking instruments to private sector actors. In clean cooking, current levels of access are far behind the stated SDG 7 objectives, and there is a need to dramatically increase investment levels, much of which is currently public finance.

Priority actions towards 2030

- A wide range of public measures exists to promote financing for low-carbon energy investment. In practice, context-specific combinations of measures are typically deployed for a technology and market. This policy brief describes several categories of public measures: demand-side interventions (policy de-risking, financial de-risking, and direct financial incentives (including carbon pricing and fossil-subsidy reform)) and supply-side interventions (financial system reform and new low-cost asset classes). A positive development is that a growing body of good practice examples and success stories for each of these categories is emerging. Looking ahead, while a number of countries already have enabling environments, the opportunity to 2030 is to continue to build on, and to spread, this good practice to the many countries that currently have gaps in their frameworks. This can be prioritized in the developing countries currently lagging in their ability to mobilize finance for SDG 7.

2 Includes off-grid (stand-alone) systems powering individual households, and mini-grids powering a network of clustered homes and/or businesses

- Digital finance and 'fintech' solutions (mobile money, data risk analytics) have the potential to deeply disrupt finance in the years ahead, and are opening the door to new, scalable low-carbon energy business models, for example in universal electrification and small-scale, distributed energy. Digitalization, particularly in developing countries, further offers a future financial system which is more efficient, transparent, inclusive, and resilient. Policy-makers can embrace digital finance and seek to make it an integral part of their planning.

- There is a growing momentum to align financial systems with sustainable development through initiatives such as UNDP's Climate Aggregation Platform and the UN Environment Inquiry. One of the major barriers to scaling-up low-carbon energy is the lack of developed or liquid domestic financial systems. International finance can step in to a degree, but this in turn can expose investors to foreign exchange risk. Hence the long-term, sustainable solution is to fast-track reform of domestic financial sectors, bringing depth and liquidity, with the aim of a balanced mix of domestic and international finance flowing to low-carbon energy.

FINANCING SDG 7

As more than two-thirds of the world's GHG emissions is attributable to the energy sector, SDG 7 is a key enabler for achieving SDG 13 (IEA, 2019b). The Energy transition from fossil fuel to renewables, energy efficiency measures and universal access through sustainable energy resources will significantly contribute to climate mitigation action. Hence, financing SDG 7 has direct implication on achieving SDG 13 targets. The urgency of ensuring financing requirements of the energy transition to tackle climate change has never been stronger. Driven by higher energy demand in 2018, global energy-related CO2 emissions rose 1.7 per cent to a historic high of 33.1 Gt CO2 (IEA, 2018). Limiting the global average temperature increase to 1.5°C would involve a 45 per cent reduction of global net human induced CO2 emissions from 2010 levels by 2030 (IPCC, 2019). This requires deep transformation of the energy sector in the next 10-12 years. A 20 per cent decline in emissions would be needed to limit global warming to below 2°C. This means accelerating the implementation of energy-related targets and raising ambition of the current national pledges made under the Paris Agreement, which are currently inadequate to ensure that global warming stays well below 2°C.

This brief addresses financing to achieve SDG 7's objective of ensuring "access to affordable, reliable, sustainable and modern energy for all" by 2030. SDG 7 has three interconnected sub-components: (1) ensuring universal access to electricity and clean cooking fuels, (2) substantially increasing the share of renewable energy in the world's energy mix, and (3) doubling the global rate of improvement in energy efficiency.

The financing universe

Financing for sustainable energy involves many actors, including public and private, domestic and international. Public actors include domestic governments and international actors (bilateral and multilateral agencies, development banks, and climate funds). Private finance in turn involves a full range of actors: households, businesses, banks, capital markets, institutional investors (such as insurance companies, pension funds, and asset managers) and philanthropy (foundations, endowments). National financial landscapes are diverse, with some countries relying on microfinance, while others have access to a full suite of financial services.

Given the scale of the investment needs, and the potential for energy investments to generate revenue and savings, a key characteristic of financing for SDG 7 is the central role of private finance and the role of public capital providers as enablers of private finance. If SDG 7 is to be met, limited public

finance will need to mobilize far larger sums of private finance that will meet the required investment volume in the order of trillions.

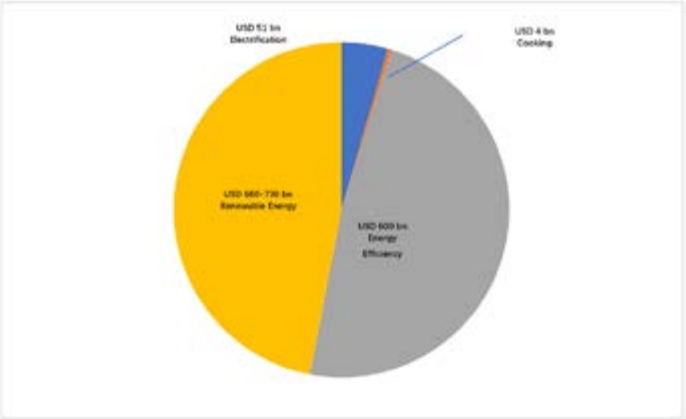
The use of economic instruments such as carbon pricing and energy and fuel subsidy reform can also play a critical role in achieving the financing needs for SDG 7 and the transition to a low-carbon economy.

Accessing finance at scale

The overall financing requirement to meet SDG 7 is estimated at US$ 1.3 to 1.4 trillion per year until 2030 (IEA et al, 2019) (Figure 1). While progress is being made to scale-up financing, present annual financing levels are significantly below this level, at approximately US$ 514 billion (IRENA & CPI, 2018; IEA, 2017b). Energy sector investment related to the SDG 7 targets will need to more than double from today's level in order to achieve the goals (IEA, 2018a). Annual investments need to increase to US$ 55 billion for electrification and clean cooking, US$ 600 billion for energy efficiency, and US$ 660-730 billion for renewable energy sector (IEA, 2018a; IRENA, 2019ac).

As such, there is currently an annual financing gap in the range of US$ 800 to 900 billion per year. Moreover, investment is not spread equally, with developed countries and some middle-income countries accessing finance while many developing countries lack access to finance for scale-up or face very high financing costs. In 2017, power sector investments in China and the United States were above US$ 100 billion while investments in Sub-Saharan Africa, Southeast Asia, and the Middle East/ North Africa were well-below US$ 50 billion (IEA, 2018).

Figure 1: Annual financing needs to 2030 to meet SDG7



Source: IEA & WB, 2015; IEA, 2017a, IRENA, 2019a

The following is a breakdown of investment by sector.

Renewable energy[3]

Renewable energy financing requirements to meet SDG 7 are estimated at US$ 660 to 730 billion per year until 2030 (IEA et al, 2019)[i] (IRENA, 2019a). Actual renewable energy investment was US$ 263 billion in 2016 (IRENA & CPI, 2018), with solar and wind as the leading technologies. 2016 investment levels decreased 20 per cent with respect to 2015, however this was partly due to hardware cost reductions and 2016 nonetheless represented a record for annual new installed capacity.

3 Large hydro is treated differently by reference source. (IRENA & CPI, 2018) figures, which include the headline 2016 investment figures quoted here of USD 263 billion, include large hydro (IRENA & CPI, 2018). (REN21, 2017) and (UN Environment, 2017) do not include large hydro.

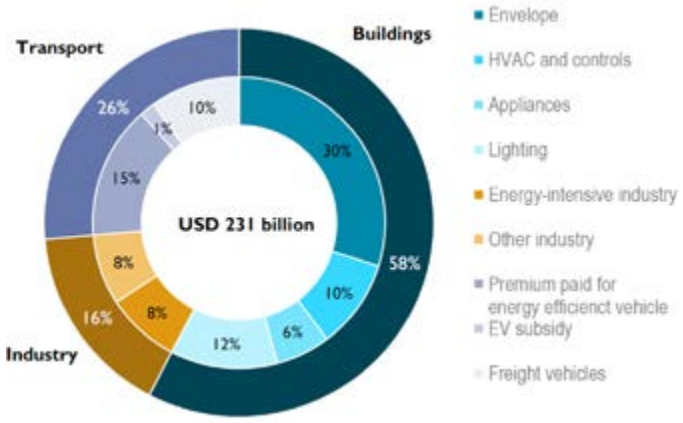
Developing countries accounted for 48 per cent of 2016 investment with China the biggest recipient (REN21, 2017). Globally, 90 per cent of direct renewable energy investment in 2016 was financed by private sources. However, public finance is still significant in many developing countries, accounting for a 49 per cent share of direct investments in renewable energy in Latin America and the Caribbean, 41 per cent in sub-Saharan Africa, and 24 per cent in South Asia (IRENA & CPI, 2018).

Utility-scale projects, using asset finance, contributed US$ 187.1 billion in 2016 investment, and small-scale distributed assets, a growing sector, US$ 39.8 billion (UN Environment, 2017).

Energy efficiency

Energy efficiency financing requirements to meet SDG 7 are estimated at US$ 600 billion per year to 2030 (IEA et al, 2019)[i]. Overall energy efficient investment[2] was US$ 231 billion in 2016, with energy efficient measures in buildings accounting for close to 58 per cent (Figure 2). Total 2015 investment grew by a rate of 5 per cent year on year (IEA, 2017b).

Figure 2: Global incremental investment in energy efficiency by sector and sub-sector



Source: IEA, 2017b

Energy efficient investments are largely via the cash and savings of households and businesses (REN21, 2017), with commercial bank lending, leasing, and ESCO models, amongst other approaches, also contributing. Private finance, depending on the sector, can be significant; for example, it is estimated to account for 94 per cent of global energy efficient investment in the building sector in 2015 (IEA & WB, 2017). Public finance can be channelled via various entities, including Green Investment Banks.

Universal access: electrification

The financing requirements for universal electrification to meet SDG 7 are estimated at US$ 51 billion per year to 2030. These are primarily needed in India and sub-Saharan Africa. Currently, investment levels are approximately half of this, estimated at US$ 19.4 billion per year in 2013-2014 in SEforAll's 20 high-impact countries, which accounted for 80 per cent of the global access deficit (SEforAll, 2018).

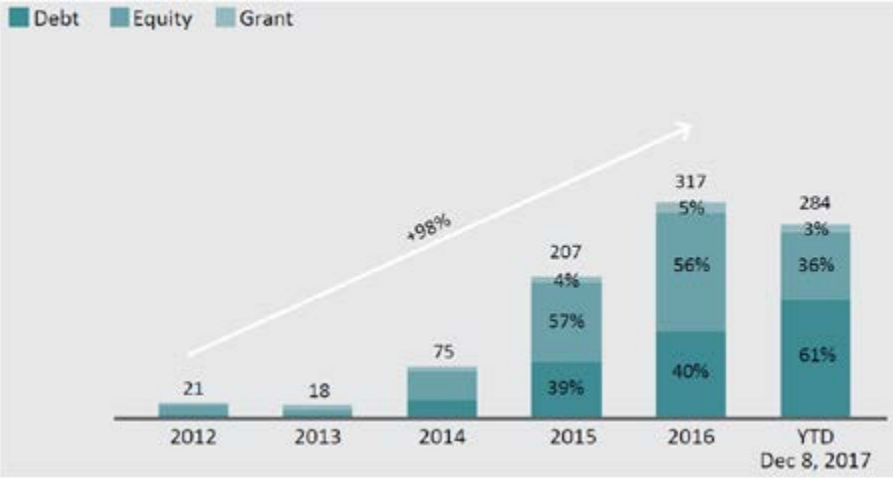
To date, nearly all investment has been directed to grid expansion, with donor financing accounting for 55 per cent of total investment in 2013 (REN21, 2017). Continued grid expansion is anticipated to remain a significant public funding need. However, this sector is in the midst of transformative change. Decentralized[4]

4 Includes off-grid (stand-alone) systems powering individual households, and mini-grids powering a network of clustered homes and/or businesses

solutions have been identified as the least-cost option for 54 per cent of the future connections to reach universal access by 2030 (IEA, 2018). Grid extension can be less favourable than decentralized off-grid systems in cases of complex terrain, low population density, institutional regulations, or high investment and maintenance costs that are not recoverable by utilities. It is estimated that grid extension in remote areas can cost around US$ 2,300 per connection while mini-grids cost consumers US$ 500-1000 per household connection (Brookings, 2017). A real opportunity exists in the coming years to meet this challenge with private sector solutions for off-grid renewable energy, either via solar mini-grids or solar home systems (UNDP, 2018). The three key trends converging behind this opportunity are reductions in hardware costs, improvement in appliance efficiencies, fintech solutions, and innovative business models such as Pay-as-you-go (PAYG).

According to the latest analyses, in sub-Saharan Africa, private sector models for off-grid solar solutions (solar home systems, mini-grids) are now estimated to be the lowest-cost option for 54 per cent of the future connections needed to meet SDG 7 (2019 SDG7 Tracking Report, forthcoming). In addition to being cost-effective, such systems are environmentally sustainable, rapidly deployable, and modular (IRENA, 2017). IRENA estimates that approximately 133 million people were served by off-grid renewable energy technologies in 2016 (IRENA, 2018a). Financing for private sector off-grid solutions has started to take off globally, albeit from a low base, in particular PAYG solar home systems (Figure 3). Recent illustrations are *M-KOPA*'s US$ 80 million debt and equity financing (October 2017) and *Off-Grid Electric's* US$ 55 million equity round (January 2018). If off-grid electrification is to truly scale, there is a need to access commercial debt financing at large volumes, supported by dedicated policies and regulations and enabling institutional frameworks. A recent example is the energy access fund under the Facility for Energy Inclusion (FEI) which is providing debt financing for off-grid companies (AfDB, personal communication).

Figure 3: Annual financing for off-grid solar companies (US$ million)



Source: WB, 2018b

Universal access: cookstoves

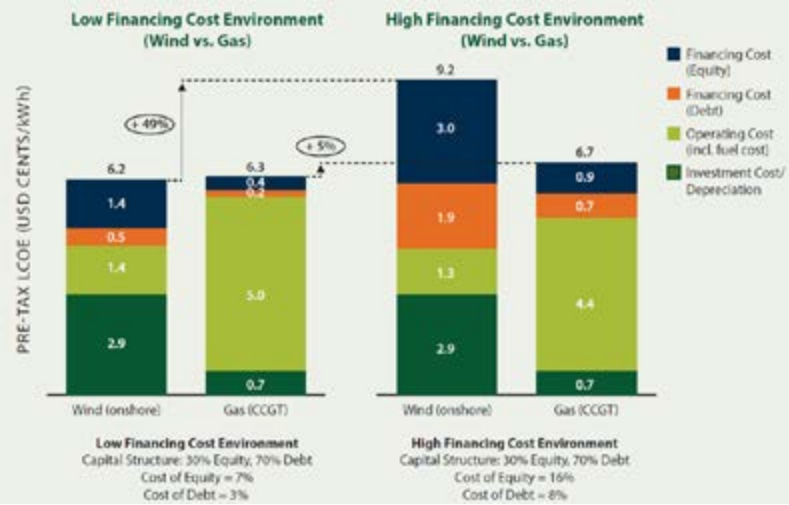
Residential cooking, heating, and lighting in rural areas in developing countries contribute to black carbon emissions also known as short-lived climate forcers. Reducing these short-lived climate forcers can in the short term contribute significantly to limiting warming to 1.5^{0}C (UNEP, 2017). The financing requirements for universal access to clean fuels and technologies for cooking to meet SDG 7 and contribute to SDG

13, are estimated at US$ 4.4 billion per year to 2030 (IEA & WB, 2015). The latest estimates of current investment levels show a reduction in annual investment from US$ 32 million in 2013-14 to US$ 30 million in 2015-16 (SE4All, 2018), which is a small portion of the US$ 4 billion annual investment required by 2030. Private finance in this sector is very limited; SEforAll estimates that in 2013 public financing in the form of grants accounted for US$ 26 million of the total US$ 32 million per year, with international public finance predominating.

Access to low-cost financing

A further challenge for financing SDG 7 is accessing *low-cost* financing. Given low-carbon energy's upfront capital intensity, low-carbon energy is penalized from high financing costs environments vis-à-vis conventional energy in (Figure 4). Such high financing costs can reflect a range of low-carbon energy investment risks that exist in early-stage markets. Providers of debt and equity capital price these risks into their cost of financing. Barriers limiting the availability of capital in developing countries can also raise financing costs.

Figure 4: Comparison of the levelized cost of utility-scale wind and gas in high and low financing cost environments



Source: (UNDP, 2017)

Actual financing costs for low-carbon energy vary widely depending on technology and context. In developed countries and certain developing countries, low financing costs are being secured for mature technologies, particularly for large, utility-scale renewable energy. However, financing costs for low-carbon energy can be prohibitively expensive in many developing countries. In such markets, UNDP estimates that financing costs can account for up to 60 per cent of the life-cycle cost of low-carbon energy (UNDP, 2017) (Figure 4).

POLICY IMPLICATIONS

In assessing policy implications to finance SDG 7, a range of public interventions are available. The suitability of public measures for a specific country and market depends on the national and local circumstances. Combinations of public measures are typically deployed, which will increasingly need to be holistic and more fully integrated across different sectors (power, heating and cooling, transportation). This brief describes the main categories of public interventions.

Demand for Capital

Given the central role of private finance, a key role for public finance for SDG 7 is to improve the risk-return profile of investment opportunities that are seeking private capital—a mechanism also termed as 'demand-side interventions.' Public finance can be applied in the form of instruments that either *reduce* (policy de-risking), *transfer* (financial de-risking), or *compensate* (direct financial incentives) for risk.

Policy de-risking instruments

Policy de-risking instruments can be understood as programmes, policies, and regulations that *reduce* the risks the private sector faces when investing in low-carbon energy. These are typically implemented by domestic governments and can take a wide variety of forms. Well-designed policy de-risking instruments can provide the long-term stability, visibility and transparency that is critical to attract and sustainably scale-up private sector investment.

A growing body of evidence of good practice policy instruments for low-carbon energy is emerging, particularly for mature technologies. In utility-scale renewable energy, these instruments include auction processes (now also increasingly being used in the mini-grid space), which have recently been successful in developing countries, and reforms to ensure financially sound utilities (cost-recovery). In energy efficiency, these include the design, implementation, and enforcement of various minimum energy efficient standards such as green building codes, or in lighting and appliances. Public procurement, with its high volumes, can be used effectively to prime energy efficient product markets. Policy de-risking instruments, tracked by initiatives such as the World Bank's *RISE* (WB, 2017), and analysed by organisations such as IRENA, the IEA, and REN21 (2018), are increasingly being deployed (e.g. the Electricity Regulatory Index (ERI); by end of 2016, 176 countries had renewable energy targets and 137 countries had energy efficiency policies enacted (REN21, 2017). In end-use sectors, however, supportive regulatory measures are lagging, as only 68 and 21 countries had adopted transport, heating, and cooling regulations, respectively, as of the end of 2016 (IRENA, IEA and REN21, 2018).

In general, while a number of countries have well-designed policy environments, many countries still have gaps in their frameworks and can benefit from further improved instruments deployed in a more integrated manner across sectors.

A priority area is in universal electrification, where—given fast moving developments in digital finance, technology efficiencies, and private sector models for off-grid solutions—there is an immediate need in many countries to put in place enabling policy environments (including integrated energy planning and implementation) and lay the foundation for private sector entrepreneurship and investment.

Looking to the future, countries can benefit by introducing well-designed policies for small-scale, distributed energy solutions in both renewable energy and energy efficiency. Relatedly, standardized contracts, indicators, and terms for low carbon energy can reduce transaction costs and facilitate emerging aggregative investment vehicles and asset classes. In more mature renewable energy markets, investors will increasingly seek well-functioning, innovative policies around grid planning for variable renewable energy, which calls for an increased flexibility of power systems through enabling technologies (storage, digitalisation), business models (aggregators, peer-to-peer trading), market design (time-of-use tariffs, regional markets), and system operation (advanced forecasting, co-operation between transmission and distribution operators) (IRENA, 2019b). In the future, a new frontier in renewable energy—moving beyond power—will be applications in heat and transport.

Financial de-risking instruments

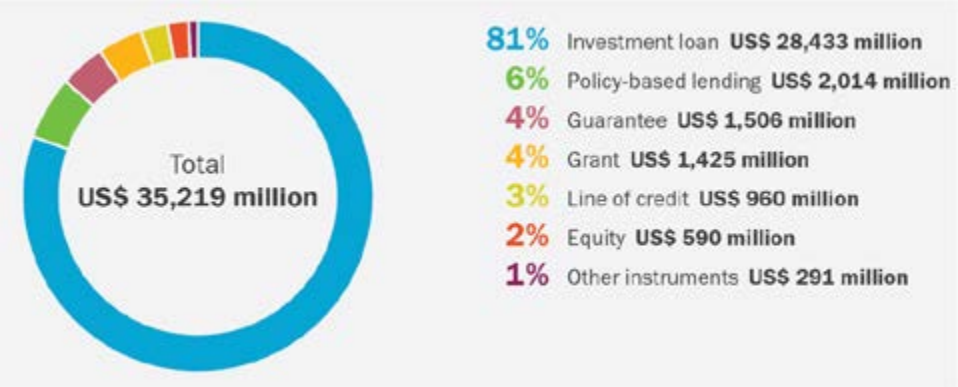
Financial derisking instruments can be understood as financial products which *transfer* risk around investment opportunities to those market players who are best able to manage such risks. These instruments are provided by a variety of institutions, including development banks (multilateral (MDBs), bilateral or

national)), national governments (ministries of finance), and agencies (export credit agencies), as well as private insurance companies and banks. Instruments can take many forms, such as guarantees for political, credit and liquidity risks, currency and interest rate hedging instruments (swaps, forward contracts), and other products (IRENA, 2016). When implemented, financial de-risking instruments can bring comfort and engage the commercial financial sector in early-stage markets and be key to achieving first-of-a-kind investments. According to an OECD and Milken Institute (2018) study, guarantees are the most effective leveraging instruments, achieving 45 per cent of all private capital mobilisation while representing only 5 per cent of development finance commitments.

In terms of deployment, MDBs[3] committed US$ 35.2 billion in climate mitigation finance products in 2017, with a 28 per cent increase from the previous year. Of the total amount, US$ 27.9 billion, or 79 per cent, was committed to climate change mitigation finance and US$ 7.3 billion, or 21 per cent, was committed to climate change adaptation finance (AfDB et al, 2018).

MDBs reported that 81 per cent of total climate finance was committed through investment loans and the rest comprised of instruments such as policy-based lending, guarantees, grants, equity, line of credit, and others. The breakdown of the total climate finance by instrument type is shown in Figure 5.

Figure 5: MDB Climate Finance 2017 Breakdown by Instrument Type



Source: AfDB et al, 2018

In the future, there is a clear need for the continued and much scaled-up provision of financial derisking instruments by development banks. Multilateral and bilateral development banks can increasingly structure their products to attract the private sector. The MDB's *Maximizing Financing for Development* initiative is building momentum towards this objective. Innovation in products and alignment in activities with areas of emerging SDG 7 private sector activity, such as small-scale renewable energy and universal electricity access, can also be beneficial. MDB's should also explore optimizing their balance sheets to free up headroom for new lending by the securitization of their non-sovereign financial sector and infrastructure loans (see Room 2 Run initiative by AfDB).

However, this shift in the policy landscape of development assistance incurs the risk of steering away from low income countries (LICs), as it is easier to mobilize private finance in more stable and mature markets. Thus, it is critical that MDBs and bilateral organizations understand and manage risks to ensure that blended finance does not contribute to poor targeting of development assistance and that investments support the LICs to meet the 2030 Agenda.

Direct financial incentives

Direct financial incentives can be understood as direct financial transfers or subsidies to low-carbon energy investments. These instruments *compensate* the private sector for the higher real or perceived investment risks in early-stage markets, help level the playing field with fossil fuel sources that continue to receive more subsidies, and increase the financial return component in an investment's risk-return profile. These instruments are intrinsically results-based and can take a variety of forms, including premium tariffs, up-front capital subsidies, tax credits, waiving of VAT, and tradable renewable portfolio standards.

Significant resources can be allocated to direct financial incentives for renewable energy. For example, in 2015, expenditures for such instruments in Europe and Norway amounted to US$ 66 billion, considerably more than direct public investment in these markets (IRENA & CPI, 2018).

In general, direct financial incentives for low-carbon energy can be a costly approach to catalysing private finance and should be well-designed, and used sparingly in a targeted fashion (UNDP, 2013). Sub-optimally designed incentives can generate fiscal burdens and result in policy-reversal, creating uncertainty and additional risk for the private sector.

Within SDG 7, there are two areas meriting particular consideration for direct financial incentives. The first is universal access to energy, particularly for financial support to private developers providing energy services via mini-grids and solar home systems, or similar programmes targeting consumers. The second is energy for public infrastructure in rural areas (clinics, water pumps, public lighting, etc.), where improved energy access can contribute to a number of SDGs. Recent trends in public investment suggest this is already starting to occur to some extent (IRENA, 2018b).

In addition, financing SDG 7 will benefit from engagement on two policy areas—carbon pricing and fossil fuel subsidy reform—which are closely related to direct financial incentives. These two areas each improve the relative competitiveness of low-carbon energy investment opportunities, removing distortions and creating a level playing field vis-à-vis conventional energy. More broadly, both instruments can be fiscally beneficial, and create overall economic efficiencies.

Carbon pricing, in the form of a carbon tax or an emissions trading system (ETS), economically internalizes the climate externality of greenhouse gas emissions. To date, there are 57 national and sub-national carbon pricing initiatives in 46 countries, covering 19.6 per cent of global GHG emissions, up from less than 5 per cent in 2005 (WB, 2019; WB and Ecofys, 2018). Future opportunities include expansion of carbon pricing to new jurisdictions; digitalization or fintech application to improve monitoring, reporting, and verification standards; and deployment of carbon pricing in conjunction with other economic policies (energy, environment, fiscal, and others) and in alignment with divestment from fossil fuel subsidies (WB, 2018).

The IEA estimates global **fossil-fuel consumption subsidies** in 2017 at US$ 300 billion (IEA, 2018), with oil subsidies representing the largest share (45 per cent) at US$ 137 billion, while IRENA's estimate of global fossil fuel subsidies in 2015 is around US$ 451 billion (IRENA, 2019 forthcoming). Current fossil fuel subsidies are often regressive, benefiting higher income households and can be a barrier to the development of sustainable energy sector through market distortion. In turn, reform can be politically challenging and proceeds may need to be rechannelled to compensate vulnerable social groups. In recent years, a number of countries have begun reform processes; further progress in this area will be an important contribution to facilitating financing for SDG 7.

Inequality, energy pricing, and environmental taxation

Environmental taxation applied to consumption goods, such as heating and cooking fuels, could represent a higher proportion of a poor household's income than a rich household's income, depending on the design and national circumstances. There is a popular perception that the regressive effects make such taxes

undesirable, particularly in relation to energy and fossil fuel pricing, as many countries use fossil fuel subsidies to try to reduce the price of necessities. In the last few years, many national efforts at fossil fuel subsidy reform and environmental taxation have been derailed by popular protest against the policies' perceived inequities, while other countries have successfully implemented reforms. Despite the perception of regressivity, if properly structured, the effect of reforms on the poor can be offset by using the revenue for redistributive expenditure, similar to other taxes. A large portion of the value of some subsidies may be captured by the rich. For example, they may have greater access to vehicles, often with low fuel efficiency. Country experiences show that the likelihood of success in subsidy reform almost triples with strong political support and proactive public communications. Clear communication about beneficiaries is important because political acceptability may be tied to the use of the revenue. Despite much analytical work and many practical guidelines, some countries proceed without coherent plans that encompass: (a) timetables for slowly phasing in reforms; (b) administration mechanisms; (c) mitigation measures for the poor or vulnerable; and (d) strategies for consultation and communication. Implementation of mitigation measures before subsidies are fully phased out or taxes fully phased in—such as larger cash transfer programmes—can demonstrate the political commitment to using revenue to reduce inequality. Such approaches can be summed up in the concept of just transition, a principle that is embedded in the Paris Agreement. Examples of successful just transitions from both developed and developing countries can serve as useful references for countries planning reforms (United Nations, 2019).

Supply of Capital

Public policy can also seek to shape the availability of private financing for low-carbon investment opportunities in SDG 7—here termed 'supply-side interventions.'

Financial system reform

Domestic financial systems are varied and complex, involving a mix of actors (private and public), regulations, norms, and dynamics. In recent years, increasing momentum has been building around **aligning financial systems with sustainable development**, including low-carbon energy. Initiatives such as the *UN Environment Inquiry into the Design of a Sustainable Financial System* have provided global leadership, accompanied by country-level strategies and actions.

In low-carbon energy, many developing countries are currently held back by underdeveloped domestic financial systems. This limits access to affordable, local currency financing. International finance can step in to a degree, but this in turn can expose investors to foreign exchange risk. A long term, sustainable solution is to develop the depth and liquidity of domestic financial sectors, with the aim of a balanced mix of domestic and international finance flowing to low-carbon energy.

Potential financial system reforms are wide-ranging, including policies addressing barriers related to capital allocation, risk assessment, and improving transparency. Reforms can be carefully considered, weighed against the need for overall system stability. An example is central bank reform of liquidity or collateral requirements for commercial bank lending, facilitating longer-term loans for low-carbon energy.

Green bonds and impact investment

Emerging asset classes and sources of capital for low-carbon energy, such as green bonds and impact investment, are a growing source of low-cost, high impact, and longer-term financing.

Global **green bond** issuance reached US$ 167.3 billion in 2018 from US$ 155.5 billion in 2017. Although the market growth slowed compared to year-on-year increase in 2017, the year 2018 experienced a significant rise in the issuance of sustainability, SDG, and social bonds, highlighting increasing diversification of the market. Taking into account all the above-mentioned issuance categories, the market saw a 13 per cent

increase in 2018 from US$ 199.3 billion to US$ 226.3 billion in 2018 (CBI, 2019).

the United States, China, and France topped the market accounting for 47 per cent of the global issuance in 2018, while the Asia-Pacific region achieved the highest year-on-year growth rate at 35 per cent. Eight new countries had their debut green bond issuances in 2018: Iceland, Indonesia, Lebanon, Namibia, Portugal, the Seychelles, Thailand, and Uruguay (CBI, 2019).

Impact investment represents investments made with the intention to generate social and environmental impact, alongside a financial return (GIIN, 2017). Impact investors range from banks, to institutional investors, to family offices and foundations. The market for impact investment is growing rapidly both in terms of new entrants and investment volume from existing investors (OECD, 2019).

According to Global Impact Investing Network (GIIN)'s 2018 Annual Impact Investor Survey consisting of 229 respondents, the impact investment market was valued at US$ 228.1 billion in assets under management (AUM), of which 56 per cent was allocated to emerging markets (GIIN, 2018). The main sectors for impact investments in 2017 were financial services (excluding microfinance), which received 19 per cent of AUM; energy in second at 14 per cent; microfinance at 9 per cent; and housing at 9 per cent (OECD, 2019).

To scale up these low-cost energy asset classes, policy makers play a key role in creating a conducive environment for attracting larger and more diversified pool of private investors. For green bonds, there is a need to continue to raise awareness, build capacities within local regulators and financial institutions, provide incentives, and strengthen certification and disclosure requirements in existing and new markets. Emerging new green bonds include aggregative asset classes for small-scale, low-carbon energy assets. Development banks can co-invest in green bond funds and provide credit enhancement to new issuances.

For impact investment, a variety of actions can be taken. For example, in January 2017, members of the UNEP Finance Initiative launched the "Principles for Positive Impact Finance" (PRI), a framework for investors to analyse, monitor, and disclose the social, environmental, and economic impacts of the financial products and services they deliver (UNEP FI, 2017). Complementing this framework is the OECD Policy Framework for Social Impact Investment, which is intended to assist governments in their efforts to design impact investment conducive policies in the context of private sector financing for the SDGs (OECD, 2019), as well as the increasingly popular TCFD (Task Force on Climate-related Financial Disclosures) framework developed by the Financial Stability Board and supported by over 500 companies (TCFD, 2018). UNDP's Climate Aggregation Platform is another initiative that helps countries create policy and market architecture to achieve an increasing pipeline of low carbon energy assets and develop low cost source of financing by tapping into new and diverse investor base.

Digital finance

Finance is constantly evolving and technology has always been a central driver of this evolution. However, recent developments in **digitalization** and 'fintech' solutions have the potential to deeply disrupt finance, acting in unprecedented and transformative ways. These new digital technologies have multiple applications, from mobile money, to enhanced data risk analytics, to the Internet of Things (IoT), to advances in artificial intelligence (AI).

In low-carbon energy, digitalization is opening the door to novel business models and value propositions, with opportunities in both new private sector models and enhanced end-user experiences in universal electrification and small-scale, distributed energy (both renewable energy and energy efficiency). More generally, digitalization offers a future financial system which is more efficient, inclusive, and resilient, and for developing countries to accelerate their financial system development.

Policymakers can embrace digital finance and seek to make it an integral part of their planning. Some early lessons in low-carbon energy are emerging. For example, in universal electrification, experiences with

mobile money indicate that an initial light touch policy approach, leaving the space for innovation and consulting regularly with fintech actors, can result in a vibrant and competitive market. In turn, as markets mature, policy measures can begin to address related issues such as consumer protections and privacy.

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POLICY BRIEF #4

ENERGY AND SDG 4 (QUALITY EDUCATION)

Developed by

United Nations Children's Fund (UNICEF)

In collaboration with

UN DESA, ENERGIA, The World Bank, and the International Energy Agency (IEA)

Key Messages

Educational facilities require energy for lighting, cooking, heating, cooling, water delivery and purification, and information and communication technology (ICT), including for disaster and medical emergency situations. Lack of access to sustainable energy forces schools, dormitories, kitchens, and staff facilities to rely on unsustainable sources such as biomass, charcoal, or kerosene for lighting and cooking purposes. This exposes students and staff to indoor air pollution, creating health risks ranging from headaches to respiratory disease, which compromises health and learning abilities. Low levels of electricity access are correlated with poor educational performance, lower attendance, and a decreased ability to attract and maintain teachers.

Globally, over 230 million children go to primary schools without any electricity, 217 million of them in sub-Saharan Africa, South Asia, and Latin America. While overall electrification rates have reached 87 per cent globally, electrification at primary schools lags behind, reaching only 69 per cent. This leaves millions of children without access, thus compromising educational and development outcomes—most prominently in disadvantaged and rural communities.

There is a positive correlation between access to electrification, particularly for lighting, and improved education. For instance, research in Bhutan indicated that rural electrification contributed to 0.65 additional years of schooling for girls and 0.41 additional years for boys. Similarly, research in rural villages in Madagascar demonstrated that the electrification of households affects children's ability to keep up with school and helps reduce gender inequality by providing girls, who are traditionally more engaged in housework than boys, with opportunities to study after sunset.

However, about 63 million children still do not go to school, half of them in sub-Saharan Africa. School attendance and performance levels have been shown to increase with higher electrification rates—especially for lighting and equipment (including ICT). Electrification allows schools to stay open for a better learning environment, extended operating hours of study, and teacher preparation and training after hours.

Schools with better access to sustainable energy can also be used to provide other community services, such as clean water, hygienic sanitation, and health and emergency services.

Efforts towards achieving the SDG 7 target of universal access to affordable, reliable, modern energy services also contribute to the sustainable development goal of ensuring inclusive and quality education for all (SDG 4), and, moreover, can help inculcate a mindset of low-carbon development for future generations, contributing to the urgent action required to combat climate change and its impacts (SDG 13).

Priority actions

- Increase efforts and coordination among different stakeholders to gather quantitative and qualitative data and information on energy access in educational facilities, to drive evidence-based decision making.
- Adopt enabling policies that incentivise and prioritise investment in energy access in the education sector and, reinforce existing policies that facilitate a more coordinated approach in the public sector for collaboration on the provision of energy and education infrastructure and services.
- Build support for these policies through stakeholder engagement, public advocacy, and outreach to influence decision makers.
- Enhance public awareness and education for adults and children about sustainable energy, in order to facilitate necessary behavioural changes, build a technical skill base, and encourage youth innovation to advance sustainable energy solutions.

Energy in education in the context of the Sustainable Development Goals

Access to modern, reliable, and affordable energy is critical for development and contributes directly to achieving positive educational outcomes. Education facilities require energy for lighting, cooking, heating, cooling, water delivery and purification, and information and communication technology (ICT), including for emergency and medical situations. Lack of access to sustainable energy forces schools, dormitories, kitchens, and staff facilities to rely on unsustainable sources such as biomass, charcoal, or kerosene for lighting and cooking purposes. This exposes students and staff to indoor air pollution, creating health risks ranging from headaches to respiratory disease, which compromises health and learning abilities.

There is a positive correlation between access to electrification (particularly for lighting) and improved education. For instance, research in Bhutan indicated that rural electrification has been shown to contribute to 0.65 additional years of schooling for girls and 0.41 additional years for boys. Similarly, research in rural villages in Madagascar demonstrated that the electrification of households affects children's ability to keep up with school and helps reduce gender inequality by providing girls, who are traditionally more engaged in housework than boys, opportunities to study after sunset (UNICEF, 2015).

Access to reliable and sustainable energy allows educational facilities to maintain and extend operating hours and improve the quality of education by providing a place for teachers to prepare lessons or receive training, which contributes to teacher retention by improving their quality of life. For example, in rural areas of Kenya, 75 per cent of head teachers reported that recruiting and retaining teachers was a problem and 60 per cent 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).

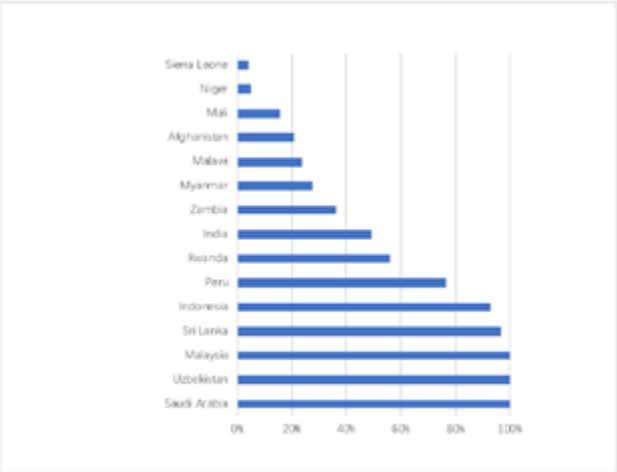
Overall, efforts in achieving the SDG 7 target of universal access to affordable, reliable, modern energy services also contribute to the sustainable development goal of ensuring inclusive and quality education for all (SDG 4).

Current status

More data needs to be collected on energy access in the education sector, but available research shows clear trends and correlations between electrification and education. Studies have shown that there is a strong correlation between electricity consumption per capita and higher scores on the education index, which is a proxy for the mean years of schooling a student receives (Kanagawa, 2008). Other studies have shown that lower levels of electricity access are also correlated with a decreased ability to attract and maintain teachers; a study on South African "mud schools" noted that "extremely poor infrastructure has an effect on teachers, as well as pupils" (Skelton, 2014), while another study on sustainable energy for children in Zimbabwe notes that "teachers and nurses have been known to shun rural schools without access to electricity" (UNICEF, 2015a).

In terms of primary school access to electricity, sub-Saharan Africa has the lowest rate, with 35 per cent, followed by South Asia with 51 per cent and Latin America with 87 per cent (UNESCO, 2019). Globally, over 230 million children go to primary schools without access to any electricity, and 217 million of these pupils live in the regions mentioned above (UNESCO, 2019). It is worth noting that not only does sub-Saharan Africa have the lowest levels of electricity, it is also the region with the lowest levels of learning (UNDESA, 2014).

Figure 1: Percentage of primary schools with access to electricity in selected countries



Source: UNESCO, 2019

A quality education is instrumental in improving a person's life. Throughout the years, there has been tremendous progress towards increasing access to education and raising enrolment rates in schools. Enrolment in primary education in developing countries is currently at 92 per cent, yet about 63 million children still do not go to school (UNESCO, 2019). Over half of those children live in sub-Saharan Africa.

Access to sustainable energy can help advance the education sector in numerous ways. Electrification at schools is associated with a better experience and opportunities for children, as lighting allows for better learning environment, extended operating school hours used for studying, better teacher preparations, and the facilitation of training for community members. School attendance also increases with lighting, especially in regions that face poor sunlight penetration. Qualitative research in Bangladesh demonstrated that teachers consider it almost impossible to teach under conditions of low light (Practical Action, 2013). In the Philippines, teachers have reported cancelling schools in rainy weather when classrooms are not adequately lit for teachers and students (Valerio, 2014).

Teachers have also reported cases during school days where, to be able to print teaching materials and test papers, they have had to travel as long as an hour to get to the nearest city. Facilitating the use of ICT—possible only through access to electrification—therefore provides for a more effective use of time and resources for teachers and students, heightens the quality of education, combats the widening digital divide, and builds essential skills for the modern economy. For example, middle school children in Ethiopia who use laptops scored significantly higher in identifying analogies and categories than those who do not (Hansen et.al., 2012). Another example comes from India, where a computer-assisted learning programme offering customised learning to children produced significant improvements for scores in math and Hindi, with the most gains found among the weakest students (IBB, 2018).

Electrification of educational facilities can bring overall benefits to the community too, as schools can be used as integrated service platforms for children, where clean water, nutritious meals, and primary health services can be provided in a safe environment. Electricity can be used for water delivery and purification systems, emergency radio or disaster warning alarms, and the refrigeration of both food and vaccines. A recent example can be found in Lagos, where a solar-powered floating school was built in the Makoko water community, providing education for more than 100 children (UNEP, 2017). Innovative approaches like this one can make solar energy more accessible and affordable, especially in countries like Nigeria that possess great solar energy potential (RECP, 2016).

In addition, sustainable energy improvements and energy efficiency in kindergartens, schools, dormitories, kitchens, and staff quarters can provide clear benefits in meeting basic energy needs and enhancing the well-being of students and staff alike. Reliable and affordable energy is a prerequisite for accessing clean

water and sanitation. Renewable energy for lighting and hot water systems; energy-efficient building designs, space heating, cooling, and appliances; and cleaner cooking fuels in schools, dormitories, and kitchens, go a long way in ensuring a hospitable, comfortable, and safe environment in which students and teachers can study, stay healthy, and be productive. A recent study on the effect of increasing temperatures on learning outcomes, which assessed the relationship between temperature and educational outcomes in the United States, found that that in already warm areas, higher temperatures are strongly related with lower academic performance, with each degree increase in temperature resulting in a 1 per cent decrease in school test results. It also concluded that air conditioning offsets all negative effects of temperature on educational outcomes (Goodman, J. et al., 2018).

Evidence also suggests schools can save on energy expenses by up to 25 per cent through simple behavioural and operational measures alone. The savings can then be utilised in other priority areas in schools (US EPA, 2011). For example, in Kampala, a social enterprise provides eco-stoves to schools, and thus supports the reduction in firewood costs and CO_2 emissions. All earnings acquired through this clean cooking technology are being returned and invested in the schools, supporting their annual maintenance, management, and monitoring (KCCA, 2019).

At the same time, sustainable energy measures provide considerable benefits in reducing indoor air pollution and related health risks, particularly for children. Indoor air pollution, largely caused by the use of solid fuels, contributes to over half a million deaths of children under 5 (UNICEF, 2015). Countries currently suffering from critical air pollution levels, such as China, India, and Mongolia, are gradually making efforts towards adoption of sustainable energy solutions in public service facilities, including in the education sector, to reduce and mitigate children's exposure to air pollution. Incidentally, adoption of energy-efficient building designs in kindergartens in Mongolia has resulted in improved indoor air quality, warmer classroom environments, and better health outcomes for children and staff, with a nearly 30 per cent reduction in absenteeism due to illness (GIZ, 2016).

Essentially, by transitioning towards a more sustainable energy pathway, educational facilities can simultaneously achieve multiple benefits, including improved learning environments, better health, increased energy savings, and positive environmental and economic conditions.

How are we faring—are we on track?

The 2018 Global Tracking Framework report shows that under the current rate of progress, we are not on track to achieve the SDG 7 energy targets globally. With regard to closing the energy access gap, 992 million people still live without electricity (IEA, 2017a).

Some countries have shown positive progress towards increased primary school electrification rates in recent years, including Rwanda, Cabo Verde, and Zambia, which increased primary school electrification rates by 16 per cent, 5 per cent, and 4 per cent, respectively, between 2016 and 2017. However, efforts to electrify schools have mostly been lagging, leaving millions of children without access to electricity, particularly in disadvantaged and rural communities. The lowest levels of access are found in Niger and Sierra Leone, where approximately 5 per cent and 4 per cent of schools have electricity, respectively.

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

School performance has also been shown to increase in correlation with electrification rates, with primary school completion rates enhanced due to greater electrification (UNDESA, 2014). Advancing access to energy can therefore play a crucial role by complementing other educational investments with the aim of improving schooling and educational attainment.

Key challenges and recommendations

Barriers that limit access to sustainable energy in educational facilities pertain broadly to (a) weak policy complementarities and coordination across energy and education sectors that meaningfully facilitate access; (b) issues of affordability and high upfront capital costs; (c) technical barriers, including reliability of power supply, maintenance, and after-sales services; and (d) a lack of information and awareness about the multiple benefits of energy and its implications on educational outcomes.

Although energy access has gradually advanced over the years, the number of students globally thatstill lack access highlights the need for carefully targeted measures to address the challenges.

First, sufficient quantitative and qualitative information is required to clearly reflect the magnitude of the challenge and drive evidence-based decision making. As it stands, a lack of data is often a key difficulty and challenges remain in trying to obtain data on energy access in the education sector. Challenges pertaining to limited data then translate into limited information, which in turn undermines evidence-based decision making. Therefore, increased efforts at data generation and analysis are needed for better insights and sound decision-making.

Second, enabling policies that incentivise and prioritise energy access in the education sector should be put in place and enforced. Limited quantitative data makes it challenging to authoritatively estimate the financial resources it would take to electrify the education sector. The IEA estimates that a US$ 1 trillion investment is needed to achieve universal access to energy by 2030; this offers a broad signal of the magnitude of investment required to adequately reach out to the education sector (IEA, 2017). 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 future scale-up for schools with no access.

Leveraging private sector finance is critical, particularly because it can help address some of the barriers listed above through business models that can defray high upfront costs and can address technical barriers too. A policy environment that incentivises private sector financing is needed to promote innovative business and service delivery models for provision of quality energy services—particularly in underserved areas. A suite of public-private partnership (PPP) models have been successfully demonstrated for infrastructure and service provision in the education sector. This can be extended to investments in school electrification programmes, too. Several case studies exist where PPP models have been successfully employed in school electrification programmes, including in Argentina, South Africa, and the Philippines.

It is also imperative to reinforce policies that facilitate a more coordinated approach among public agencies for collaborating in the provision of energy and education infrastructure and services. In terms of ensuring reliability of energy access, technical connection and equipment problems can be offset through the use of strong regulatory frameworks, national standards, quality assurance, and certification systems. In fact, these have been shown to facilitate more reliable local manufacturing and maintenance activities, reduce costs and improve quality of service.

Furthermore, policy advocacy, stakeholder engagement, public awareness, and education are vital not only in influencing decision-makers but also in facilitating necessary knowledge, attitude, and behavioural changes among children and adults on the benefits of sustainable energy. For example, advocacy for schools to both have an energy management policy or strategy and implement an energy management

system based on nationally appropriate standards with monthly updates of energy performance indicators for management can serve to support decision making and long-term investment decisions regarding facility power planning.

Advocacy for an air quality action plan for schools that are exposed to unsafe air quality levels is another area of recommended focus. Such an action plan would minimise children's exposure to air pollution through better waste management systems, improved ventilation, and design/construction to reduce 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 from early on, creating a young generation that can act as change agents, while simultaneously allowing greater youth innovation to advance sustainable energy solutions.

Interlinkages with other Sustainable Development Goals

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

Solar PV systems and solar pumps have been used successfully in educational facilities to provide better access to safe water and hygienic sanitation. UNICEF's Global Solar Water Pumping Programme, for instance, deploys renewable energy to access, treat, and supply safely managed water to children, their families, and communities, prioritising public service facilities such as health facilities, schools, and community centres. In Kenya, before electrification, schools would tend not to clean their toilets due to lack of water, and water-borne diseases such as skin infections, typhoid, and cholera were common, leading to "rampant absenteeism of students and teachers"; electrification was successfully used to rectify these issues (UNDESA, 2014).

With regard to gender empowerment, energy access has been found to directly contribute to time and labour benefits for women and girls. This, in turn, enhances their ability to attend school and educational activities. In Mali, for instance, electrification has increased levels of girls' school attendance, improved performance, and drastically improved girl-to-boy ratios. Similarly, a study conducted in 52 developing countries showed that numerous countries with lower electricity access have lower girl-to-boy ratios in schools. Nepal, for example, showed an increase in girl student enrolment by 23.3 per cent across a sample of villages that received school electrification (UNDESA, 2014).

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POLICY BRIEF #5

ENERGY AND SDG 8 (DECENT WORK AND ECONOMIC GROWTH)

Developed by

International Renewable Energy Agency (IRENA) and the International Labour Organization (ILO)

In collaboration with

European Commission, PowerForAll, The World Bank

Key Messages

New sustainable economic opportunities continue to emerge from the ongoing energy transition. To take full advantage of these, it is essential that the depth and diversity of local labour markets and supply chains be strengthened through appropriate industrial, fiscal, and trade policies.

Renewable energy: According to the most recent estimate by IRENA, employment in the renewable energy sector reached 10.3 million in 2017, a 5.3 per cent increase over the previous year, with solar PV jobs representing the largest segment (IRENA, 2018b). In electricity generation, there is generally higher labour demand related to renewable energy compared to fossil fuel sources. In the transport sector, the manufacturing of electric or hybrid cars will create jobs and demand for new skills, for example in the production of car batteries, specific maintenance skills and emission control engineers.

Energy efficiency: Employment opportunities related to energy efficiency will be concentrated in sectors that manufacture energy efficient goods, as well as the machinery and equipment to produce them. The construction sector is also expected to be a major source of jobs related to energy efficiency. There will be demand for new skills in handling new materials and technologies, sustainable construction processes, and the planning and management of major building projects.

But workers and communities whose livelihoods rely on fossil-fuel based industries will need support and social protection, in order to reorient themselves to the new energy economy. Gains in sustainable energy jobs will not completely offset the loss of fossil fuel jobs, and employment gains and losses will not necessarily match in terms of skills, locations, and availability.

In the ILO's WESO model 2018 analysing net job impacts on 84 occupations in the transition to energy sustainability, 24 million jobs would be created and 6 million lost, out of which 5 million could be filled through reallocation—through job openings in the same occupation in another industry within the same country. Only about 1 million workers are in occupations with no expected equivalent vacancies in other industries.

Decentralised renewable energy solutions are creating increasing numbers of jobs and can support livelihoods through productive use of energy. Depending on the business model, employment opportunities may be more in sales and distribution (cash-based transactions), or in technical jobs such as software design, logistics, and customer service (pay-as-you-go model). Improved energy access enables productive uses of energy and catalyses local economic activity, creating income streams and additional employment.

Employment in the energy sector is traditionally male-dominated. However, findings from an IRENA survey suggest that women represent 32 per cent of the labour force of the responding organisations—substantially higher than the 22 per cent average in the global oil and gas industry (IRENA, 2019). The distributed nature of off-grid renewable energy solutions offers tremendous opportunities for women's engagement along multiple segments of the value chain.

As the renewable energy industry expands, removing barriers to entry, ensuring retention, and prioritising career advancement for women will be essential to meet the growing skills demand. Barriers include: hurdles preventing women from entering an industry or advancing to certain roles; limited transport and insufficient workplace infrastructure; inadequate institutional sexual harassment policies; regressive organisational cultures in male-dominated fields; gender pay gaps resulting from occupational segregation and unequal pay for equal work; and lack of care services.

Introduction

The present text updates the information presented in Policy Brief #13 (UN DESA, 2018), which examined the manifold ways in which SDG 7 on energy and SDG 8 on decent work and economic growth are interconnected.

New sustainable economic opportunities continue to emerge from the energy transition. For an economy to take full advantage of these, it is essential that the depth and diversity of local supply chains be strengthened through appropriate industrial, fiscal, and trade policies.

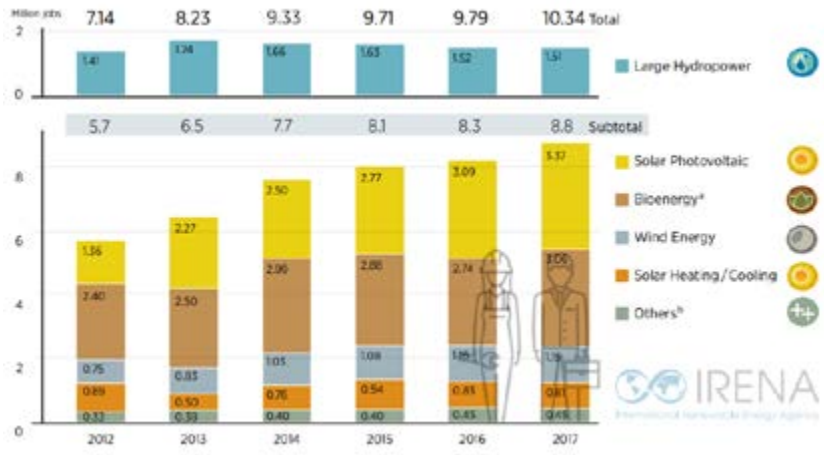
Workers and communities whose livelihoods rely on fossil-fuel based industries will need support and social protection during the transition, in order to have a chance to reorient themselves to participate in the new energy economy. In areas that lack access to electricity and modern energy services, decentralised renewable energy solutions are creating increasing numbers of jobs and can support livelihoods through productive use of energy.

Whether in the modern energy context or in energy access situations, it is becoming increasingly clear that a focus on gender equality needs to be at the core of actions taken in the sector, to both articulate the eeds and views that women have and tap into the vast talent pool they represent.

Employment

The transition to a sustainable energy system implies an expanded role for both renewable energy and greater energy efficiency. The state of knowledge about employment in renewable energy has improved in recent years. The ongoing expansion of installed renewable energy capacity has translated into a growing workforce in the sector. According to the most recent estimate by IRENA, employment in the renewable energy sector reached 10.3 million in 2017, a 5.3 per cent increase over the previous year (IRENA, 2018b)[1]. Solar PV jobs represent the single largest segment and increased almost 9 per cent, to reach 3.4 million in 2017, reflecting the record installation of 94 gigawatts of solar PV (Figure 1).

Figure 1: Global Renewable Energy Employment, 2012-2017



Source: IRENA, 2018b

However, policy makers are concerned with economy-wide employment trends and patterns—the direct, indirect, and net job effects shaped by a wide range of technical, economic, and policy-driven factors,

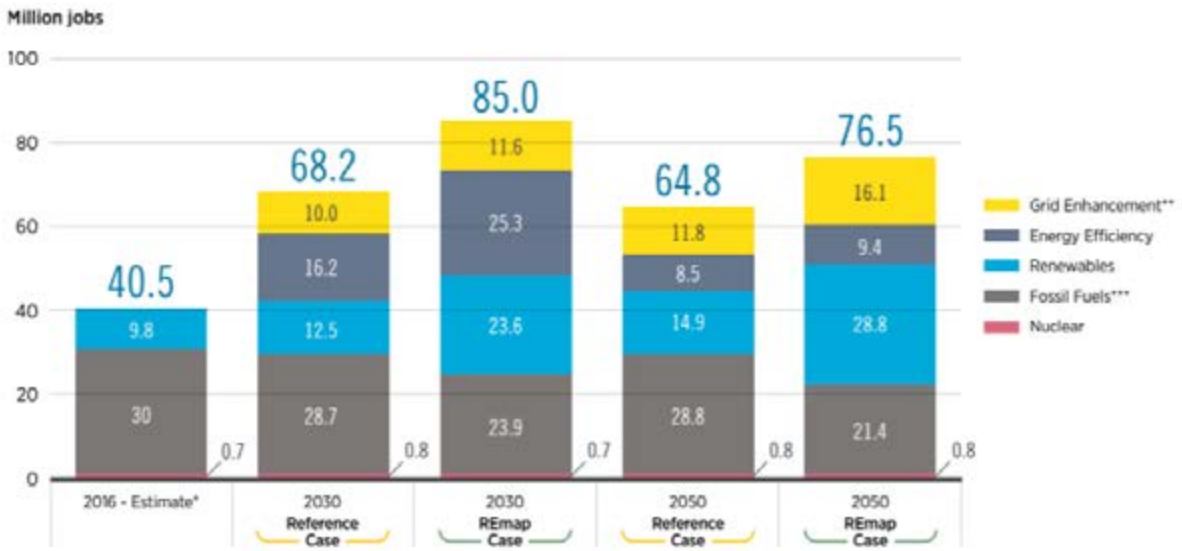
1 The estimate is based on an extensive annual review of available databases, studies and estimates. Except for the hydropower sector, the jobs numbers include direct and indirect employment along the renewables value chain. Induced jobs, which are generated when employees of the renewable energy sector spend their salaries on goods and services throughout the economy, are excluded.

and interlinkages between sectors, supply chains, and global trade structures. In fact, policy makers want to know the net employment effect of a sustainable energy transition designed to achieve SDG 7 with an energy system compatible with the 2°C goal of the 2015 Paris Agreement and SDG 13.

Based on different sets of approaches and methodologies, recent econometric studies show varying results. They converge, however, on a shared conclusion—meeting the climate goals will translate into net employment gains in the global economy. An IRENA study (IRENA, 2018a) estimates the gain in 2050 that is around 0.14 per cent higher under the agency's 'Remap' energy transition case than under the Reference Case (which is based on a current policies scenario).

The energy transition will increase employment across the broader economy, and also specifically in the energy sector. As shown in Figure 2, the global energy sector employed some 41 million people in 2016. Under REmap, employment in renewable energy could potentially double to reach 23.7 million by 2030 and then 28.8 million by 2050. It would completely offset the loss of fossil fuel jobs, although gains and losses do not necessarily match in spatial, temporal, or skills terms. Salient examples on how to manage coal mine closure from the perspectives of those impacted, including governments, enterprises, workers, and communities, are highlighted by a recent World Bank Report which presents global best practices and aims to foster new platforms and partnerships (Stanley et al., 2018). Investments in energy efficiency measures and grid enhancement under IRENA's REmap transition pathway create a further 25.5 million employment opportunities.

Figure 2. Employment in the overall energy sector, 2016, 2030 and 2050 (million jobs)

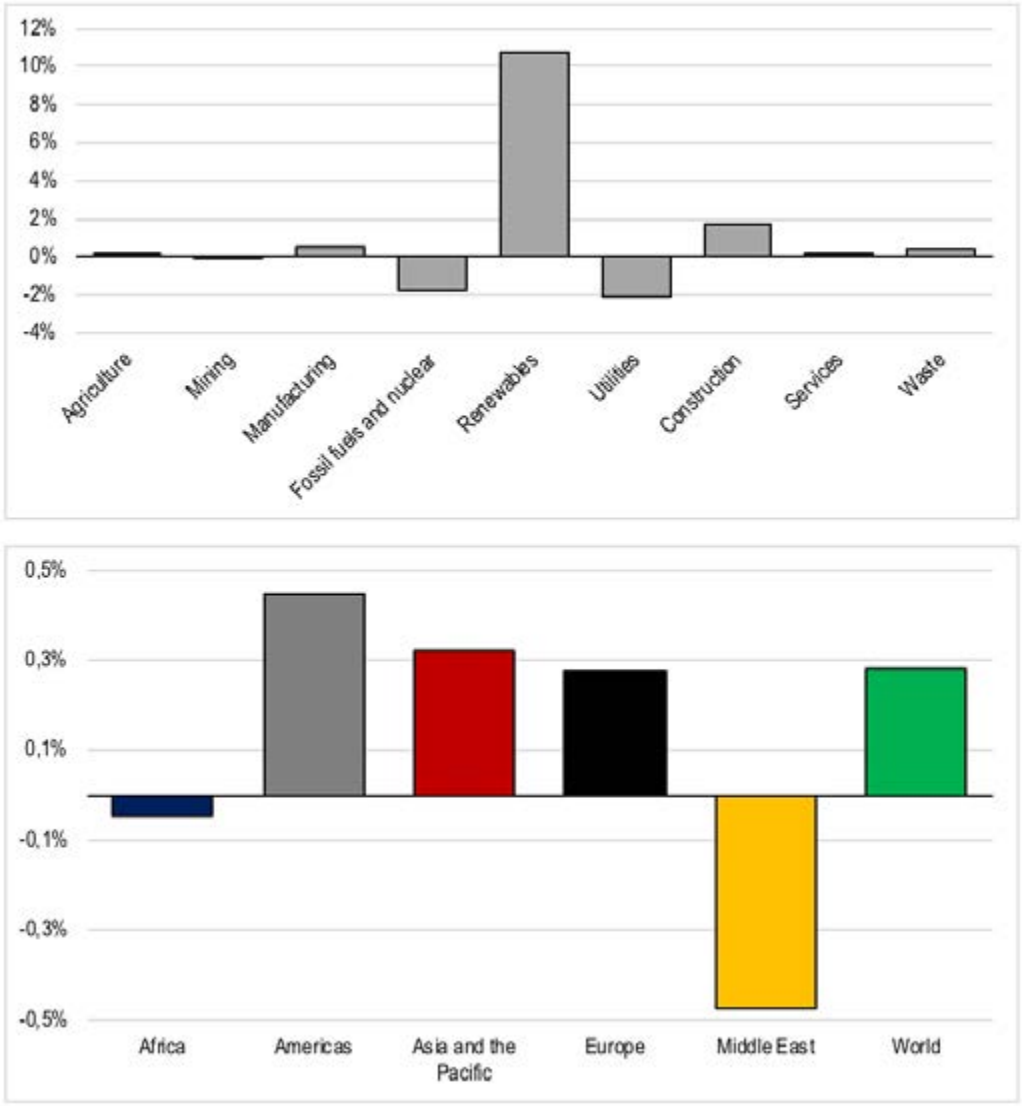


Source: IRENA, 2018a

Similarly, the ILO developed a global model to estimate net employment, based on International Energy Agency (IEA) country-specific scenarios that decouple the energy sector from fossil fuels in the electricity, transport, and construction sectors, thereby achieving SDGs 7 and 13 (ILO, 2018). The projected net job creation of 18 million by 2030 is the result of around 24 million jobs created and 6 million jobs lost globally. The global figures mask significant differences across regions, countries, and sectors (see Figure 3). Employment creation is driven by the higher labour demand of renewable energy sources in comparison with electricity produced from fossil fuel sources where losses are greatest. Employment demand grows in value chains associated with renewable energy and electric vehicles and construction. In the renewables

sector (hydro, biomass, solar thermal, solar photovoltaic (PV), tide and wave, and geothermal), job creation is expected to be higher by around 11 per cent in the Renewable Energy 2°C scenario, as compared to the business-as-usual scenario. Information on the quality of these jobs, such as wage levels and workplace quality, is important to consider.

Figure 3. Employment in 2030 associated with energy sustainability, compared with the business-as-usual scenario, by region and sector



Notes: Percentage difference in employment outcomes between the IEA Energy Technology 2°C and BAU 6°C scenarios by 2030.

Source: ILO calculations based on Exiobase v3

Accounting for jobs related to energy efficiency is a complex undertaking because efficiency is a fluid concept, rather than a fixed threshold. Further, it entails diverse technologies and stretches across the entire economy. The traditional focus of energy efficiency policy on energy savings is linked to an underestimation of the benefits that energy efficiency can bring, such as improved sustainability of energy systems, economic and social development, health and wellbeing, and improved industrial productivity. Direct and indirect linkages between energy efficiency, employment, and social welfare are very clear, although less information exists compared with other energy sectors.

According to *Assessing the Employment and Social Impact of Energy Efficiency*, a study published in December 2015, energy efficiency employs nearly 1 million people in the European Union. Sectors with the greatest levels of energy efficiency jobs were those that produce, or are part of the supply chain for, investment goods. This includes jobs related to manufacturing of machinery and equipment that enables the production of energy efficient goods, as well as the energy efficient goods themselves. More jobs can be created thanks to the manufacturing and installation of energy efficient products, although the sectors that will provide the most opportunity for job creation will be the building and transport sectors.

Skills Requirements of Renewable Energy

Policy Brief #13 pointed to the diverse array of skills and occupations in the renewable energy sector, with findings from studies of labour requirements in solar PV and onshore wind projects of a typical size. Additional insights are available for offshore wind, where a total of 2.1 million person-days are needed for a typical 500 MW facility (see Figure 4). Procurement and manufacturing represent 59 per cent of the total; operation and maintenance, 24 per cent; and grid connection and installation, 11 per cent.

Figure 4: Employment impacts in the onshore wind power value chain

Source: IRENA, 2018c

The ILO Skills for Green Jobs Report 2019 analyses skills and occupational needs in a transition to energy sustainability and achieving SDGs 7 and 13 (forthcoming ILO Global Skills for Green Jobs, June 2019). In addition, it compares 32 countries in terms of their policy coherence regarding green jobs, renewable energy policies, and skills policies. By expanding the results explored by the ILO WESO model 2018 to analyse net job impacts in an 'Energy Technology 2 degree world by 2030,' it quantifies the implications for skills, genders, and occupations. In the 84 occupations analysed in the transition to energy sustainability, out of the 24 million jobs that will be created and the 6 million lost, 5 million of those can be filled through reallocation. This means that those 5 million workers are in occupations where they will lose their jobs because of the downsizing of a particular industry, but will find that a job opens in the same occupation in another industry, within the same country. As result, a little more than 1 million workers are in occupations with no equivalent vacancy in another industry (jobs in occupations lost, not reallocatable). This also means that skills needs are required for occupations in around 19 million new jobs (ILO 2019 forthcoming).

Energy efficiency and skills

In the EU transport sector, manufacturing electric or hybrid cars will create both jobs and demand for new skills, for example, in the production of car batteries, specific maintenance skills and emission control engineers. The construction sector is also expected to be a major source of both low- and high-skilled

jobs related to energy efficiency. There will also be demand for new skills in handling new materials and technologies, sustainable construction processes, and planning and management.

In general, there will be demand for high-skilled workers in jobs that involve auditing, consulting, organisation, and consultation, such as managers of major building projects. When it comes to building a skilled workforce, training in science, technology, engineering, and mathematics will be key, due to the technological nature of many of the occupations.

Results from ILO also show that most job creation and reallocation is concentrated among mid-skill level occupations. These results suggest that the growth in mid-skill level jobs under a transition to energy sustainability scenario can partly offset the global trend of skill-based technological change.

Employment through Reliable Energy Access

As business models for providing energy access spread and mature, the expansion of off-grid renewable energy solutions creates growing employment. Information remains relatively sparse, but a number of reports are shedding light on this fast-evolving situation. A 2017 study (Hystra, 2017) compiled information on direct employment provided by companies operating in the energy access field. A 2018 study by the organisation GOGLA regarding direct employment in the off-grid solar sector (looking at sales data and information from close to 40 companies), estimated that direct employment in the off-grid solar sector in sub-Saharan Africa and South Asia runs to about 450,000 full-time equivalent jobs and could rise to 1.5 million by 2022 (see Figure 7).

Figure 7. Direct Employment in the Off-grid Solar Sector, 2018 and 2022 projection

	Employment (thousands)	
	2018	2022
East Africa	77	350
West Africa	26	150
Central Africa	7	70
South Asia	340	970
Total	450	1,540

Source: GOGLA, 2018a.

This estimate covers the sales and distribution, installation and maintenance, and customer support segments of the value chain, but excludes manufacturing and assembly, which takes place primarily in countries like China (PV panels) and Germany (batteries). Depending on the business model, employment opportunities are either more present in sales and distribution (cash-based transactions), or in technical jobs such as software design, logistics, and customer service (pay-as-you-go model). Improved energy access enables productive uses of energy and catalyses local economic activity, creating income streams and additional employment (GOGLA, 2018b).

Meanwhile, in 2018, the group Power for All launched an annual jobs census on the decentralised renewable energy (DRE) sector in low-energy access countries, as part of its #PoweringJobs campaign. This is the most comprehensive jobs census known to date for the DRE sector, surveying nearly 150 companies in India, Kenya, and Nigeria across the DRE technology spectrum (including solar lanterns, solar home systems, solar irrigation, commercial and industrial solar systems, and mini-grids), as well as the supply

chain (from manufacturing and wholesale imports to sales, installation, and operations). This is a first-of-its kind bottom-up source of jobs data for the sector. The survey will expand its geographic scope each year, aiming to cover 10 countries in 2019 and 25 the following year.

Initial findings show tens of thousands of people employed directly by the DRE sector in the three countries, and many more induced jobs stimulated through access to electricity in rural communities. The quality of DRE jobs—in terms of retention and compensation—is high when compared to other energy sectors. The survey provides data specific to these and other areas, including women and men and youth representation in the workforce. The data show that women are heavily under-represented in the current workforce, while youth representation is mixed. The research identifies significant gaps in skills and training, in particular management and business development, that need to be filled in order to build a robust energy access workforce and ensure that universal electricity access is achieved. Full results will be released later in 2019.

Gender equality as a central factor for success

The business case for tackling gender equality is growing. A 2018 World Bank Group (WBG) report indicates that for 141 countries, the loss in human capital wealth due to lifetime gender income inequality is approximately US$ 160 trillion. This suggests that globally, human capital wealth could increase by 21.7 per cent and total wealth by 14 per cent if there was gender equality in earnings (Wodon and de la Brière, 2018b). In addition, emerging research has shown a link between greater gender equality in employment and positive business outcomes, such as increased productivity, retention, and firm performance.

Employment in the energy sector is traditionally male-dominated. However, findings from an IRENA survey (IRENA, 2019)[2] suggest that women represent 32 per cent of the labour force of the responding organisations—substantially higher than the 22 per cent average in the global oil and gas industry. These findings are consistent with reports from a range of countries. In the US, for instance, the share of women in the solar industry rose quickly from 19 per cent of the workforce in 2013 to between 26 per cent and 28 per cent in recent years (Solar Foundation, 2019). Data from an 8 country baseline assessment in South Asia showed that in Afghanistan, there were 14 women engineers out of a total of 68 (21 per cent) working at the national power utility (World Bank, 2019a). In Africa, Ethiopia Electric Utility has about 20 per cent female employees out of a staff of over 14,000 (EEU, 2018), pointing to significant gender gaps.

When looking at gender gaps in science, technology, engineering, and mathematics (STEM), it is important to note that these gaps begin early as girls and boys embark on different educational tracks. The gaps grow as girls and boys progress through primary, secondary, and tertiary education and contribute to the underrepresentation of women in STEM. There are more women enrolled than men overall at the tertiary education level globally, but only around 30 per cent of women pursue STEM-related fields of study (UNESCO, 2015). As they move along the pathway of employment, close analysis is needed of various barriers faced by women, including in areas relating to entry into the labour force, retention, and career advancement. A range of factors at the societal, institutional, and individual levels come into play.

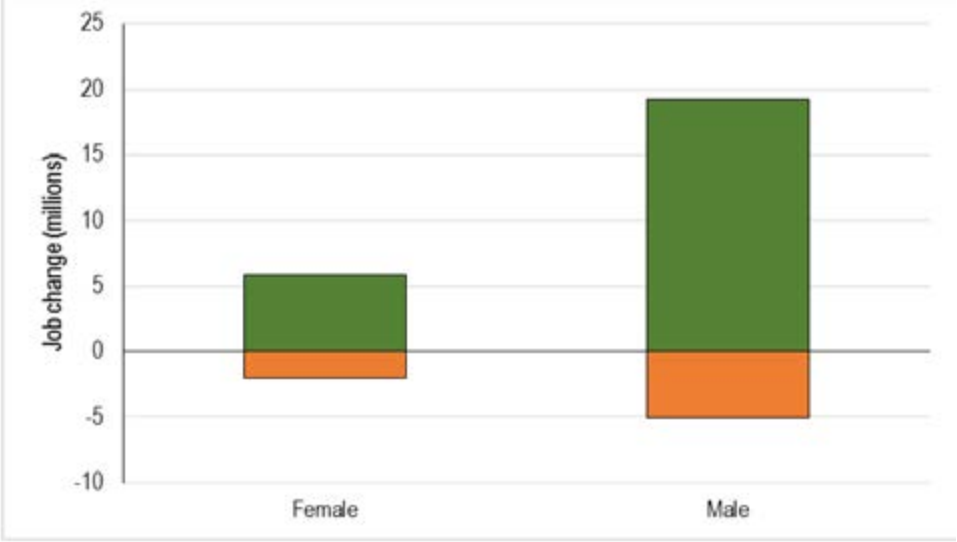
As the renewable energy industry expands, removing barriers to entry, retention, and career advancement for women will be essential to meet the growing skills demand. Barriers that need to be addressed include: hurdles preventing women from entering an industry or advancing to certain roles; limited transport and insufficient workplace infrastructure; inadequate institutional sexual harassment policies and reporting mechanisms; regressive organisational cultures in male dominated fields; gender pay gaps resulting from occupational segregation and unequal pay for equal work; and a lack of care services. (Orlando et al., 2018; World Bank, 2019b). Ingrained social and cultural norms are behind many of these barriers. Changing norms inevitably takes time, but will allow remedial measures to be more effective, including workplace policies that promote training,

2 The multi-stakeholder survey attracted close to 1,500 respondents from 144 countries working for private companies, government agencies, non-governmental organisations, academic institutions, and other entities.

gender-sensitive policies, diversity targets, networking, and mentoring, (IRENA, 2019).

ILO model results on achieving SDG 7 in conjunction with SDG 5 (Gender equality) show that most job creation and reallocation is concentrated among male-dominated occupations. If no policy action is taken, most of the jobs that will be destroyed would be concentrated in occupations which are male-dominated, and the same is true for the majority of jobs that will be created. This would mean a continuation of current discrimination in energy-related occupations, with no equal access to employment opportunities for women.

Figure 8: Jobs created and destroyed in an energy transition scenario by gender, 2030



Source: ILO calculations based on EXIOBASE v3 and national labour force surveys

The distributed nature of off-grid renewable energy solutions offers tremendous opportunities for women's engagement along multiple segments of the value chain. Evidence also points to the fact that engaging women as entrepreneurs, employees, and consumers can enhance development outcome. For example, evidence from Kenya shows that when female entrepreneurs are engaged in the clean cooking value chain, they outsell men by almost 3:1 (Shankar, 2015). Moreover, when women purchased cookstoves from female entrepreneurs, they were more likely to report consistent and correct use of cookstoves. In Indonesia, initial assessments indicate that users are more likely, by almost 20 percentage points, to report sustained use of their cookstoves when they are purchased from women as opposed to men (World Bank, 2016). Many of the skills needed to take advantage of those opportunities can be developed locally and women are ideally placed to lead and support the delivery of off-grid renewable energy solutions. However, women face barriers to participation in the sector, including cultural and social norms, as well as a lack of programmes and policies tackling barriers to employment and livelihood programmes, and lack of skills and training opportunities. Better access to training and skills-development programmes, reduction in time and drudgery constraints, enhanced mobility, and improved access to finance, are some of the intervention that could reduce the barriers to women's employment in value chains.

Recommended actions

To advance the energy transition, Policy Brief #13 recommended a comprehensive package of measures, including macroeconomic and growth policies, industrial and sectoral policies, enterprise policies, skills development, occupational safety and health, social protection, active labour market policies, rights and social dialogue, and ensuring that a focus on women's employment is at the core of energy sector

engagement. These policy tools and interventions remain salient.

Among the next steps to be taken is an improved and more fine-grained analysis of the benefits of energy efficiency. This Update expands the analysis in Policy Brief #13 to cover net employment and recommends policy actions to ensure a 'just transition' as outlined by the ILO (ILO, 2015).

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POLICY BRIEF #6

ENERGY AND SDG 10 (REDUCED INEQUALITIES)

Developed by

UN DESA, ENERGIA, and TERI

In collaboration with

United Nations Development Programme, the International Energy Agency (IRENA), and the World Bank

Key Messages

Ensuring access to affordable, reliable, sustainable, and modern energy for all (SDG 7) is a key condition for reducing inequalities (SDG 10). Progress on SDG 7 is a critical tool towards achieving the principle 'Leave no one behind'. However, the linkages are not always straightforward; they get operationalised through a complex set of interactions and interdependencies across a host of other SDGs, such as SDGs 3, 4, 5, 8, and 13, involving both synergies and trade-offs (Ahlborg et al., 2015).

Unequal access to energy and low human development are highly correlated. The concept of 'energy poverty' includes 'fuel poverty' in the developed world, but it is most often applied to the developing world in the context of lack of access to electricity, and/or clean cooking fuels or technologies. More than 800 million people still lack access to electricity and close to 40 per cent of the people in the world lack access to clean cooking fuels.

Given that energy poverty and fuel poverty are issues of access and affordability, disproportionate spending on energy and use of energy efficient equipment by poorer households could worsen their poverty levels, with consequences for prevailing inequality levels. This disproportionate spending could lead to a vicious cycle of energy poverty and could in turn worsen the state of inequality by pushing poorer households into fuel debt traps. There is also the notion of relative deprivation of poorer households, when a household does not have socially and materially necessary energy services, as per the prevailing social norms and milieu (Bonatz et al., 2019).

The cost impacts of public clean energy incentive schemes may also disproportionately burden poorer taxpayers, and public money tends to favour national grid infrastructure over smaller-scale off-grid development.

Policy targets need to take into account the quality of energy access. The Multi-tier Matrix for Measuring Access to Household Electricity Supply outlines 6 different levels of energy access from 0 to 5. It is only at Tier 3 and above that there are new opportunities for productive uses that lead to poverty reduction and reduced inequality. Often, productive uses of energy result in a higher ability and willingness to pay for electricity, and can create a virtuous cycle of increasing energy consumption resulting in enhanced welfare and higher levels of human development (Pueyo and Maestre, 2019; Terrapon-Pfaff, 2018), which would generate favourable effects on poverty and inequality. Policy targets formulated for energy access should transcend a binary approach (access or not) and institute timelines and milestones for portions of the population that can graduate to Tier 5 (full) access to energy, while also acknowledging 'fuel poverty' and supporting energy efficiency investments by low-income households.

Policy makers should address the interlinkages between energy, poverty, and inequality by combining Tier 5 ('full') energy access with the promotion of productive energy use.

The distribution and quality of energy access is not only determined by socio-technical and political economic drivers operating across scales, but also by the strength of institutions at all layers of governance. The presence of effective, accountable, and inclusive institutions at all levels could significantly contribute to the energy access goals (Ahlborg et al., 2015; Trotter, 2016), thereby generating positive impacts concerning the level and extent of inequality. Social and legal structures, as well as regulatory governance conditions, contribute to energy constraints (Mertzanis, 2018) that are significantly related to SDG 16 (peace, justice and strong institutions).

Energy and SDG 10

Despite the important role that sustainable energy plays in poverty reduction, more than 800 million people still lack access to electricity and 40 per cent of the world's people still rely on solid fuels for cooking and heating (UNDP, 2017). Poor people also pay a high price—in cash or labour—for the energy they use. Moreover, they spend a much greater share of their household income on energy than do wealthy people, not only because their incomes are so much smaller, but also because the fuels and equipment they use are so much less efficient than modern fuels and equipment. No country has managed to substantially reduce poverty without greatly increasing the use of energy.

While use of modern fuels and equipment can have many positive effects on reducing inequality, these changes might generate temporary hiccups if adequate policy measures are not taken. Commercialisation and marketing of once-free traditional biomass energy sources and switching to new and modern energy sources in developing countries could bring price shocks for poorer households and accentuate the levels of prevailing inequality. Privatisation of energy services generally expands inequality.

Lack of access to energy services is a form, an outcome and a cause of poverty (Poor People's Energy Outlook, 2010).

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

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

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

There is a positive association between provisioning of energy and labour productivity (Alam et al., 2018) and the potential of a "vicious circle" whereby "a lack of energy access leads to limited income-earning capability, which reduces purchasing power, which in turn limits the access to energy that could improve incomes" (Poor People's Energy Outlook, 2010).

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

Use of alternative and unsafe energy sources often has severe consequences on health, which in return

impacts poverty levels. Similar associations can be found between access to energy and levels of education and health, which would reduce inequality (Sharma, 2019).

In addition, some regions with the lowest energy consumption and greenhouse gas emissions, countries in sub-Saharan Africa and South Asia for example, are the most vulnerable to climate change impacts and will suffer the most. Sustainable energy can help build the resilience and adaptive capacity of these communities against climate change impacts and reduce inequality between and within nations. However, this synergy could be reversed if households are required to spend more on energy for their heating and cooling requirements, due to changes in climate, leading to energy vulnerabilities and aggravating the extent of inequality. This can result in poorer households' inability to acquire needed energy services to sustain a decent life, hence impairing SDG 16 (Middlemiss and Gillard, 2015).

Box 1.

Clean energy access is critical for women's health, education and productive activities and is strongly related to reducing poverty and inequality for women since in many parts of the world women spend more time than men cooking and collecting water and fuel. Improving energy access would reduce the drudgery of women's unpaid labour and care work, enabling them to access education and employment options and enhance their livelihoods. Empowering women to participate in the global economy on an equal basis with men would add US$ 12 trillion worldwide by 2025 (McKinsey Global Institute, 2015). Investment in women—women with higher levels of education and their own income lead to improvements in education, health, food, and, through increased agency, norms of gender equality for generations to come.

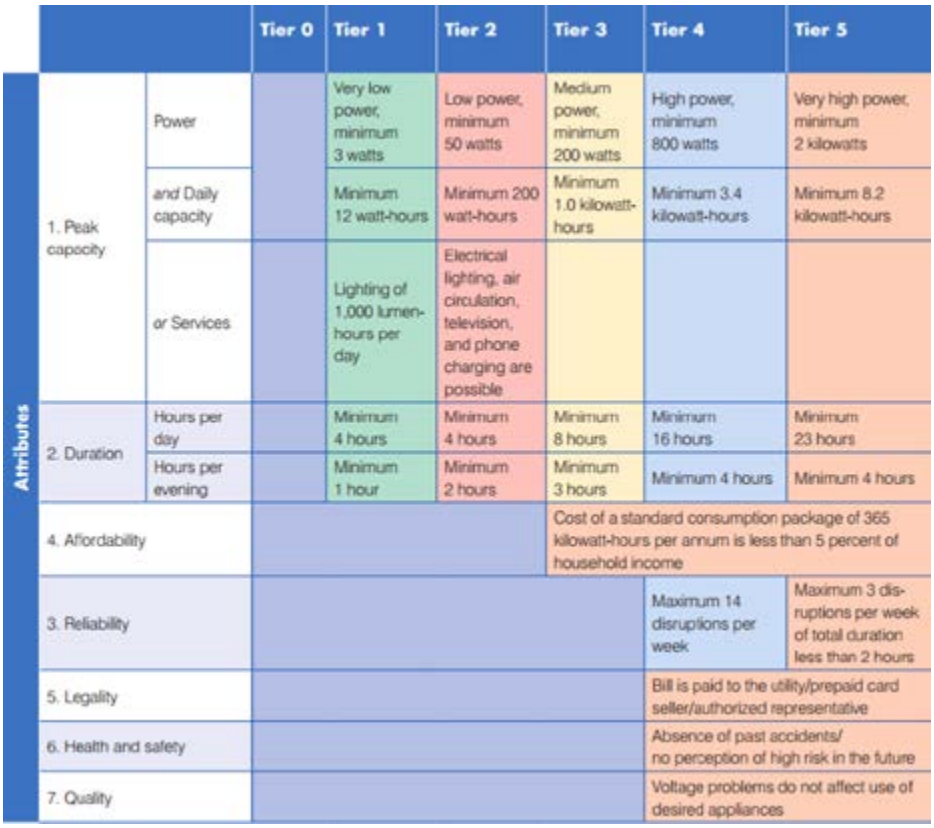
Less often discussed, but equally important is the relationship between public expenditures on clean energy development and the translation of these costs to the taxpayer. While the costs of clean energy incentive schemes are usually borne by all taxpayers, these programmes can disproportionally affect the poor if the policies are not sufficiently designed to cushion vulnerable households with social safety nets. Another crucial consideration for equal distribution of public expenditures is the far stronger focus on national grid infrastructure; small scale off-grid development is often neglected and not eligible for similar public funds allocation, as compared to national infrastructure. Often, there are distributional effects of policies, and incentives and policy instruments for clean energy sources benefit others more than the consumers, while a disproportionate share of the cost is borne by the consumers. This has equity implications, as public expenditures often do not benefit poorer households because of their low liquidity and credibility (Bonatz et al., 2019).

The tracking of progress on energy access is mainly based on a binary perception of access to energy. However, it is clear that the potential contribution of energy to income generation through productive uses depends on the supply being appropriate to opportunities for income generation, and that these opportunities are context-specific and depend on the type of enterprise. Even small amounts of electricity can open up opportunities for micro enterprise, where reliability and affordability are key. Also supply of fuels is crucial for many small and informal enterprise activities. There is a gender dimension in a focus on higher tiers of electricity as men are more often represented in types of enterprises that have higher electricity demand, while women have higher representation in enterprises with higher demand for fuels.

Higher tier electricity supply from Tier 3 onwards can be prioritised in community services and locations that attract enterprises (customers), to optimise benefits as long as Tier 5 is not yet feasible. Therefore, a step-wise approach will be the most inclusive approach to early optimisation of benefits on the path to Tier

5, or "full" energy access for all.

Figure 1. Multi-tier matrix for measuring access to household electricity supply



Attributes			Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
	1. Peak capacity	Power		Very low power, minimum 3 watts	Low power, minimum 50 watts	Medium power, minimum 200 watts	High power, minimum 800 watts	Very high power, minimum 2 kilowatts
		and Daily capacity		Minimum 12 watt-hours	Minimum 200 watt-hours	Minimum 1.0 kilowatt-hours	Minimum 3.4 kilowatt-hours	Minimum 8.2 kilowatt-hours
		or Services		Lighting of 1,000 lumen-hours per day	Electrical lighting, air circulation, television, and phone charging are possible			
	2. Duration	Hours per day		Minimum 4 hours	Minimum 4 hours	Minimum 8 hours	Minimum 16 hours	Minimum 23 hours
		Hours per evening		Minimum 1 hour	Minimum 2 hours	Minimum 3 hours	Minimum 4 hours	Minimum 4 hours
	4. Affordability					Cost of a standard consumption package of 365 kilowatt-hours per annum is less than 5 percent of household income		
	3. Reliability						Maximum 14 disruptions per week	Maximum 3 disruptions per week of total duration less than 2 hours
	5. Legality						Bill is paid to the utility/prepaid card seller/authorized representative	
	6. Health and safety						Absence of past accidents/ no perception of high risk in the future	
	7. Quality						Voltage problems do not affect use of desired appliances	

Source: ESMAP, 2015

SDG 7 provides opportunities to drive a transition towards clean energy access for all. However, sustainable energy in developing countries often faces technical, informational, financial, and regulatory barriers that create associated investment risks, both real and perceived.

In pre-market conditions, as in many of the poorest countries and communities, these barriers to sustainable energy can act as immediate "show-stoppers." For example, investment is often impeded by a lack of access to affordable financing and capital scarcity due to lack of legal frameworks, underdeveloped economie,s and weak financial sectors. This presents a challenge for scaling up sustainable energy solutions, as higher returns are needed to compensate for the greater investment risks found in early-stage markets. Under these conditions, sustainable energy interventions become very sensitive to financing costs, making them less attractive and less cost-competitive than conventional solutions.

A market transformation approach is needed that assists governments in implementing combinations of public instruments that systematically target these barriers and investment risks, with the aim of cost-effectively achieving risk-return profiles that attract investment in sustainable energy at scale. An investment's risk-return profile can be improved through reducing risk, transferring risk, or compensating for risk. Measures that reduce or transfer risk result in lower financing costs. Any residual risk may then be addressed by measures that compensate for risk. All public interventions to promote sustainable energy act in one or more of these three ways.

While creating markets through instituting incentive schemes is beneficial for the sector, considering access to energy as a marketable service could have deleterious effects on poorer households. Hence, it is equally

important that the transition to market-based approach is done in a phased manner during the transition process, as in many contexts, 'energy' for poorer households continues to be a 'merit good' with many welfare aspects (Mishra et al., 2015). Hence, it is important to consider complementariness in the policy mix, to promote uptake of energy by consumers (Rosenowa et al., 2017). The distributional analysis of policies is often neglected, resulting in undesirable socio-economic impacts (Zimmermanna, and Pye, 2018).

The public sector, or select customers (including enterprises) with the highest energy demand profile, should be aware that there may be cases where private sector engagement can lead to increased consumer prices or where energy infrastructure is solely built in areas where returns are highest. In these cases, public-private partnerships may be able to contribute to solutions that avoid this risk.

Socio-technical and political economic drivers of equity and quality of energy access across scales

The nature of energy access is determined by a variety of processes at multiple scales. These are characterised not only by techno-economic factors, but also by path dependence, incumbency, inertia, and resistance to change. At the global scale, the geopolitics of infrastructure (oil and gas trade links, multinational treaties) modulates energy transition pathways. At the national scale, energy remains a sensitive political issue, with public perceptions driving the commitments of governments, along with economic and technical concerns. At the sub-national regional scale, population demographics and intersecting factors such as class and ethnic factors matter. At the local scale, norms along religious and gendered lines determine access within communities and households.

There is growing recognition of the multi-scale and intersectional nature of the drivers of energy poverty. But it must be translated into affirmative action, adoption of transparency measures, and substantive public participation in decision making on energy services. This is necessary in order to systematically reduce inequalities in energy access and address energy poverty. Such action requires policy measures that are responsive to the political, economic, and socio-technical realities of energy within multi-scale administrative contexts (Sareen, 2017). Otherwise we run the risk of actors with entrenched interests pushing for regressive courses of action in the energy sector at great public cost.

Energy and poverty alleviation in light of fuel poverty and energy efficiency

The links between energy and poverty alleviation, as well as reducing inequalities, may be seen most obviously in the context of access to clean energy, but there are also cases of energy poverty related to "fuel poverty". The complexity of this question of poverty is that energy poverty is multidimensional and intricately connected with several aspects of human development. It has been highlighted that energy becomes catalytic for development and hence could be crucially linked with other development indicators such as health and education (Sharma, 2019). In situations where people have access to energy, it is often the poorest that end up paying disproportionate shares of their income to energy, in part because the higher upfront costs of investments in energy efficient equipment are more difficult to bear for low-income households (Simcock et al. 2017). Energy poverty widens this discussion to encompass factors related to the built environment, including reliable, safe, and comfortable access.

Fuel poverty is mainly associated with developed countries where low-income households have difficulty keeping their homes warm at a reasonable cost. However, it also relates to low-income households in developing countries, since, especially for people in the poorest countries, the most inelastic segment of demand is energy for cooking and heating to ensure basic survival. Enhancing access to modern and cleaner forms of household energy is important for this group, owing to its potential for increasing income

levels. Just as important, however, is the need to reduce their expenditures on energy services. Previous analysis has shown that in most countries poor people spend a higher share of their income on energy than the non-poor, for both electricity as fuel (IISA, 2012).

Access to energy will not alleviate poverty if it is not affordable for the lowest-income households. In some cases, tariff systems with progressive fee structures (cross-subsidies) have been introduced as solutions to this challenge. However, such solutions may also create counterproductive signals to clean energy development for low-income households. It may lead to clean energy, such as solar systems, being of most interest to households with higher utility fees, thereby creating distortions in the business model of the utility, which may lose its higher-paying customers. Careful consideration of energy price policies is needed, while alternative policies to cushion vulnerable households with social safety nets are preferred.

Electricity access and clean cooking are therefore only part of the desired policy objectives to reduce poverty. Equally important is access to energy efficient and low-cost end-use options and devices used by the poor in agro-processing, small scale value-addition processes, water pumping, housing, and transportation.

Provisioning of clean energy access is argued to have favourable employment generating effects, thereby positively links SDG 7 and 8, more through decentralised modes of energy supply (IRENA, 2018). However, clean energy transitions, often raise energy justice questions, when such transitions generate stranded fossil fuel assets and in turn have negative employment effects.

Policy recommendations

Prioritising the linkages

Given the complex and critical linkages across SDGs, it is pertinent to understand the interaction pathways and directions, which often differ depending on the contexts, urgencies, resources, and capabilities. It is important to understand the interactions in order to maximise the synergies and minimise the risks that may emanate from trade-offs.

Quality of energy access

The policy discussion on energy access must move from a binary to a qualitative understanding of access to energy. The five-tier framework of energy access can provide a graded picture to attune action to the context and emphasise the relation between quality of energy access and poverty and inequality (ESMAP, 2015). Policy targets formulated for energy access should move beyond the binary concept and set timelines and milestones for percentages of population with Tier 5 (“full”) access to energy.

Barriers to energy access improvement and their associated investment risks

In order to allow private sector financing to contribute to access to energy, thereby reducing poverty and inequality, policy makers should analyse the investment risks contributing to high financing costs and address the risks in a systemic and integrated manner. Policy de-risking instruments geared towards renewable energy uptake should be the first choice for action as these offer the most cost-effective and sustainable future solutions, while market transformation usually require a mix of policy and financial de-risking instruments, supplemented by direct financial incentives as required.

Socio-technical, politico-economic drivers of equity and quality of energy access across scales

Policy makers must act on the emerging consensus that energy poverty and inequitable access persist: (a) due to political economic factors that can be dealt with through more participatory decision-making and transparency measures in the energy sector; and (b) due to the misrecognition of socio-technical factors that modulate energy access at different scales and must be taken into account in national and regional energy policies. As cities, regions, and countries undertake energy transitions, we must utilise the opportunity to democratise this sector into one that is responsive to public interest. Regulators, administrators, and utilities alike must be held accountable for provision of quality access to clean energy in an equitable, inclusive manner.

Institutions and governance aspects of energy

Institutions are central in governing the energy transition and optimising the interlinkages. Linkages and interconnections between the SDGs could effectively governed by the institutionalisation of emerging interconnected challenges. The presence of institutions at varying scales could significantly contribute to enhanced access to energy, which would have salutary effects on reducing inequality.

Energy and poverty alleviation in light of fuel poverty and energy efficiency

The interlinkages between energy, poverty, and inequality can be addressed by policy makers by combining Tier 5 ("full") energy access with promotion of productive use of energy, but also by acknowledging the concept of "fuel poverty" and supporting for energy-efficiency investments by low-income households.

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POLICY BRIEF #7

ENERGY AND SDG 16 (PEACE, JUSTICE AND STRONG INSTITUTIONS)

Developed by

UN DESA, International Renewable Energy Agency (IRENA), UN Environment, United Nations Institute for Training and Research (UNITAR), and Norway

In collaboration with

United Nations High Commissioner for Refugees (UNHCR), the International Energy Agency (IEA), and the World Bank

Key Messages

Energy production, distribution and use are fundamental to our economies, and central to relations between and within states—as well as major contributors to global climate change.

Climate change will place great pressure on national institutions, economies, and social and political systems, as well as countries' natural resources, food production, water supplies, and liveable spaces. The negative impacts of climate change will not be equally distributed, and this could generate significant geopolitical tensions. People in the poorest countries and in places affected by conflict are the most threatened. Three key policy drivers that can strengthen their resilience are: targeted climate adaptation programmes, development and humanitarian programmes to help improve response capacities, and peace building and conflict prevention programmes to reduce tensions. As tackling climate change becomes more and more critical, the current energy system will need to undergo a profound transformation. The global transition to sustainable sources of energy will need to accelerate, with major implications for international relations, peace and security around the world.

IRENA's "Global Energy Transformation: A Roadmap to 2050" shows that renewable energy and energy efficiency combined can deliver 90 per cent of energy-related emission reductions required to achieve the objectives of the Paris Agreement, assuming an ambitious acceleration of the energy transformation.

Renewables bring numerous benefits that could address many of the root causes of poverty, marginalisation, migration, and political instability—by promoting prosperity and job creation, improving food and water security, and enhancing sustainability and equity.

The shift to renewables could help to alleviate competition over important natural resources, including water and food, while increasing energy access and offering developing economies an opportunity to bypass a fossil-fuel based development model. At the same time, renewables can have a democratising effect, as renewable resources are available in most countries (unlike fossil fuels), are not limited in quantity, and are harder to disrupt (though there are new challenges in the form of cyber-security risks, technology dominance, and access to minerals).

Where there is conflict or displacement of people, renewable energy solutions can also offer more sustainable and affordable energy supply options for humanitarian and peacekeeping missions.

All these potential benefits from a transition towards renewable energy-based economies will only materialise with effective, accountable, and inclusive institutions at all levels, and policies addressing structural aspects from the socio-economic system and its interaction with the energy transition.

The decline of the conventional energy system will generate many stresses and risks, which will need to be managed effectively. The energy transformation is expected to put significant pressure on fossil-fuel producing countries. New social tensions and financial risks, such as stranded assets, could reverberate through international politics. If revenues from fossil fuel production decline, countries that have not diversified their economies sufficiently could potentially be destabilised. The loss of fossil fuel revenues in countries with weak governance could lead to fractures in society and political instability, undermining progress towards SDG 16. Thus, it is paramount to anticipate the challenges that arise from the transformation to facilitate a smooth, fair, and just transition.

I. Introduction: interlinkages between SDG 7 and SDG 16

Energy is fundamental to our civilization and to the prosperity of nations. Its production, distribution, and utilization are deeply embedded in the fabric of our economies and central to the relations between states, peaceful and inclusive societies, and accountable and inclusive institutions. Actions taken to address SDG 16 will to a large extent pave the way for a successful achievement of SDG 7, while at the same time achievement of SDG 7 will underpin the achievement of SDG 16.

The energy sources powering our societies have been undergoing a period of rapid change. Renewables have emerged as a technologically feasible, economically attractive, and sustainable choice that can increasingly meet the energy needs of many countries, corporations, and citizens. As tackling climate change becomes more and more critical and renewables steadily increase their capacity to meet our energy needs, the global transition to sustainable sources of energy will continue to accelerate, with major implications to international relations, peace and security around the world.

Renewables bring numerous benefits, which could address many of the root causes of poverty, marginalization, migration, and political instability. The pivot to renewables may promote prosperity and job creation, improve food and water security, and enhance sustainability and equity. The shift to renewables will also help to alleviate competition over important natural resources, notably water and food, and help combat air pollution and climate change. It will increase energy access and offer developing economies an opportunity to leapfrog a fossil fuel-based development model. At the same time, the number of energy-related conflicts is likely to decline. Competition for fossil fuel resources has been at core or on the margins of many inter- and intrastate conflicts,. The pivot towards modern forms or renewable energy has the potential to reduce the incidence of energy-related conflicts, thus contributing to Goal 16.1 to significantly reduce all forms of violence and related death rates everywhere.

Sustainable energy solutions could benefit people in situations of displacement. Providing access to affordable, reliable, sustainable, and modern energy services is essential to protect and assist displaced people more effectively and economically. Similarly, renewable energy solutions can also offer more sustainable and affordable energy supply options for peacekeeping missions.

At the same time, peaceful and just societies, along with accountable institutions, are critical for sustainable development and ensuring a just transition. SDG 16 aims to promote peace and justice for all through the strengthening of institutions and good governance norms to reduce violence and lawlessness (including state violence and government corruption), promote the rule of law and access to justice, and protect human rights. Implementation of SDG 7 requires the development of effective, accountable, and inclusive institutions at all levels (Goal 16.6). Renewables could also be a powerful vehicle of democratization because they enable the decentralization of the energy supply and empower citizens, local communities, and cities. This can contribute to Goal 16.5 to substantially reduce corruption and bribery in all their forms.

All these potential benefits from a transition towards a renewable energy-based energy system will only materialize with policies addressing structural aspects from the socio-economic system and its interaction with the energy transition. Just and fair transition considerations need to be addressed upfront to ensure an inclusive energy transition. At the same time, the decline of the conventional energy system will generate many stresses, social tensions and financial risks, such as stranded assets, that could reverberate through international politics and which need to be managed effectively. In this regard, the energy transformation is expected to put significant pressure on fossil fuel-rich countries. If revenues from fossil fuel production decline, countries that have not diversified their economies sufficiently could potentially be destabilized. The loss of fossil fuel rents in countries with weak governance could lead to fractures in society and political instability, undermining progress towards SDG 16. Thus, it is paramount to anticipate the challenges that arise from the transformation to facilitate a smooth, fair, and just transition.

This policy brief attempts to highlightthe interlinkages between SDG 7 and SDG 16, referencing analytical work done to date by various UN agencies and non-UN entities. However, it is by no means comprehensive and exhaustive with regard to the many challenges. It aims to inform the debate on what steps countries and international institutions could take to mitigate the risks associated with climate change and the energy transformation and develop strategies to enhance a smooth transition.

II. The nexus between SDG 7, climate change, and security

Climate change will put pressure on the economic, social, and political systems that underpin each nation state, as well as their natural resources. Where institutions and governments are unable to manage the stress or absorb the shocks of a changing climate and associated climate damages, the risks to the stability of states and societies will increase.

UN Environment in the context of its work on climate change and security stresses that climate change is a "threat multiplier," aggravating already fragile situations and potentially contributing to further social tensions and upheaval. The UN Security Council has addressed the topic of climate and security on several occasions, including most recently in January 2019. It is important that discussions on climate and security consider the nexus to sustainable energy.

Energy is the main contributor to climate change, with energy use accounting for more than two thirds of greenhouse gas emissions according to the IPCC. Thus, progress in SDG 7 Goal 7.2, to increase substantially the share of renewable energy in the global energy mix, and Goal 7.3, to double the rate of improvement in energy efficiency, are critical to effective climate action. In fact, IRENA's "Global Energy Transformation: A Roadmap to 2050" shows that renewable energy and energy efficiency combined can deliver 90 per cent of energy-related emissions reductions required to achieve the objectives of the Paris Agreement, assuming an ambitious acceleration of the energy transformation. In addition to climate change mitigation, the energy transformation would provide a 2.5 per cent improvement in GDP and a 0.2 per cent increase in global employment by 2050, compared to business as usual.

In this report, IRENA further quantifies the impact of climate damages on global macroeconomic performance. The report finds that climate damages significantly reduce GDP growth, but that this negative impact would be eased under an energy transition scenario in line with global climate objectives. However, even under an energy transition scenario, GDP growth would be reduced by more than 10 per cent by 2050 due to climate damages. Moreover, the regional distribution of climate damages is very unequal, and this could generate tensions which hamper progress towards prosperity, sustainability, and peace. Increasing the transition's ambition and providing socio-economic resilience are two priorities that need to go hand in hand.

The 2015 report "A New Climate for Peace—Taking Action on Climate and Fragility Risks" commissioned by the G7 stresses that people in the poorest countries—and the most vulnerable groups within those countries—are the most threatened by the impacts of a changing climate. People face especially challenging obstacles to successful adaptation in places affected by conflict. If they fail to adapt to the effects of climate change, the risk of instability will increase, trapping them in a vicious cycle. But even seemingly stable states can be pushed towards fragility if the pressure is high enough or the shock too great for systems to manage peacefully.

The report identifies seven key compound climate and fragility risks, including local resource competition, livelihood insecurity and migration, volatile food prices and provision, transboundary water management, and unintended effects of climate change policies. Extreme weather events and disasters will exacerbate fragility challenges and can increase people's vulnerability and grievances, especially in conflict-affected

situations. Climate change is highly likely to disrupt food production in many regions, increasing prices and market volatility and heightening the risk of protests, rioting, and civil conflict. Transboundary waters are frequently a source of tension; as demand grows and climate impacts affect availability and quality, competition over water use will likely increase pressure on existing governance structures. Rising sea levels will threaten the viability of low-lying areas even before they are submerged, leading to social disruption, displacement, and migration, while disagreements over maritime boundaries and ocean resources may increase. As climate adaptation and mitigation policies are more broadly implemented, the risks of unintended negative effects—particularly in fragile contexts—will also increase.

The "New Climate For Peace" report further identified three key policy drivers that could help strengthen the resilience of states and societies to climate-fragility risks. Climate change adaptation programmes help countries anticipate the adverse effects of climate change and take action to prevent, minimize, and respond to its potential impacts. Development and humanitarian aid programmes help states and populations build their economic, governance, and social capacities and improve their resilience to shocks. Peacebuilding and conflict prevention programmes address the causes and effects of fragility and conflict by reducing tensions and creating an environment for sustainable peace.

III. The emerging new geopolitical landscape of energy shaped by renewables can foster greater peace and security

The global energy transformation driven by renewables has major geopolitical consequences. It is changing power dynamics between and within states, bringing the promise of greater energy independence to nations and communities, and enhancing energy security and democratic empowerment. To understand and analyze this changing geopolitical reality the International Renewable Energy Agency created with the support of Germany, Norway, and the United Arab Emirates, an independent Global Commission on the Geopolitics of Energy Transformation. The Commission presented its report "A New World. The Geopolitics of the Energy Transformation" (IRENA, 2019) to the 9th Assembly of IRENA in January 2019. One of the Commission's key findings is that the growing renewable energy deployment across the globe can reduce energy-related conflicts and lower competition for natural resources which have been predominantly associated with fossil fuels.

The Commission highlighted in its report that the energy transformation from fossil fuels to renewables will drive a geopolitical transformation as profound as that which accompanied the shift from biomass to fossil fuels two centuries ago. Unlike fossil fuels, which are concentrated in specific geographic locations, renewable energy sources are available in one form or another in most countries. This reduces the importance of current energy choke points, such as the narrow channels on widely used sea routes, that are critical to global supply of oil.

Energy flows such as renewables do not exhaust themselves and are harder to disrupt; therefore, countries that succeed in developing their renewable energy sources will significantly improve their energy security. Renewable energy sources can be deployed at almost any scale and lend themselves better to decentralized forms of energy production and consumption, adding to the democratizing effects of renewables. Countries that switch from imported fossil fuels to domestically generated renewable energy will improve their trade balance and enjoy significant macroeconomic benefits. They will also be less vulnerable or beholden to their suppliers and will therefore be able to pursue their strategic and foreign policy goals more independently.

At the same time, the Commission points out that the energy transformation also brings risks and challenges. These include cybersecurity concerns, technology dominance and access to minerals essential for renewable energy development. However, the Global Commission on Geopolitics of Energy Transformation finds that overall the benefits outweigh the risks, provided appropriate and holistic policies are adopted

early on.

One of the major geopolitical challenges related to fossil-fuel exporters is that they are likely to see a decline in their global reach and influence unless they can reinvent their economy for a new energy era. Major fossil fuel exporters face economic, social, and political risks if they do not take steps to transform and diversify their economies. According to a 2018 IEA report on the "Outlook for Producer Economies 2018—What do changing energy dynamics mean for major oil and gas exporters?" a changing energy system is posing critical questions for many of the world's largest oil and gas producers already. Inaction or unsuccessful efforts to reduce reliance on hydrocarbon revenue would compound the risks facing both producer economies and the global economy. In the long run, however, fossil fuel-driven economies have a huge opportunity to reverse the risks posed by oil dependence, and create a more sustainable economic future for their peoples. Countries that lead in technological innovation stand to gain from the global energy transformation.

The Global Commission also highlighted that the energy transformation will lead to the emergence of new communities and interdependencies. As countries develop renewables at home, they will be also seeking to integrate their grids with those of neighbouring countries, creating new geographies of energy trade. Electricity will become the cornerstone of new patterns of energy trade. Trade rade in renewable energy technologies and electricity will expand. In broad terms, the weight of energy dependence will shift from global markets to regional grids. Cross-border electricity trading will create opportunities for regional cooperation, and the creation of 'grid communities.' Illustrations of these include the Scandinavian countries, which have traded electricity between themselves for decades, and the ongoing efforts to bolster electricity market integration within the European Union. Regional electricity pools are also being developed in Asia (the ASEAN power grid), Africa (five sub regional power pools), Central America (SIEPAC), and the Middle East (the Gulf Cooperation Council power grid). In recent years, several renewable energy supergrids have been proposed, including the Asia Super Grid, and the North Sea Offshore Grid. IRENA's Clean Energy Corridor initiativesin Africa and Central America are also supporting the creation of regional markets for renewable power and.and facilitiating its cross-border trade.

IV. Sustainable energy as a solution insSituations of displacement

The UN estimates that in 2019 over 131 million people are in need of humanitarian assistance due to conflict, natural disasters, and other complex global challenges. In situations where large numbers of people are moving within or across borders, access to energy is a priority for basic survival. Safe and accessible cooking fuel is needed to be able to eat. In the absence of adequate shelter, energy is needed to maintain livable temperatures. Power is needed in undertaking productive economic activities or for children to study in the evening hours. Power is also needed to charge mobile phones that enable communications—allowing contact with family members and receipt of information as well as supporting the transfer of money in cash-assistance programmes.

Current energy practices in situations of displacement are often insufficient, inefficient, unsafe, expensive for displaced people, and harmful to the surrounding environment.

The current electricity production is also costly for implementers. Delivering protection and humanitarian assistance requires a reliable power supply in often off-grid situations, such as for public lighting, water pumping and treatment, offices and residences, cooling of medicine and vaccines, laboratory services, or light for emergency services (such as the delivery if babies) at night. At present, fossil-fuel powered generators tend to be the main source of electricity in displacement settings, which results in high costs from high fuel prices, logistics, transportation, maintenance, and security, as well as administrative and technical inefficiencies. A recent study estimates that around 5 per cent of humanitarian agencies' expenditure goes on diesel, petrol, and associated costs such as fixing generators. That would mean that the sector spent some $1.2 billion on

polluting fuel in 2017.

The Global Plan of Action for Sustainable Energy Solutions in Situations of Displacement (GPA) was launched in July 2018 to address current challenges that impede energy access in humanitarian settings, and thus provides a framework that will provide concrete actions for a more systemic, collaborative approach towards the vision of "safe access to affordable, reliable, sustainable, and modern energy services for all displaced people by 2030."

V. Energy in peace missions

UN Peacekeeping missions play a key role in assisting a range of host countries navigate the difficult path from conflict to peace. Currently, the UN Department of Peace Operations (DPO) runs 14 active peacekeeping missions, deploying over 140,000 peacekeepers on an annual budget of US$ 6.8 billion . These missions operate in complex, conflict affected regions where uniformed and civilian personnel are deployed to protect civilians, prevent conflict, build rule of law, and promote human rights. Mandated by the UN Security Council and General Assembly, UN Peacekeeping serves to aid countries in the transition from conflict to peace.

Most Peacekeeping missions are operating in conflict or post-conflict states where basic infrastructure is underdeveloped or unreliable. Operating these missions involves constructing facilities, shelters, and offices which, in practice, function as small towns consisting of people from a diverse set of troop-contributing countries. The associated water, energy, and waste demands can become a burden to the local ecosystems when not properly managed, especially in larger missions such as in South Sudan, the DRC, and Mali, which deploy over 15,000 people each. Considering the fragility of conflict and post conflict states, systematic action on environmental management is an imperative for UN Peacekeeping missions to ensure cohesion with host countries instead of causing unintended harm.

Without access to reliable electricity grids to power offices and facilities, peacekeeping missions have a heavy dependency on diesel and petrol for generators and use high volumes of fuel for vehicle and aircraft fleets. In 2017, operations emissions were totalled at 1.05 $MtCO_2$, or 55 per cent of the UN system-wide emissions. It was estimated in 2009 that the annual fuel cost for DPO-supported base operations was US$ 638 million, and aircraft fuel costs were estimated at US$ 201 million in 2010. Extrapolating these estimates means that an estimated 2 per cent of the overall peacekeeping budget is spent on unsustainable and dirty fuel sources. Operating in areas where oil and gas governance is a contributing factor to conflict, minimising the need for traditional fuels would be ideal. Changing these practices could result in more efficient use of financial resource and contribute to global and national sustainable development goals.

VI. Conclusions

The energy transition cannot be considered in isolation to the broader socio-economic structure it is based on nor to the broader geopolitical landscape it evolves in. Frameworks to assess countries' exposure, relative risk, and potential to benefit from the energy transformation, as well as exploring policy options and tools available to proactively support a smooth fair and just energy transformation both in individual countries and globally are key. Adopting a holistic energy transition approach with effective, accountable and inclusive institutions at all levels will be key in maximizing the synergies between SDG 7 and SDG 16.

Encouraging countries that depend heavily on fossil fuel exports to diversity their economies, avoid economic disruption, and reduce the risk of social instability will be equally critical. This can be done, for instance, through institutional reforms and policies to promote education, enhance skills, and boost job creation

and SMEs, as well as building capacity and sharing information about best practices for diversification in fossil fuel-dependent economies, with particular attention paid to the need of stranded communities and workers will be equally critical. It is paramount to develop strategies and programmes to support countries that face the twin challenges of fragility and fossil fuel dependency, especially the countries that can be considered as both fragile and/or conflict prone and highly dependent on fossil fuels.

At the same time, it is important to support the least developed countries, in particular African countries and Small Island Developing States (SIDS), in their efforts to optimise use of their renewable energy sources: issues to be addressed include market access, trade agreements, technology and investments, as well as policies to enhance security and regional integration.

Leveraging the imperative of regional and transcontinental energy system integration to promote regional dialogues on energy infrastructure interconnections, while strengthening governance for the management of cross-border electricity transmission and control over grid infrastructure, could have significant positive spillover implications for peace and stability.

Other essential steps include the continuous monitoring and analysis of emerging geopolitical challenges related to the energy transformation, with special regard to critical material supply chains, , tensions over technology transfer and cybersecurity, and potential asymmetric dependencies. A dialogue on measures to safeguard energy systems and grids and develop global norms and rules for cybersecurity is particularly urgent.

Last but not least, assessing existing and needed capabilities of the international community and in particular the United Nations system is of critical importance. This should encompass a focus on building analytical, mediation, and coordination assets, and the ability to provide effective assistance for diversifying the economies of vulnerable countries and advance intergovernmental and multi-stakeholder cooperation at the intersections of peace, security,climate change and sustainable energy.

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POLICY BRIEF #8

ACHIEVING SDG 7 IN AFRICA

Developed by

The UN Economic Commission for Africa (ECA)

In collaboration with

The African Development Bank, African Union Commission, ENERGIA, the International Renewable Energy Agency (IRENA), and the International Energy Agency (IEA)

Key Messages

Since 2015, Africa has made significant progress with electrification, increasing the overall rate from 38 per cent in 2015 to 44 per cent in 2017. However, much more needs to be done by policy makers to create the enabling investment environment needed to close the continuing energy deficit.

Mega projects, mainly in power generation and distribution, are being implemented with support from development partners and multilateral organisations, including under the Programme for Infrastructure Development in Africa (PIDA), Power Africa, and African Development Bank's 'New Deal on Energy' initiatives. When complete, these projects are expected to improve electricity access in many African countries. For example, Power Africa aims to increase capacity by 30,000 MW and create 60 million new connections by 2030.

However, not all countries can achieve the SDG 7 targets with their current policies, levels of ambition, and pace and scale of investment. Thirteen countries had electrification rates of less than 30 per cent in 2017. To be on course to achieve SDG 7, further regulatory reforms and private sector investments in energy infrastructure are needed.

The low level of access to clean cooking fuels and technologies is evidence of a lack of robust policies and actions to deploy them, particularly in rural areas. Only 17 per cent of sub-Saharan Africa had access to clean cooking in 2017, compared to 12 per cent in 2010 and 13 per cent in 2015. The majority of rural households continue to rely mostly on traditional biomass for cooking.

Deployment of modern renewable energy technologies, especially solar and wind, is increasing, and providing access to millions of households. According to IRENA (2016), modern renewable energy technology options across sectors and countries will contribute to 22 per cent of Africa's total final energy consumption by 2030—up from 5 per cent in 2013.

Significantly, there is an increase in private sector participation and investments in the form of independent power producers (IPPs). As of 2017, 59 IPP projects were ongoing in 18 countries in the region (excluding South Africa), totalling US$11.1 billion in investments and 6.8 GW of installed generation capacity.

Priorities in the short term to medium term

Improving the enabling policy environment for private sector participation should be a top priority, particularly in the Least Developed Countries (LDCs). Diversification of investments sources remains crucial, and many countries still need to be assisted in creating conditions that facilitate private sector participation in the sector.

Rural electrification remains low at 22 per cent, down from 24 per cent in 2016 (but up from 17 per cent in 2015). Often, rural electrification is the preserve of the public sector, and clean cooking technologies are mainly championed by development partners. Rural energisation for heating and lighting, as well as productive activities, should be a high priority.

Energy efficiency is not receiving the attention it deserves. Its potential for improving electricity systems and cooking solutions, both on the demand and supply sides, remains largely untapped. Country efforts on household and industrial energy efficiency measures need to be supported and expanded.

Complementing the establishment of the African Continental Free Trade Area (AfCFTA), Africa energy markets need to be developed and integrated regionally, with anticipated benefits of lowering energy costs and increasing supply to expand access. Implementation of the ongoing regional power interconnection projects will need to be accelerated.

Africa and the Sustainable Development Goals

This chapter will identify the importance of improved energy access for achieving SDG 7; present an overview of the current status; assess the rate of change needed; and reveal what is needed to fill the gap. The chapter recognises the important strides that Africa has made, given the current limitations, to improve energy access, particularly electricity. Further challenges, however, still remain. These include, amongst others, the reliability of the electricity systems, rural energy poverty, and static access to clean cooking fuels and technologies, among others.

Progress over the first 4 years of the 2030 Agenda (2015-2019): current status

While Africa's overall access rate remains lowest of the world's regions at 44 per cent, there is notable progress in improving access to electricity across Africa, even in some of the LDCs. At country levels, there is added impetus, caused mainly by policies and strategies that promote electricity investments in the energy sector. For instance, Ethiopia aims to increase electricity from current 44 per cent to 70 per cent in 2025. The country's electricity access rate was 29 per cent in 2015. Kenya's electricity access is now close to 70 per cent, compared to 36 per cent in 2015.

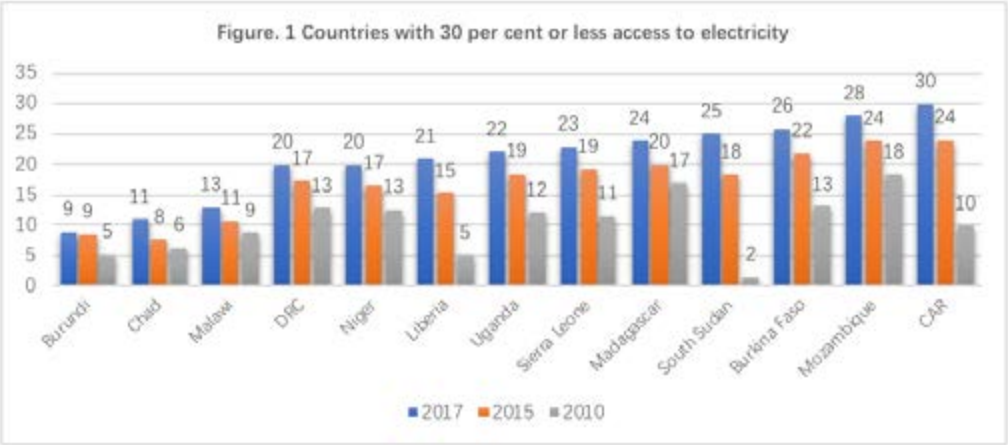
Improved progress is amplified by the increasing investment in the energy sector at country and regional levels, particularly private sector participation in the electricity supply. By 2016, 126 independent power producers (IPPs) accounted for 13 per cent of Africa's electricity output. By 2017, 59 IPP projects were under development in 18 countries in sub-Saharan Africa, excluding South Africa, totalling approximately 6.8 GW of installed generation capacity (Eberhard et al, 2017).

The African Union Development Agency's (AUDA) Programme for Infrastructure Development in Africa (PIDA) has major ongoing projects mainly on hydroelectric and the interconnection of regional power pools. The PIDA vision aims to save Africa $30 billion on electricity production costs and improve access to power to 70 percent by 2040. There are other ongoing regional initiatives, such as USAID's Power Africa, which since 2014 has added more than 9,500 MW (with 2,300 MW alone in 2018) of new electricity connections, benefitting more than 57 million people, or 12.5 million homes and businesses. There are other ongoing initiatives under the "New Deal on Energy in Africa," where the African Development Bank pledged US$ 12 billion of its own resources in the energy sector up to 2020. Additionally, there is the Africa Renewable Energy Initiative, which is an Africa-led initiative to accelerate and scale up the harnessing of the continent's huge renewable energy potential, with the target of installing at least 10 GW of new and additional renewable energy generation capacity by 2020, and mobilize the African potential to generate at least 300 GW by 2030.

Specifically, below are key observations up to 2017-18 in respect of the three key indicators of SDG 7 are as follows:

Electricity access

Access to electricity has outstripped population growth since 2017, but still the number of people without electricity, as a percentage of the overall population, remains high. There was a net 15.5 GW of new installed energy capacity added in Africa in 2017 and this kept up with the population growth across all parts of the continent, except Central Africa, as well as with GDP growth in all regions, except East Africa (Africa Energy Atlas 2018/19). Figures show improved access year on year as concerted efforts made at country and regional level to increase electricity supply through investment in energy infrastructure and policy reform. Still, 29 countries are currently below the 60 per cent access rate.



Source: Data drawn from World Bank 2019

While the progress has been gradual over the last few years about 13 countries—all of which are LDCs—are unlikely to reach the SDG 7 target on universal electricity access by 2030 (Figure 1). These countries are characterized by a combination of challenges, which include low investments in energy infrastructure, macroeconomic instability, and weak or insufficient policies and strategies, power sector governance, inabilities of national power utilities to fulfil mandates, and so forth.

Rural electricity supply is very low in most African countries. Of the nearly 600 million people currently without access to electricity, the majority are in rural areas. Rural electricity access is 22 per cent (World Bank 2019). Expanding grid electricity to rural areas has been sluggish owing more to the high cost of extending grid infrastructure and the corresponding under recovery of the supply. Countries are increasingly considering off-grid technologies, mainly solar and small hydro, as well as mini-grids. However, investments in these technologies are still low as priorities are mainly on on-grid power for urban areas.

Some of the things that needs to be considered in future assessment are issues such as low electricity consumption, low reliability of power (frequent power outages), high per kilowatt costs of electricity, and financial vulnerability of power utilities.

Access to clean cooking fuels

This should be an area of concern for African policy makers. Over the years, there have been insignificant changes. Only countries in North Africa and a few in sub-Saharan Africa have almost universal access to clean cooking fuels. In West Africa, it is Cabo Verde with 70 per cent, and Gabon with 77 per cent. In Southern Africa, it is Mauritius (94 per cent), Seychelles (90 per cent), and South Africa (84 per cent). For the rest of the countries, it appears that this target will not be met by 2030. From analysis of the current data, it appears that there is not a strong correlation between electricity access and clean cooking fuels. In simple terms, access to electricity does not necessarily mean that household transition to exclusively cooking with electricity.

Data analysis shows that there are no changes to about 21 countries where access to clean cooking is less than 50 since last progress tracking in 2017. These countries also exhibit a correlation between low access to clean cooking technologies and overreliance on biomass in both urban and rural areas.

For the rest of the African countries, the change or progress has been minimal—between 1 per cent and 3 per cent. These include Africa's economic power house, Nigeria, which access has improved from being less

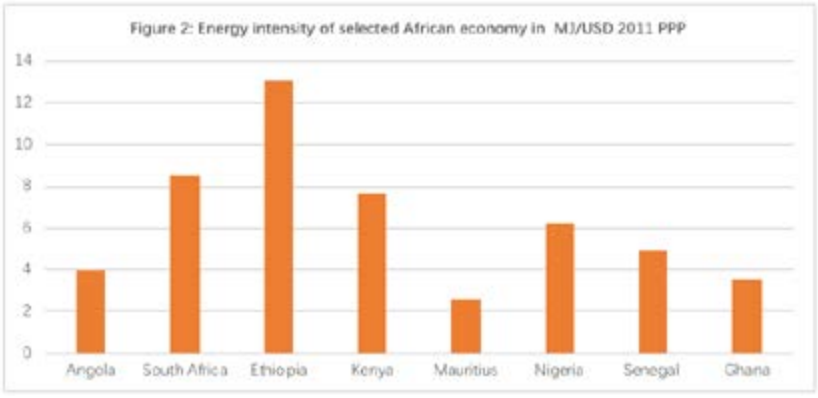
than 5 per cent in 2015 to 6 per cent in 2017.

Energy efficiency

With a possible exception of a few countries (mainly in North Africa), energy efficiency appears to be lower in the agendas of most African countries. Generally, the priority is to increase energy supply to address the growing energy deficits and consequently grow the economies of the continent. Therefore, energy efficiency, defined as the goal of reducing amount of energy required to provide products, is generally difficult to assess in many African economies. As it is observed, using "energy intensity" may not the accurate proxy for energy efficiency, as the former is affected by many factors, such as climate, structure of the economy, nature of economic activities, etc. that are not necessarily linked to pure efficiency. However, the main cause of high energy intensity in Africa is the high share of final consumption of fuelwood for cooking, which is a non-productive energy use.

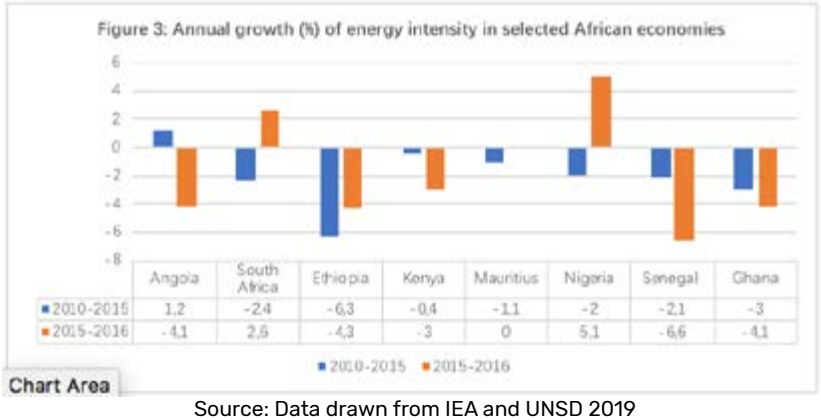
Analysing the latest available information, it appears that the African economy is the most energy intensive in all the world regions. The primary energy intensity level measured at purchasing power parity (PPP) was 7.3 MJ/US$in 2016, compared to the world average of 5.1 MJ/UD$.

It is notable that countries with growing and bigger economies have, over the years, increasing energy intensity (Figure 2). For countries like South Africa, this can be attributed to the structure, which is coal dominated. In emerging countries such as Ethiopia, this could be as a result of not focusing on maximising efficiencies in its economy.



Source: Data drawn from IEA and UNSD 2019

Correspondingly, the annual growth for in energy intensity was at 1 per cent in 2015-2016, up from -2 per cent annual growth in 2010-2015. All other regions of the world are growing in negative figures and showing annual decrease of energy intensity.



Source: Data drawn from IEA and UNSD 2019

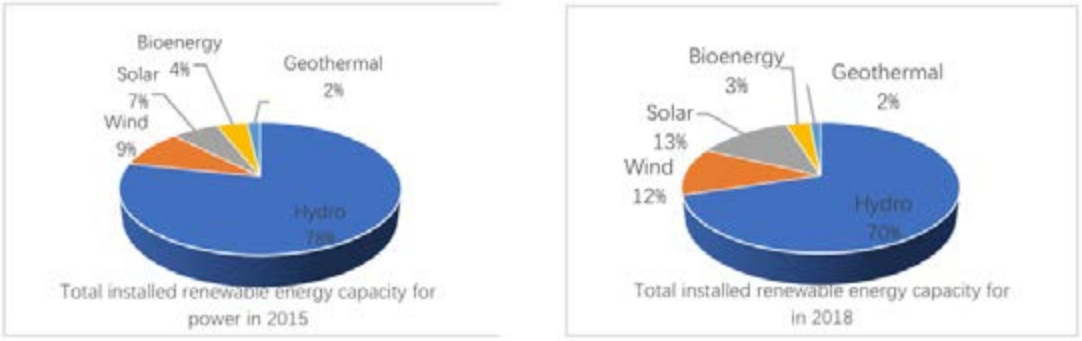
The lack of effective and robust energy efficiency policies, measures, and actions could partially explain the energy intensity of many African countries (which seems to increase annually). This is an area for future focus, particularly if it results in financial cost saving to consumers, reduction of greenhouse gas emissions, and increased energy supply security.

Renewable energy

By definition, most of the total primary energy supply (TPES) is dominated by renewable energy—notably biomass. More than 80 per cent of the population relies on wood, crop, and animal residues for meeting their thermal needs. This is despite increasing electrification in a number of countries. While it is forecasted that African households will continue to use this type of fuel for cooking, this comes at health and environmental costs.

Furthermore, off-grid applications, such as solar home systems, are surging in Africa with about 60 million people, or about 10 per cent of users. Many countries have introduced targets for mini-grids, ranging from total capacity to number of systems, connections or people served. Some targets specify the technology to be used (e.g., solar, micro-hydro, diesel-hybrid) (IRENA, 2018). Despite their relatively small contribution in the overall energy supply, renewables are playing more increasing role in improving access to electricity in the form of utility scale on-grid renewables energy projects, distributed power generation, etc.

Figure 4: Improvements in total installed renewable energy capacity in 2018



Source: Calculations based on IRENA (2019) data

The capacity in various modern renewable energy technologies particularly solar and wind, and to a lesser extent geothermal and modern bioenergy, has improved between 2015. In 2015, the total installed capacity from modern renewables was 29,481 MW, which increased to 32,485 MW in 2018—but remained a small fraction of the world's average (IRENA 2019). The installed solar capacity, mainly PVs, more than doubled in two years from 2,260 MW to 6,093 MW, although this still only accounts for 13 per cent of Africa's total renewable energy generation capacity. Wind capacity is also increasing. However, the technology still represents only 12 per cent of renewable energy installed capacity. Geothermal is growing in niche markets such as in Kenya and Ethiopia where significant investments are made. Despite huge promise at the continental level, modern bioenergy development is still negligible and hardly register any growth in energy supply.

Modern renewable deployment is an area that Africa should be focusing on moving forward. The price of renewable energy technologies continues to fall and, in some world markets, has reached grid parity. In order to accelerate off-grid renewable energy deployment, some of the foundational elements comprise dedicated policies and regulations, enabling institutional frameworks, customised business and financing models, and adapted technology solutions. These should be complimented by adequate cross-sectoral linkages and building adequate capacity across building activities (IRENA, 2017).

The co-benefits of renewable energy path are being experienced in the form of meeting energy needs in a

cost-effective, secure, and environmentally sustainable manner, which means that renewable energy can strengthen socio-economic development.

Are we on track to achieving SDG 7?

On the basis of current trends and patterns, Africa will achieve mixed results come 2030. Electricity access and doubling the use of renewables seem to be low-hanging fruit in many countries. In fact, as mentioned above, this appears to be the major energy priority in Africa. Significant progress has been made in the last 4 years, and predictably more progress will be made especially once the ongoing myriad of projects are complete. On current trends, 20 or so countries will find it difficult to achieve these two main priorities. However, when it comes to other significant targets in clean cooking fuels and energy efficiency, these appear not to feature prominently in country's energy priorities. Sub-Sahara Africa (with a few exceptions mentioned above) is not on track to achieve these targets of SDG 7.

Key challenges

In the short to medium term, there are key challenges that need to be addressed in order to accelerate access to affordable and reliable energy in Africa. It must be mentioned that, at present, there are several initiatives at regional and country levels that attempt to address these. It will be outcomes of these initiatives that will lead to a positive impact on access and sustainability of Africa's energy systems:

a, Limited investments in the energy sector

To keep with increasing power demand of six-fold between 2010 and 2040, the installed power capacity should increase from 125 GW to 700 GW, according to PIDA (the IEA is estimating 563 GW by 2040). The latter estimates that average investment needs for the power sector are US$ 42.2 billion per year (US$ 31.1 billion for generation, US$ 5.4 billion for interconnections, and US$ 3.7 billion in access). If these investments are not made, a roughly equal number of people will not have access to electricity by the end of 2030.

There is a growing diversification of investments in the power sector, particularly in the generation. Over the years, there has been a growth of Chinese investments in many African countries,[1] but governments still remain the main source of financing for power projects. The public sector is also limited in terms of skills (capacity) and resources. Private sector participation and investments are limited. About 50 per cent of countries in the sub-Saharan Africa have not engaged the private sector in the generation, transmission, or distribution of power. Intrinsic and integral access to private sector investments in the power sector will require enabling policy and regulatory environments that will ensure the protection of investments. This include accelerated power sector reforms and review of tariff structures that limit investments, in addition to political stability, currency stability, transparency, etc. For mini-grids, key factors to consider include legal and licensing provisions, tariff regulations, financial support, quality standards, and eventual grid interconnection or arrival of main grid, in addition to various other secondary (such as taxation, land rights, and environment protection) and tertiary support measures (such as capacity building and data availability) (IRENA, 2016).

b, Limited diversification of the power systems

The economies of scale, as well as the smaller supply costs, have made on-grid electricity systems the priority in terms on investment flows in the power sector. To date, even the success of renewables (in wind and solar) is in large part tied to utility scale, grid-connected systems. Investments in decentralized and distributed generation are correspondently low. It has been demonstrated that rural electrification can be achieved through investments in these systems, as they are more amenable to rural energy demand,

1 Between 2010 and 2020, China is implementing over 200 projects in Africa with a total generating capacity of 17 GW—or about 10per cent of existing installed generation (Veras, 2018).

topography, and population dynamics (i.e., sparsely populated settlements). Therefore, investments are needed in stand-alone systems, which include solar home systems as basic energy supply and mini-grids for town-size settlements or rural productive activities. It is notable to observe that a growing number of African countries see off-grid solutions as the best option for a rural economy. For instance, Ethiopia is planning to provide 30 per cent of its rural population with off-grid solutions in the next 10 years. Similarly, Rwanda expects to 48 per cent of the population to be electrified via off-grid, in order to achieve universal access by 2024[2] (IRENA, 2018).

c, Limited energy planning capacity

Poorly planned energy systems are likely to feature sub-optimal energy choices, feature high energy system costs, be vulnerable to climate variability, and be less diversified and more unreliable. Africa's main challenge is to make its energy systems reliable and sustainable; therefore, better planning is very important for a number of reasons. These include, but not limited to:

Scaling up electricity capacity to meet the energy requirements of fast-growing African countries;

- Diversifying energy supply to increase energy security through optimal use of vast renewable energy sources;
- Identifying the most economic but suitable power supply options;
- Introducing off-grid systems as early as possible in regional and national electrification planning processes;
- Providing energy security to accelerate industrial development; and
- Planning for increased private sector investments in the energy supply.

d, Weak energy or power utilities

Vertically integrated (mostly state-owned) power utilities still play a dominant role in the power industry in Africa. Although it can be said that these power utilities often operate dated energy generation, transmission, and distribution infrastructure, most of them are generally insolvent and are often propelled by constant funding from the central government than by their balance sheets. These utilities are still a vehicle for energy supply in most countries, yet their current structure and resource endowments may not allow them to lead and sustain the African energy transition in a suitable manner. Therefore, in the short to medium term, questions have to be asked if, in their current form, these utilities can be able to serve the African power industry up to 2030.

How to fill the gap to achieve SDG 7?

Concerted efforts at deploying renewables in Africa already exist, particularly utility scale solar, wind, geothermal, and modern bioenergy projects. It is also forecasted that the impacts of the ongoing initiatives in progress—when implementation is complete—will positively improve and bridge the gap to achieving SDG 7. However, in the short term, the following actions should be accelerated; and their impacts monitored.

- High level advocacy is needed for the promotion of appropriate clean cooking solutions, mainly rural areas on the continent. These could be based on clean fuels, such as making electricity and gas appliances affordable for cooking and heating.
- There is a need to assist and encourage regulatory and policy reforms to improve governance of the sector, improve efficiencies, and to make power utilities to viable.
- Energy infrastructure investments need to be diversified and the greater participation of the private

2 Mininfra (2015b), "Rwanda Energy Policy," www.mininfra. gov.rw/fileadmin/user_upload/new_tender/Energy_Policy.pdf.

sector in energy infrastructure development is needed as a panacea for increased the growth of the sector.

- Increasing and accelerating regional energy interconnections should be considered, because they could save African countries billions of dollars and could also assist with inadequate power generation, as a cost-effective way of increasing their supply.
- Promoting long-term integrated energy resource planning could assist in sustaining energy supply and demand, as well as ensure that energy catalyzes the economic transformation of the continent (and thereby lead to the achievements of other SDGs).
- Special and dedicated high level actions to promote the rapid uptake of renewable energy technologies should be pursued, particularly in viable off-grid environments, such as rural areas.
- As building energy infrastructure is costly and once-off, there is a need to adopt climate resilient strategies and actions, particularly in the planning of these infrastructure assets so that they can withstand the vagaries of extreme climatic conditions.

Policy recommendations

Therefore, and based on the discussion above, the following actions are proposed in order to bridge the energy access gap, in particular for those countries with low access rates. It also recognised that some the recommendations above are being implemented. In those instances, acceleration of those actions is important:

1. Countries should pursue power sector reform to restore the viability of utilities and expand the policy and operational space to crowd-in private sector investment in power infrastructure development.
2. Through a multi-stakeholder process, an implementing mechanism should be developed to accelerate investments in clean cooking technologies, including gas solutions.
3. The African power pools should accelerate regional interconnections and power market development to access least cost options for rapid expansion of power services across regions. In this regard, they need to address the constraints to private sector interest in regional projects.
4. Accelerate the pace of off-grid energy technologies uptake to address the acute gap of rural energy access.
5. With assistance from multilateral agencies, countries should be assisted to develop long-term energy planning capacity, including in the area of climate resilient infrastructure development.

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POLICY BRIEF #9

SDG 7 IN ASIA AND THE PACIFIC

Developed by

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

In collaboration with

TERI, the World Bank, and the International Energy Agency (IEA)

Key Messages

Status and progress towards achieving SDG 7 in Asia and the Pacific

- Although the region made remarkable progress on electricity access in the last decade, according to the data from "Tracking SDG7: The Energy Progress Report 2019," over 231 million people still have no access to electricity, around 5 per cent of the region's population. The region is on track to nearly reach universal access to electricity by 2030, however there are some countries with acutely low access rates, mainly Pacific Island countries.
- Around 2 billion people, nearly half the population, rely on polluting and unhealthy cooking fuels and technologies, and the region is far from being on track to achieve universal access to clean cooking by 2030.
- The share of renewable energy, including both traditional and modern forms, reached 16 per cent of the region's total final energy consumption in 2016, down from 44.5 per cent in 1990, though up from a low of 15.8 per cent in 2011.
- The region has demonstrated a long-term steep decline in energy intensity, falling from 9 MJ/2011 PPP$ in 1990 to 5.4 MJ/2011 PPP$ in 2016, converging with the global average.

Priority actions

Governments in the Asia-Pacific region need to maintain their commitments in order to sustain the recent increases in electricity access rates. The need to complete the last mile places emphasis on off-grid solutions, which require the respective authorities to enact adequate regulations, including provisions for potential integration of on-grid and off-grid infrastructure. Countries with acutely low access rates require particular attention from both their governments and development partners.

Given the slow progress in access to clean cooking, national targets for clean cooking fuels and technologies should be established, and clean cooking must be better integrated into energy policy frameworks. Greater investments are needed to support the expansion of technology and fuel distribution networks, and the development of options that align with consumer needs and cultural preferences.

The dramatic cost reduction of renewable energy technologies, particularly in the power sector, presents an opportunity to meet additional demand with renewable energy sources instead of fossil fuels. To realize this scenario, concerted efforts at promoting renewables are needed in Asia and the Pacific, with supportive policies and initiatives from governments and other stakeholders, directed at areas such as carbon pricing, expanded financing, and energy market and fossil fuel subsidy reforms. Governments can affect investment flows towards modern renewable energy by reducing risks, extending fiscal and non-fiscal incentives, and providing more conducive legal frameworks and regulatory stability for the business and technology choices of investors.

Tightened energy efficiency regulations are particularly urgent for the industry sector, which is responsible for more than 35 per cent of regional sectoral fuel consumption. Such efforts must target large, as well as small and medium-sized, enterprises. In the building sector, a priority is to develop stringent building codes for new buildings. Considering the continuous growth of the transport sector, the implementation of efficiency measures in this sector will become especially important in the long term, in order to ensure energy efficiency potential gains are maximized.

SDG 7 in Asia and the Pacific

The Asia-Pacific region comprises 58 economies, ranging from developed to least-developed, with a population of 4.5 billion, about 60 per cent of the world's total. Economies in the region produce approximately one third of the world's gross domestic product (GDP), consume half of the global energy supply, and include important oil and gas producers. As the region is leading the world in rising energy demand, and some of its countries have the largest deficits in energy access, the decisions and actions taken by Asia-Pacific countries will have an enormous impact on progress towards achieving global sustainable energy objectives, including SDG 7. In 2016, Asia and the Pacific produced 54.8 per cent of global emissions from fuel combustion, nearly two thirds of which were from coal. Though facing many challenges, Asia-Pacific countries are demonstrating global leadership across the three main pillars of sustainable energy—access, efficiency and renewables—offering strong commitments and innovation in those areas. New technologies and approaches have emerged, and as the Paris Agreement turned the world's focus toward decarbonization, countries across the region have offered up new and increasingly ambitious targets to improve energy efficiency and to increase their renewable energy share.

Current status

Energy access

In developing Asia, the number of people who lack access to electricity more than halved in a decade, from 642 million in 2007 to 231.5 million in 2017, with significant progress recorded in Bangladesh, China, India, and Indonesia. Despite this progress, large numbers of people remain without access to modern energy. India is home to the highest number of people worldwide without access to electricity (101.7 million, or 7.6 per cent of the population). The number of people without electricity access in Bangladesh is approximately 19.8 million (12 per cent of the population), and in Myanmar, 16.1 million (30 per cent). Significant energy access disparities exist between rural and urban populations, and between countries in the region. Rural populations, in particular women and children, bear the largest burden of energy poverty. Around 2 billion people, nearly half the population, rely on polluting and unhealthy cooking fuels and technologies, and the region is far from being on track to achieve universal access to clean cooking by 2030.

Electricity

- More than 231 million people (around 5 per cent) of the population in Asia-Pacific remained without access to electricity in 2017, with about 212 million of those people located in rural areas.
- Between 2015 and 2017, an estimated 103 million people in Asia and the Pacific gained access to electricity as the population grew by about 78.8 million.
- The regional rate of electrification rose to 94.8 per cent, up from 92.4 per cent in 2015, though national rates vary widely.
- Urban areas are gradually approaching universal access, reaching 9.2 per cent in 2017, while rural areas have reached 90.7 per cent, up from 86.7 per cent since 2015.
- In the period 2015 to 2017, Bangladesh and India each provided between 23.6 and 55.4 million additional people with access to electricity. Afghanistan connected an additional 8.8 million, while Indonesia and the Philippines extended electricity service to 1.5 million and 3.8 million of their citizens, respectively.

Clean cooking

- In the Asia-Pacific region, around 2 billion people—nearly half of the region's population and more than a quarter of the global population—remain without access to clean cooking.
- The World Health Organization (WHO) estimates 92 deaths per 100,000 people are attributable to household air pollution in developing Asia.
- In 2017, the regional rate of access to clean cooking reached 54.1 per cent, up from 38.3 per cent in 2000.

- In 2017, only 13 Asia-Pacific economies had clean cooking access rates of at least 95 per cent or above.
- The average annual share increase in access to clean cooking has hovered around 0.02 percentage points over the period 2000 to 2017, well below the pace required to achieve universal access by 2030.

Renewable energy

Asia-Pacific region leads the world in the renewable energy sector with more installed capacity and consumption than any other region. The region accounted for 75 per cent of global solar PV additions and for 48 per cent of global wind power additions in 2017. New solar PV capacity in both China and India surpassed new coal installations for the first time. China remained the world leader in installed capacities of hydropower, onshore wind power, and solar PV, and became the world's largest producer of bioelectricity in 2017, with a 23 per cent increase over 2016. India nearly doubled its solar PV capacity from 2016 to 2017, which exceeded the country's annual wind power installations for the first time. Indonesia led the world with new geothermal power generation capacity, and Turkey was among the top countries for capacity additions in solar PV, wind power, geothermal (second, after Indonesia) and hydropower.

- The share of renewable energy consumption, including both traditional (mostly traditional biomass) and modern forms, such as solar, wind, hydro, modern biofuels, and geothermal, reached 16 per cent of the region's total final energy consumption in 2016, down from 44.5 per cent in 1990, though up from a low of 15.8 per cent in 2011.
- In absolute terms, total renewable energy consumption amounted to 27.4 EJ in 2016, up from 26 EJ in 2013, continuing a long-term steady increase. Upper-middle-income countries in Asia have seen their renewable energy share in TFEC decline, as the region undergoes economic development and shifts away from traditional uses of biomass. Low-income countries in Asia have a large share of renewables because of both a high level of traditional biomass and a significant amount of hydroelectricity production.
- The estimated yearly investment needed in Asia and the Pacific to meet the renewable energy goal by 2030 is US$ 298 billion, but current investment levels fall short.
- Asia-Pacific was the largest regional market for renewable power generation capacity for the 9th consecutive year, representing nearly 48 per cent of added capacity (with a total exceeding 235 GW by the end of 2017).

Energy efficiency

Over the past decade, the region has made significant progress in decoupling the growth of energy demand and economic output, with significant recent advancements occurring in the industrial sector. Innovative technology has been developed and deployed, with countries such as China and Japan acting as global leaders in the introduction of energy efficiency into various sectors. A number of significant energy efficiency policies currently under development are expected to boost further the reduction in energy intensity. These include the strengthening of mandatory energy performance regulations in several countries in the region. In absolute terms, the largest savings come from avoided coal use in industry in China, which can in large part be attributed to policies to phase out older, more inefficient coal-based capacity and reduce air pollution.

- Asia-Pacific experienced the largest reductions in energy intensity between 2011 and 2016, with average annual declines of 3.2 per cent.
- The region has demonstrated a long-term steep decline in energy intensity, falling from 9.03 MJ/2011 PPP$ in 1990 to 5.4 MJ/2011 PPP$ in 2016, and showing convergence with the 2016 global average of 5 MJ/2011 PPP$.
- The Asia-Pacific region needs an average of US$ 211 billion in annual investment to reach the 2030 efficiency target, but current levels fall short.

Are we on track to achieving SDG 7 in Asia and the Pacific?

The energy transition needed to achieve SDG 7 and its targets is only going to be successful if efforts are made to curb demand growth, and if remaining growth is met by an increasing proportion of renewable

energy. A comparison of different outlooks for Asia and the Pacific demonstrates that aggressive measures must be taken to control energy demand towards 2030. According to the business-as-usual scenarios developed by the ADB and the IEA, energy demand may grow by more than 2,000 Mtoe by 2030. Policies announced to date (including Nationally Determined Contributions or NDCs) could result in a slight demand reduction. More progressive policies and technologies on energy efficiency could decrease this even further. However, the achievement of SDG 7 and more ambitious targets beyond 2030 require a demand reduction of 25 per cent compared to the business-as-usual case.

Fossil fuels cannot be phased out overnight and remain part of all energy forecasts. In the business-as-usual scenario the share of fossil fuels remains between 70 to80 per cent. To be on track for sustainable development, this share must drop below 70 per cent. In the business-as-usual predictions, coal retains 40 to 50 per cent on average, oil remains at 25 per cent, and there is a slight increase in gas, from 10 to 15 per cent. This leaves renewable energy (including bioenergy, hydro, and other renewables) at around 15 per cent, which would represent an overall decrease instead of a substantial increase in the share of renewables.

Although the Asia-Pacific region has experienced significant improvement in energy intensity, meeting the SDG 7 targets will require scaled up action. However, historic primary energy intensity and the 1990-2010 average improvement rate indicate that this will be challenging for the region and would require a significant effort. The progress made in China provides reason for optimism. The region's largest economy, accounting for 57 per cent of Asia-Pacific's industrial energy consumption in 2016, helped drive improvements by continuing to adopt aggressive energy efficiency measures in the industrial sector. This included the elimination of outdated technologies and establishment of standards. If the rest of the region could attain reduction rates of this magnitude, Asia-Pacific would be well on track to meeting the SDG 7 target. However, this would require sustained government commitment (IEA, 2017b).

With existing and planned policies, the Asia-Pacific is set to achieve the most basic level of near universal electricity access (99 per cent) by 2030. Much of the region's total progress is projected to be driven by populous countries such as India. However, some countries (such as the Democratic People's Republic of Korea and Papua New Guinea) show current access levels of less than 60 per cent, and may struggle with providing electricity to large shares of their populations. The Pacific Small Island Developing States are generally heavily reliant on imported fossil fuels for both transport and electricity generation, which makes them highly vulnerable to fluctuations in global oil prices and increases in the cost of doing business. Targeted efforts and assistance are needed in order to ensure that no one will be left behind. All governments with access deficits would need to make efforts to ensure that the last mile is reached, enabling everyone to take full advantage of the multiple benefits of energy services. This comes at a cost, as experience has shown that reaching the last 10 to 15 per cent is the most expensive and time-consuming part of the challenge. In the cases of China and Thailand, increasing electrification from the 30 to 40 per cent range up to 85 to 90 per cent took the same amount of time as reaching the last 10 to 15 per cent. When assessing current levels of energy access, factors such as reliability and affordability should also be considered, rather than applying the traditional binary distinction between access and lack of access (ESCAP, 2017).

Providing universal access to clean cooking by 2030 is an immense challenge. Given the current low achievement rates, the region is far from being on track to achieve universal access to clean cooking fuels and technology by 2030. On a more positive note, several Asia-Pacific countries have recently put forward clean cooking targets, have conducted research, and expanded markets for clean cooking fuels and technologies. Indonesia led the world in its pace of increasing access through the expansion and promotion of LPG fuel and technology markets, resulting in a dramatic increase from a mere 5.4 per cent in 2000 to 60.5 per cent in 2017, while the Marshall Islands distributed efficient smokeless stoves to each household in the outer islands from 2014 to 2016, giving rural dwellers access to clean-cooking solutions. If these positive examples inspire replication in the region, there may be some reason for optimism. But higher priority needs to be accorded to clean-cooking solutions.

Interlinkages with other SDGs

Energy is intrinsically interconnected with the majority of the other SDGs. It is an essential enabler for poverty reduction, food security, health, education, water, and more. Indeed, 125 of 169 targets included in the SDGs are linked to energy. That is more than two-thirds of all targets. One such interlinkage of particular importance to the Asia-Pacific region is that of energy and air pollution. The increased consumption of energy, especially fossil fuels, has significant local and regional social and environmental consequences and costs. Air pollution is disrupting not just the health of people, but it is also adversely affecting the growth potential of entire cities and economies. Of the 1,622 global cities listed in the 2014 World Health Organization (WHO) Ambient (Outdoor) Air Pollution Database, Asia-Pacific cities represented 85 of the top 100 polluted cities. In 2015, more than half of the 4.2 million early deaths worldwide attributed to air pollution occurred in India and China. India and Bangladesh have suffered the steepest increases in air pollution since 2010 and have the highest concentration of particulates in the world. The interlinkage between energy and air pollution makes a shift to cleaner sources of energy and increased energy efficiency especially urgent in the Asia-Pacific region.

Policy implications

Achieving universal access to electricity in the Asia-Pacific region will require governments to maintain their commitments to sustain the current increase rates. The challenge of reaching the last mile puts a focus on off-grid solutions which require the relevant authorities to put in place adequate regulation. Given the parallel continuous expansion of the main grid, provisions need to be put in place to ensure the potential integration of on-grid and off-grid infrastructure. In the case of the countries with continuously low access rates, most of which are located in the Pacific, additional efforts are required by both their respective governments and international development partners.

Several Asia-Pacific countries have placed policy emphasis on clean cooking fuels and technologies. However, current efforts remain small in comparison to the scope of the problem, and the challenges are great. For the switch from traditional to clean cooking to take place, greater expansion and reliability of technology and fuel distribution networks is necessary, along with greater efforts to improve utility and affordability. Clean cooking must be better integrated into energy policy frameworks, and greater investment is needed to support the development of options that meet consumer needs and overcome barriers, such as cost and cultural preferences. Furthermore, increasing employment opportunities for women in rural areas raises the opportunity cost of gathering fuel for cooking. With value attributed to women's time, households are more likely to choose more efficient technologies with shorter cooking times and reduced fuel gathering requirements. Policies in support of clean cooking fuels and technologies would also help to reduce air pollution.

The targets of SDG 7 require more financial resources and ODA will remain relevant, especially for access to energy in the more remote areas where expensive storage technology will have to be part of the solution. For renewable energy and energy efficiency, the private and public sectors remain the most important source of finance. Energy demand-related finance would need to grow significantly while energy supply-related finance would need to be geared towards cleaner sources. Governments have a central role in achieving SDG 7 and could affect investment flows by facilitating additional revenue streams from investments, reducing risks, extending fiscal and non-fiscal incentives to investors, and providing more conducive legal frameworks for the business and technology choices of investors. Thus, public financing needs to be focused on creating the appropriate conditions for attracting private capital through de-risking transactions. To achieve true scale-up, which necessarily has to come from private sources, an adequate enabling policy framework needs to be put in place to facilitate access to commercial debt and equity.

Achieving SDG 7 also requires a mix of interventions for clean energy—energy market reform, carbon emissions pricing, and fossil fuel subsidy reform—as well as effective methods for addressing the social

aspects arising from diverging energy tariffs between urban and rural areas, and from fossil fuel subsidy reform. While governments will play key roles in the energy transition, greater coordination would be needed to plan and implement the transition. Governments would need to strengthen coordination among ministries and establish an enabling environment for the private sector. To promote investment, this enabling environment must be stable and based on consistent policy. In addition, policies and strategies based on evidence-based research would need to be developed, together with research institutions and innovative national and international organizations.

To embark on the most promising pathway for increasing energy efficiency for the region, a good strategy is to first analyze the most impactful sector. The examples of the top performers in the region show that no single sector drives success alone. In all cases, countries acted on considerations of the size and impact of the sector in their particular context. With a regional sectoral fuel consumption in industry of more than 35 per cent, continued efforts to reduce the amount of energy used per unit of output is essential for Asia and the Pacific. The examples of the top performers indicate that this may be an area for quick wins, but this will imply also targeting the harder to reach small and medium sized enterprises, which often make up a large share of industrial energy consumption. As the building sector is the second most consuming sector (a bit less than 25 per cent of TFC), energy efficiency regulation for buildings should be another priority. Given the lifespan of buildings, strong building performance standards and building codes will lock in performance for decades. Notably space heating and cooling will be an important challenge across the region. The third priority is the transport sector due to its fast growth in the recent past, which will likely only increase with the demands of a growing middle class. Moreover, tightening energy efficiency regulations regularly is important to provide incentives for continual improvement. Lawmakers should look not only at regulatory breadth (covering as many sectors as possible) but also at regulatory depth (strengthening requirements to drive performance further). This requires a common measurement framework, including monitoring and enforcement of existing standards.

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POLICY BRIEF #10

SDG 7 IN ARAB REGION

Developed by

The UN Economic and Social Commission for West Asia (ESCWA)

In collaboration with

The International Energy Agency (IEA), the World Bank, and the Islamic Development Bank

Key Messages

Sustainable energy development is a critical priority for all Arab countries, not just a choice between high growth and low growth scenarios. Progress in achieving SDG 7 is essential for advancing all of the SDG goals in the face of growing climate challenges.

The Arab region lacks capacity in the areas of energy efficiency and renewable energy, while retaining an overwhelming reliance on fossil fuels. It is also affected by war, political instability, and consequent displacement and migration, which add to pressures on wellbeing, urban living space, and resources. Growing populations, with large numbers of young people, create expectations for economic opportunities, environmental sustainability and improving living standards.

Access

The Arab region's electrification rate rose from 88.4 per cent in 2010 to 92.5 per cent in 2017, at an average annual electrification growth rate of 0.7 per cent. However, in 2017, Arab LDCs reported that 88 per cent of their urban population had access to electricity, but only 50 per cent of the rural population did. Meanwhile, unplanned service disruption is a challenge for electricity users, irrespective of the urban-rural divide or income disparities.
Access to clean fuels and technologies is high in the Arab region. In 2017, 14 countries had access rates above 95 per cent. Region-wide access grew steadily at an average annual growth rate of 1.1 per cent throughout the 2000s, driven primarily by significant improvements in Arab LDCs, which account for most of the region's access deficit.

Efficiency

The Arab region historically has not been one of the most energy-intensive regions, and its energy intensity has been relatively stable over the past 25 years, while other regions have reduced their energy intensity. Energy consumption, however, has more than doubled in the Arab region since 1990, with a direct increase in GHG emissions. Transport remains by far the most energy-intensive sector in the Arab region, followed by industry and agriculture.

Renewables

Renewable energy plays a marginal role in the Arab region's energy consumption, reflecting the region's globally unparalleled reliance on non-renewable fossil fuel sources. In 2016, renewable energy, including biomass, accounted for about 10 per cent of the region's final energy consumption.

Priority actions

Over the next 4 years

- Focus on more efficient use of the region's valuable fossil fuel resources while exploring potential energy alternatives, renewable energy in particular.
- Develop and enhance legislative and subsidy settings to rationalise demand and supply patterns and increase sustainable energy.
- Build institutional capacity, transparency, accountability, data collection, dissemination, and information-sharing between institutions, as well as greater support of science and research.
- Strengthen local governance and communication between government, financial institutions, the public, and private companies, and reinforce the role of civil society.

Towards 2030

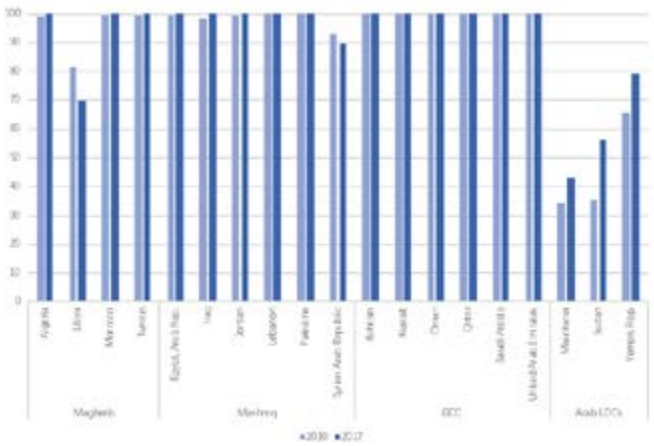
- Adopt proactive and integrated policies that manage natural resources more sustainably, especially the water-energy-food nexus, in order to address multidisciplinary energy-related issues tied to the empowerment of women and the Arab region's highly educated youth.
- Establish effective supply-side management and achieve diversification of energy supply and regional energy trade underpinning more sustainable, resilient, and cost-effective energy systems in the Arab region.
- Enhance regional trade in energy between Arab countries to achieve substantial benefits for all parties, including greater security of supply, access to cleaner energy, and considerable potential for job creation from the development of local manufacturing industries for components of clean technologies.

Energy access

Access to electricity is to a large degree a bright spot in the Arab region's sustainable development agenda.[3]

Access to electricity, as well as to clean cooking fuels and technologies, is now near-universal in North Africa, the Mashreq, and the Gulf Cooperation Council—an impressive achievement, allowing the Arab region to stand out from other regions with a high share of developing economies.

Figure 1. Share of population with electricity access in the Arab region, 2010 and 2017 (per cent).[4]



Source: World Bank energy access database- Tracking SDG7: The energy progress report 2019

Despite very positive developments in electricity access since the 1990s, some significant gaps in access to energy remain in the Arab region. Overall, access to electricity is close to universal in cities across the Arab region, although rural access remains incomplete in 5 Arab countries, with the largest access deficit in the Arab LDCs—Mauritania, Sudan, and Yemen, where rural access ranges from 0 per cent in Mauritania to 69 per cent in Yemen. Some 29.9 million Arabs did not have any access to electricity in 2017, primarily in the Arab LDCs with small numbers of people without electricity access in North Africa and the Mashreq.

Unplanned service disruptions and reliability, on the other hand, are a challenge for electricity users, irrespective of the urban–rural divide, or indeed income divide.

War and regional instability have had a devastating impact on essential services including energy access in a number of Arab countries, exacerbating the unparalleled humanitarian catastrophe unfolding in the region in recent years. Mass migration of some 7 million refugees and around 11 million internally displaced persons according to UNHCR data—primarily in Syria, Iraq, Yemen and Libya—imposes tremendous material and logistical challenges for host countries and communities, while it deprives millions of refugees of secure access to energy in addition to other essential services such as clean water, sewerage, food, and healthcare.

Through its multifaceted links to different fields of socioeconomic development, the lack of access to energy is a major stumbling block to national development efforts in the Arab LDCs.

One of the key challenges the Arab region faces as a whole is whether primary energy and electricity should remain what has been effectively a "public good" supplied at low cost by the State to its citizens, or whether

3 The Arab region here includes North Africa (Algeria, Morocco, Libya, Tunisia) Mashreq (Egypt, Iraq, Jordan, Lebanon, Palestine, Syria), GCC (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates), LDC (Mauritania, Sudan and Yemen).

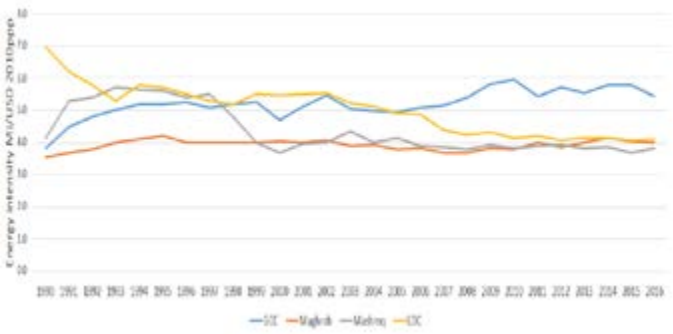
4 World Bank energy access database- Tracking SDG7: The energy progress report 2019

the region's emerging economies will need to redefine the way energy is used and supplied within their domestic market.

Energy efficiency

Between 2000 and 2017, the Arab region has maintained relatively low energy intensities at 4 MJ/US$ 2011 PPP over the past 26 years, which highlight significant need to address energy efficiency in Arab countries. Energy intensity rates differ considerably across the Arab region. Energy net exporting countries drive the regional trends as they have based their historical industrial growth on fossil fuels and energy-intensive industries. Net energy importers have seen fairly low and falling energy-intensity rates.

Figure 2. Energy intensity in the Arab region by subregion, 1990–2014 (MJ/2011 PPP US$)[5].



Source: *International Energy Agency (IEA) Database Tracking SDG7: The energy progress report 2019*

Taking the region's aggregate data, we see a moderate trend in more recent years towards falling energy-intensity levels in agriculture and transport, with declining intensity rates in industry in some economies. Power generation efficiency reflects ongoing progress in advance gas turbine technologies and integrated power and water plants. Transport, however, remains by far the most energy-intensive sector in the Arab region, followed by industry and agriculture.

On regional aggregate level, transport is more fuel-intensive than any other region of the world, reflecting increasing mobility across dispersed population centres of many Arab populations, low fuel costs, and an absence of vehicle fuel standards. Mobility improvements are necessary, enabling progress in a number of social development indicators, such as access to education and health care and rising income levels. On the other hand, most Arab countries' socioeconomic development models have been built around the concept of cheap, personal transport. There remains a significant lag in the availability of public transport systems which are inadequate in many Arab cities, suburbs, and the countryside.

Many Arab cities suffer significantly from traffic congestion, in addition to some of the highest rates of urban air pollution. Massive investments in roadworks do not keep pace with increasing vehicle numbers exacerbating congestion. The often very large additional investments in road infrastructure and vehicles and a lack of funds and policy priority on public transport continue to lock-in unsustainable transport systems.

Rising pressure for food production has also driven significant efforts at increasing the energy efficiency of the agricultural sector indirectly. The dispersed nature of agriculture, with many small farms spread across geographic conditions and outside the reach of centralized urban policymaking and legislation, further complicates the implementation of energy-efficiency and renewables measures in agriculture, while most financial markets in the Arab region lack financial products suited to the needs of farmers.

Very low, subsidized prices for energy, electricity, and water, combined with a lack of energy-efficiency

5 International Energy Agency (IEA) Database Tracking SDG7: The energy progress report 2019

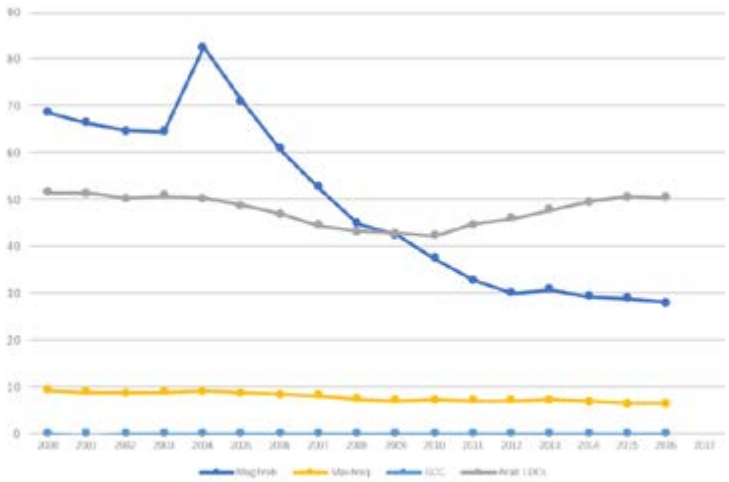
regulations in different economic sectors have resulted in a large increase in per capita water and electricity consumption throughout the Arab region.

Where economies and living standards have been growing, market incentives to conserve energy have been lagging significantly behind across the entire Arab region. Measures that help increase energy efficiency and therefore energy productivity over time, particularly on the regulatory side, have in many parts of the Arab region been sketchy and piecemeal. Even in high-income countries in the Arab region, policy focus and hands-on reform efforts differ markedly between countries, with historical priority having been given to fast-rising development and quick improvements in living standards. Typical market structure of the energy industry in the Arab region further affects incentives for energy efficiency.

Renewable energy

Renewable energy is, despite progress through a number of high-profile deployment projects in recent years, still a largely untapped resource in the Arab region. In 2016, renewable energy, including biomass, accounted for some 10 per cent of the region's final energy consumption. This is despite considerable potential for renewable energy, in particular modern technologies such as wind and solar power, given the region's favourable geography and climate conditions.

Figure 3. Share of renewable energy in total final energy consumption in the Arab region by subregion (per cent)[6]



Source: IEA and IRENA renewable energy Database Tracking SDG7: The energy progress report 2019

Over 80 per cent of the region's consumption of renewable energy is based on solid biofuel, accounted for by a small number of countries whose primarily rural populations continue to use biomass.

Renewable energy sources have played a marginal and declining role in the region's energy mix. In most parts of the Arab region, conventional fossil fuels have for many decades underpinned the systematic expansion of modern energy access, leading to near-universal access rates of electricity and clean cooking fuels.

The weak presence of renewable energy stems from the absence of targeted policy initiatives, as well as the prevalence of state-owned energy utilities and—particularly during the 2000s—widespread use of fossil-fuel subsidies, which have traditionally discouraged the use of new non-fossil fuel-based technologies. However, this rationale has started to change in recent years in some parts of the region, and the share of

6 IEA and IRENA renewable energy database- Tracking SDG7: The energy progress report 2019

modern renewable energy stabilized in 2014-2017. Renewable energy costs have been also falling, making investments, particularly in wind and solar power, more attractive.

Recent years have seen a pick-up in modern renewable energy technologies, particularly solar power. Solar resources are plentiful in the region, and solar technology has proven to be both flexible and cost-competitive. Still, deployment has been accelerated, but lags considerably behind the technology's vast potential in the region.

Nonetheless, long-term policy obstacles to deploying renewables remain in place, and while new initiatives such as competitive auctions and public–private partnerships hold considerable potential for the future of the energy sector, such business models have yet to prove their popularity regionally.

While the Arab region's recent trend in solar- and wind-power energy deployment is currently driven by a few countries, more dedicated policies to establish these technologies could substantially increase the level of deployment over the coming decades. This includes allowing markets to establish a business case for alternative technologies. In a market that remains dominated by fossil fuels—more than any other region—this will require not only more systematic reform to open up utility sectors, but also work on enabling factors for small-scale applications such as off-grid use, through mechanisms such as transparent pricing and funding.

Decentralized generation offers significant market potential, including in conflict-affected countries. While in the past, solar and wind power used to be primarily driven by the deployment of individual utility-size projects, highly encouraging developments in the use of solar stand-alone systems in countries such as Jordan, Lebanon, Palestine, and Yemen from 2014-2017 suggest far greater policy focus should be turned to distributed generation in its own right.

More market uptake requires more proactive legislation. Harvesting the significant benefits of modern renewable energy requires far more dedicated policy design—and investment—than is currently the case. Effective legislation and a business-friendly environment have been an important driving force behind recent success in deploying low-cost, large-scale solar and wind projects in the Arab region. Further growth, including in the off-grid sector, will depend on the affordability of the technology, and hence access to finance, as well as effective quality control for solar home-based products.

Interlinkages with other SDGs

Progress in sustainable energy can no longer be seen as separate from other socioeconomic development goals in the Arab region. Modern energy access is essential for the achievement of virtually all development goals, including the fight against poverty (SDG 1); in support of greater gender equality (SDG 5); decent work opportunities and economic growth (SDG 8); and the development of modern industries, innovation, and infrastructure (SDG 9). The fragile natural resource balance in many parts of the Arab region, coupled with rapid and rising economic expectations by the region's young and increasingly educated populations, means that managing the natural assets of Arab countries takes centre stage in ensuring that future generations can lead stable and successful lives.

Energy is crucially interconnected with a whole range of other factors for developmental success. Accessible, affordable energy remains the 'engine' for development. From its close link to the security of water and food supplies, sustainable energy is key to driving progress in development goals such as:

- universalizing access to modern health services and education
- gender equality and women empowerment
- the creation of sustainable living spaces
- technology innovation and productivity

- critical progress in mitigation of, and adaptation to, climate change

Policy implications and recommendations

Improving efficient natural resource governance and policy will play a pivotal role in driving the Arab region's energy transition. Existing market mechanisms provide insufficient incentives for a change in production and consumption patterns in the Arab region. Missing minimum efficiency regulation, consumer information, and enforcement of existing regulation throughout the Arab region have further increased the energy intensity of regional economic growth.

Future efficiency improvements and renewables from current policy changes will provide significant reductions in energy demand and near-term financial savings, as well as multiple benefits across other SDG goals. Over the longer term, such changes can provide significant cost savings to national economies and the reduction of deadweight loss to economies through resource waste.

Initiating proactive policymaking approach towards sustainable energy in the Arab region.

This could involve the following steps:

Strengthening the link between sustainable energy and environmental management to social and economic development goals. This includes a more efficient use of the region's valuable fossil-fuel resources, and the exploitation of the economic potential of renewable energy alternatives to deliver SDG wellbeing and environmental outcomes in the face of emerging climate stresses on the region. Moreover, the Arab region displays a wide range of experience in the arena of regulating energy efficiency, with a significant gap between the potential benefits of energy efficiency regulation and the actual progress achieved. In the case of high-income Arab countries, progress in energy efficiency also lags vastly behind income levels, and hence expected progress and level of sophistication of regulatory tools. Reconsideration of legislative settings that discourage wasteful consumption and production patterns is important; adapting energy subsidies to favour sustainable outcomes is crucial.

Using innovative policy approaches.

The deployment of renewable energy in the Arab region in recent years illustrates this positive learning curve in Arab countries that started registering positive progress in the deployment of renewables. Public-private partnerships in this context are becoming an increasingly attractive solution for Arab countries aiming to attract private finance for sustainable-energy projects but must be based on sound public policy foundations for sustainable energy and a sustainable society.

Ensuring that new policies, **plans, and targets are stringent, and compliance is enforced**. This is of particular importance in buildings, appliances, and vehicle technologies, where regulatory efforts implementing worlds-best practice efficiency levels are economic and critical to sustainable outcomes.

Effective government communication and strategy-making. Ultimately, the most effective way of promoting a positive energy transition is the creation of complementary policies between different government bodies that integrate individual policy changes. Ensuring regulations support a wider sustainable strategy that targets the most efficient use and management for wellbeing. Such policies promote energy efficiency and renewable energy in the national interest, with new legislation and regulation from different ministries in coordination with each other. Sustainable policy principles identify the full cost of a business-as-usual and sustainable scenarios—consulting rather than just informing—and use quantifiable goals and targets that help the public understand progress and motivate sustainable change.

Enhance research, development, and innovation in the field of sustainable energy and environmental technologies and services. Significant efforts are needed to improve research and innovation to further identify and adapt technologies to the current challenges facing the region, particularly in light of the water-

energy-food nexus.

Promoting the diversification of the Arab region's energy mix would also require capital and management skills and increasing capacity for technology innovation. This can happen through pilot projects, competition, investment in research and development and community-based projects.

Increase capacity for technology innovation through dedicated public policies and provide incubation, financing and incentives for entrepreneurs to scale up innovation.

Building institutional capacity, transparency and accountability requires effective and credible institutions with sufficient access to information and data, access to skilled human resources, and professionalization of the public sector; clear institutional mandates to design, implement, and monitor policies reinforced local governance and the role of cities; greater use of existing competence by strengthening of communication channels between government institutions, financial institutions, and public and private companies; and strengthened civil society institutions that are able to communicate to their constituencies far more credibly than government institutions.

Restructuring domestic energy and water-pricing. Pricing policies are of pivotal importance for the allocation of scarce resources, including energy. The Arab region's slowly changing pricing environment for energy could be one of the most important structural drivers of a gradual improvement in energy efficiency and renewables, if social contract energy subsidies are redirected toward sustainable energy outcomes, e.g., the supply of a household PV system, negates the need for ongoing subsidy by creating energy independence and minimises further upstream supply investments. The aspect of wider energy and utility markets regulation and liberalization remains one of the most important areas for further development in the Arab region over the coming decades offering benefits to many different parties.

Preparing financial markets. Access to finance is a key factor in determining market uptake of more sustainable energy technologies. A number of financing solutions have been demonstrated to drive clean-energy deployment in the Arab region, however, illustrating the diversity of options that can work in different circumstances. These include microcredits for small-scale applications, especially in the off-grid segment; international sources of funding, with an increase in initiatives linked to clean-energy development in developing countries; and locally oriented, national policies specific to each individual country. While social contract energy subsidies exist, governments will need to stimulate demand for investment in energy efficiency and renewables.

Sustainable public transport infrastructure. Public transport infrastructure is key to ensuring the dual developmental objectives of ensuring people's mobility while managing domestic energy demand for transport fuels. Providing sustainable public transport solutions is also critical to ensure particularly the mobility of women and children, who are often disproportionally affected by the absence of safe transport options, leading to lack of access to education, work and health care. Sustainable public transport solutions are also critical to the reconstruction process currently underway in several Arab countries, or in those having recently experienced war and political conflict resulting in the systematic destruction of infrastructure. Important areas of government action are the expansion of safe, effective and sufficient public transport options in cities and in rural areas as well as the safeguard of more energy efficient forms of public transport, such as fuel-efficient public vehicle fleets and, where feasible, the electrification of public transport.

Regional energy trade. Intraregional cooperation over energy could be an important factor underpinning more sustainable, resilient, and cost-effective energy systems in the Arab region, contributing towards economic growth, shared prosperity, and reduced poverty.

Arab countries should seize opportunities for regional cooperation and public-private partnerships (PPP) by working together to expand markets for investment and trade in cleaner, more efficient technologies, and goods and services in key sectors.

Enhancing regional trade in energy between Arab countries, such as through interconnected electricity grids, would entail substantial benefits for all parties, including greater security of supply, access to cleaner energy produced in bulk where it is cheapest, and considerable potential for job creation from the development of local manufacturing industries for components of technologies whose greater deployment could be driven by increasing regional cooperation in renewable energy.

Strengthening information quality and awareness-creation. The Arab region's fast socioeconomic development over the past three decades has triggered a rise in energy consumption, but this has not been accompanied by a parallel shift in public awareness of the need for rational energy use and related topics such as environmental protection. Information management and consumer motivation are critical components in upgrading an economy's energy performance because both behavioural changes and investments in upgraded energy efficient technology require time to recoup initial investment costs. Many innovative solutions, such as rooftop solar panels, require consumer action that is frequently hampered by lack of information.

Access to data and information plays a pivotal role in government and business decisions to invest in and favour sustainable technologies and guide consumer behaviour. Overdue progress in improving information access in the Arab region will rely on a number of factors, including data collection and dissemination.

Information-sharing between institutions; communicating with final consumers; re-prioritizing sustainable energy use and environmental consciousness in the public discourse; greater freedom of science, research, and the media; and depoliticizing data are all key.

In the longer term, achieving sustainable development goals, including in the area of energy, will require a degree of data dissemination and media reporting, empowering civil society to present their interests and help governments to assess society's needs and preferences.

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POLICY BRIEF #11

SDG 7 IN LATIN AMERICA AND THE CARIBBEAN REGION

Developed by

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

In collaboration with

The Latin American Energy Organization (OLADE), the World Bank, and the International Energy Agency (IEA)

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, in spite of the positive advances, it is necessary to redouble efforts, otherwise it will be more difficult to achieve the objectives set for 2030. In addition, the countries with the greatest backlogs represent a challenge that will require greater and focused efforts.

Access

The number of people without access to electricity fell from 44 million to 12 million between 2000 and 2017. In urban areas the degree of coverage in 2017 remains at 99 per cent while in rural areas it reached 92 per cent, with a large increase compared to 2014 where it only reached 88 per cent. If current growth rates are maintained, this objective can be achieved. However, greater efforts must be devoted to supporting countries that are lagging furthest behind (Haiti, Honduras, Nicaragua, and Guyana and Suriname). However, access to modern and healthy cooking and refrigeration technologies is still lagging behind, despite the efforts made, where around 83 million people still lacked access to such sources, so it is unlikely to reach the 2030 target unless they focus electrification policies on covering this dimension by electrifying cooking and refrigeration.

Renewable Energy

The region continues to make progress on this issue and it is expected that in the short term a large amount of MW will be installed in the region. The significant share of renewable sources represents 27.6 per cent of total final energy consumption and modern renewable energies represent five sixths of this share, which places the region in a privileged situation. The region has an installed renewable energy capacity of 218.2 GW in 2017. Capacity expansion rates show significant increases from 2014, from which date increases greater than 5 per cent are observed. That will increase thanks to the policies that promote the participation of renewable energies. In this area, the mechanisms of bidding and auctions stand out, observing values for wind energy of $0.06 Kwh and photovoltaic solar energy of $0.13Kwh in 2017.

Efficiency

The region has historically been the one with the lowest energy intensity in the world. However, in recent years this indicator has not changed, limiting the region's advantage over other regions of the world. Although the indicator has decreased in the last decade, given the trend in the last 5 years, improving efficiency will require additional efforts to those that have been made if we want to reach the target set for 2030.
Priority actions: next 4 years

- The active role of the State as facilitator of the development of the energy sector should be reinforced and the country's comparative advantages (endowment of natural resources) converted into competitive advantages (access to clean and accessible energy).
- Promote the inclusion of non-conventional renewable energy technologies in policies, programmes and projects for energy access, particularly in rural areas.
- Implement state policies that encourage the development of renewable energies and are sustainable over time.
- Deepen the implementation of national programs to promote the use of efficient and clean wood

stoves, with emphasis on caring for the environment, protecting people's health and paying attention to the socio-cultural aspects in which families live.

- Promote the development of National Energy Efficiency Plans, which define goals, provide instruments and have the necessary resources for implementation.

Priority actions: towards 2030

- Integrate the change of the energy matrix towards a renewable and sustainable, hand in hand with the electrification of transport, considering the incorporation of multimodal public transport systems.
- Moving towards convergence between energy prices and production costs. Reduce subsidies to fossil fuels and develop mechanisms that guarantee benefits to the most vulnerable populations.
- Promote the gradual replacement of traditional biomass in cooking and heating uses by modern sources.

Disclaimer note: In order to allow consistency and intercomparability between the data presented from the different regions in the entire report, in the Latin America and the Caribbean Policy Brief, the information used relied on the 2019 energy tracking report prepared by the SDG7 indicator custodian agencies. However, we recognize and support the important work done by the regional bodies, in particular by the Latin American Energy Organization (OLADE). It is important to emphasize that further efforts are required to deepen harmonization among the existing databases for the region.

I. Energy and the Sustainable Development Goals

Energy is an essential factor for the development of all economic sectors and human settlements. This is certainly in direct support of the challenge of ending poverty, protecting the planet and ensuring that all people enjoy peace and prosperity. However, there is evidence that the use of polluting fossil energy sources is unsustainable. As a result, the idea of a major environmental boost through the decarbonisation of the energy matrix has emerged, with the aim of reducing dependence on fossil fuels and moving towards a new horizon of socio-environmental sustainability.

Energy plays a fundamental role in the use of basic necessities such as food, which require preparation, refrigeration and cooking to prevent most Foodborne Diseases (FCDs). In 2001, WHO published the five keys to food safety, a document whose reference to energy systems is evident in the recommendation to use clean calorific systems to bring food to full cooking and in the use of refrigerant systems to slow bacterial growth.

Another aspect of energy access is the use of clean-burning cooking technologies, which prevent air pollution in confined and unventilated kitchen spaces. According to UN Women, more than 4 million people died in 2012 from the use of solid fossil fuels in the kitchen. 60 per cent of them were women.

On the other hand, the diffusion of knowledge in the 21st century depends highly on the availability of modern virtual information systems. In this sense, isolated peasant communities would benefit from access to modern energy services. This would contribute to new job opportunities for those living in inhospitable areas.

The data included in this Policy Brief show the progress made in addressing the above issues, which have been systematically addressed by Agenda 2030 with 17 specific global targets named "**Sustainable Development Goals**" (SDGs). These issues have led various international organizations to monitor annually the indicators of SDG 7 (Affordable, Clean and Sustainable Energy) that will be discussed in this Policy Brief.

It is easy to understand the role of energy in almost all of the great challenges and opportunities facing the world today. Consequently, for these goals to be achieved, and for the world to develop sustainably, it will be necessary to ensure access to affordable, reliable, sustainable and modern energy services, while reducing greenhouse gas emissions and the carbon footprint of the energy sector. It is for this reason that the SDG #7 set a set of energy targets for 2030, which represent an important step in the UN's efforts to focus on the social, environmental, economic and policy challenges related to each other and to the production, distribution and access to services that depend on energy supply.

Similarly, the sustained adoption of clean and affordable cooking solutions can improve the health and well-being of millions of people. In this regard, it is sufficient to refer to the harmful effect on health (particularly on women and children) caused by the burning of traditional solid fuels such as firewood, charcoal or agricultural residues for cooking at home. Avoiding their use also generates additional benefits by saving time that would otherwise be spent collecting or buying solid cooking fuels, allowing children to spend more time studying and allowing women to generate livelihoods and income through other productive activities.

It is also recognized globally that current approaches to energy are not sustainable in economic, environmental or social terms, in the face of global population growth and increasing demand for energy services. Consequently, there is a need to shift to more sustainable energy systems, where both increased use of renewable energy and significant improvements in fossil fuel energy efficiency have an important role to play and are not mutually exclusive. It is therefore a question of focusing the debate on the essential role that energy plays in the global sustainable development agenda, while at the same time emphasizing the need to protect the environment (paying special attention to the negative environmental impact of conventional approaches to energy) and promoting the conservation of non-renewable resources.

The promotion of energy efficiency is transversal to the four dimensions of sustainability, insofar as it positively impacts on the productivity and competitiveness of economies, reduces investment needs in the energy industry, has positive effects on the external sector of a country's economy, improves security of supply, reduces the energy bill in households, facilitates access to new and modern sources, promotes technological improvement, mitigates negative effects on the environment and contributes to the conservation of non-renewable energy (increasing its future availability). As a result, improved energy efficiency has a positive impact on many of the SDGs.

Access to Energy

Latin America and the Caribbean have been successful in moving towards universal access to electricity services. Indicators dating back to 2017 show that the region has steadily expanded its coverage, bringing the deficit from 8.3 per cent in 2000 to 2 per cent in 2017; in 17 years the deficit has been reduced from 43.6 to 12 million people.

Access at the urban level shows a deficit of around 0.5 per cent, which represents that universalization is highly likely by 2030. At the rural level, there is a deficit of around 8 per cent in 2017.

As a result of the rural level deficit observed, it is a priority that the efforts and action plans adopted by the countries be placed with greater emphasis in this sector, where although the trend shows an increase in coverage, universalization has not yet been achieved. In order to improve trends at the rural level, initiatives must continue to incorporate renewable energies, which, since they do not require networks fed by centralized generation sources, make it possible to use local energy resources.

In some countries of the region, it has been observed that the development of renewable energy projects at the rural level involves the integration of peasant and indigenous communities. The document of the Government of Chile: "Indigenous Chapter of Energy Policy 2050" shows how policies have been carried out that have centred the inclusion of peoples based on an understanding of the immanent cosmovision of these communities, understanding the social, cultural, political and ecological principles that have governed these societies for centuries, and from this paradigm the institutional strategy for the electrification of the rural sector has been developed.

In general terms, SDG #7.1, despite the encouraging regional perspective, is overshadowed when sub-regional data are analyzed, particularly in access in the Caribbean, where it is observed that it is the sub-region with the greatest deficits. In 2017, the gap was 14per cent and coverage has increased very slowly, following a pace similar to population growth. However, Haiti has a deficit of 56per cent and around 39per cent of Haiti's population lives in rural areas, explaining the high backwardness of the access indicator in the Caribbean. Another country with considerable deficits is Grenada, where 64.3per cent of the population is rural, which explains its 5per cent deficit. On the other hand, in Central America and South America respectively Nicaragua, Honduras and Guyana, have more than 10per cent of the population without access to electricity and coverage has been expanding at an average rate of 1per cent per year. Only by maintaining these total coverage rates could we expect the goal to be met by 2030. Meanwhile, Bolivia and Guatemala will have to make additional efforts to the current ones to ensure that 7per cent of the population without access is connected, reaching values close to 100per cent by 2030.

Likewise, another dimension of access is related to the use of clean combustion technologies for cooking (CFT). The figures per country for access to modern energy sources for cooking use show a similar and heterogeneous trend, where on the one hand an important group of countries has a participation of 90 to 100per cent. Then there is a medium segment of countries with shares ranging from 74 to 86per cent (Guyana, Peru, Cuba, Mexico, Belize and El Salvador). Finally, a group of countries where access to CFT varies between 65 and 45 per cent (Nicaragua, Honduras, Guatemala and Haiti) and Haiti which only has

4.34per cent. In historical trends, a great dynamism is observed in the search for the reduction of the gap However, if the current trends continue, those countries under 65per cent would not be able to meet the established objectives. As expected, the case of Haiti deserves special consideration with only 4.34per cent access to CFT, which is based on the poor socioeconomic conditions in which the vast majority of the population lives, where almost all households use firewood and charcoal as the main energy sources in cooking. In the specific case of CFT, a significant additional effort will be required in countries where the use of firewood and charcoal are the main fuels for cooking food. In addition, WHO has approached this indicator from the perspective of food safety, which without refrigeration or cooking systems can be harmful to health. According to WHO, 13per cent of the population of Latin America and the Caribbean may not consume safe food because they do not have access to modern and safe cooking and refrigeration technologies, equivalent to about 83 million people in 2016. This constitutes a public health problem and poses a high risk to people's lives, as the existence of Foodborne Diseases (FCDs) is increasing.

As a general conclusion, it can be inferred that, if efforts are focused on those countries with the greatest backwardness, there are reasonable expectations that by 2030 the region as a whole will be able to reach the objective outlined in SDG #7.1.

Renewable Energy

According to those available, in the Latin America and the Caribbean region the final consumption of renewable energies covers 27.6per cent of total consumption in 2015. One of the causes of the declining trend may be the incorporation of modern fuels into the energy matrix, such as gas and biofuels, whose share in residential and industrial subsectors has increased. In addition, it should be noted that the renewable energy participation indicator is highly composed of the preponderance of hydroelectric projects.

According to data compiled by the International Renewable Energy Agency (IRENA), the region has an installed renewable energy capacity of 218.2 GW in 2017. Capacity expansion rates show significant increases from 2014 onwards, from which date increases greater than 5per cent are observed. This trend is expected to continue thanks to the policies that have incorporated the countries of the region as part of the measures that seek to increase the share of renewable energy. In this area, the mechanisms for bidding and auctions of renewable energy projects, the tax benefits of importing renewable energy technologies and the accelerated depreciation of assets stand out.

On the other hand, despite a downward trend in final consumption of renewable energy, the region continues to maintain a high share compared to the world average, which is 18.05per cent (World Bank & IEA). An aspect that should be considered in the incorporation of non-conventional renewable energies to the energy matrix in the reduction of the leveled cost of energy. According to studies by Bloomberg New Energy Finance (BNEF), there is evidence that the leveled cost of non-conventional renewable energy is decreasing, this means that installed capacity increases even if the same levels of investment are maintained. The lowering of costs through the analysis of learning curves, presumes that this trend will continue over time thanks to a growing understanding of the manufacturing process of renewable energy technologies. As an example, the global average of generating one Kwh through the use of photovoltaic panels fell from $0.36 in 2010 to $0.10 in 2017 (in dollars) (IRENA, Auction Database). In South America it is observed that wind energy costs on average $0.06Kwh and photovoltaic solar energy $0.13Kwh in 2017. A surprising case of low-level electricity costs is Chile, whose auctions of photovoltaic farms have reached $0.05Kwh (Bloomberg New Energy Finance).

Despite low costs, the data show that installed capacity by type of renewable energy technology is dominated by the participation of hydroelectric plants, which is considerably greater than the rest. However, other types of energy that have strongly entered the energy matrix, such as wind and solar energy, should not

be neglected, as they have significantly increased their installed capacity (e.g. solar from 2.7 MW in 2000 increased to 1500 MW of installed capacity in 2017).

Despite the positive trend observed in recent years, the evolution of the respective shareholdings is still far from achieving the goal of SDG #7.2. However, the great dynamism observed in the development of non-conventional renewable energies and also hydroelectric, generates favorable expectations being able in the short term to achieve significant progress in achieving levels of participation of renewable energies above 30per cent and continue to expand the participation spaces of modern renewable energies.

Energy Efficiency

With regard to energy efficiency, the Latin American and Caribbean region has the lowest energy intensity indices in the world, but also the lowest rates of improvement (around 0.5per cent per year). Between 1990 and 2015, energy intensity decreased from 4.3 MJ/GDP to 3.8 (USD according to the 2011 PPP).

Improvements in energy efficiency are due to the replacement of firewood with more efficient sources such as gas. It should be noted that electrification has also contributed to improving efficiency rates, as it allows the use of more efficient and modern energy sources in various tasks of residential and industrial subsectors. The latter sector has contributed substantially to the reduction of energy intensity, realizing that the energy efficiency plans imposed on the sector have been successful.

With regard to the variation in energy intensity, it can be observed that, during the years 2012, 2013 and 2014, the variation rates have slowed down; however, in 2015 a dynamism returns where a decrease in intensity of over 2per cent is observed. The negative figures represent an improvement and the positive figures represent a setback in the decrease in energy intensity.

CEPALSTAT database shows that in 2016 the region registered an increase in energy intensity from 0.62 in 2015 to 0.63 expressed in thousands of barrels of oil equivalent per million USD. Given that it is only one year, we believe that it is not the long-term trend and rather reflects a trend towards stability of the indicator when compared with previous years (2013 and 2014) where the value was also 0.63.

In reference to the behavior of energy intensity at the subregional level, the sub-regions of Central America, the Caribbean and South America show a decreasing trend. It can be seen that the Caribbean has had an important trend, evolving from 0.12 in 2000 to 0.08 in 2016 (ktoe/MUSD 2011 PPP).

Energy intensity must be focused on strategies that do not compromise economic development or harm people's lives, helping to decouple economic growth from energy consumption, and raising the comfort levels of the population, 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. In this sense, the achievement of the 2030 target can only be achieved by accelerating the rates of reduction in energy intensity. Therefore, improving efficiency will require additional efforts to those that have been made. However, if the stationary trend in the rate of improvement in regional energy efficiency is not reversed, the region will hardly be able to achieve the objective.

II. Policy Implications/Recommendations

The analysis of indicators to monitor the implementation of SDG 7 clearly establishes the urgency to intensify efforts in all dimensions of SDG 7. It is clear that one of the greatest challenges is the foolishness of achieving greater commitments to bolder policies and the willingness to adopt such policies, hand in hand with new technologies. However, it is clear that a major constraint in the region is access to increased

financing.

Given the great heterogeneity of the region, it is necessary to develop ad-hoc solutions for each country based on its socioeconomic characteristics, the degree of development of energy infrastructure, geographical conditions and the technologies available to address the challenges of its energy systems. However, since 2010, the region has accelerated the adoption of policy measures in support of the implementation of SDG 7 and is definitely approaching a level of policy framework as found in Europe.

Latin America and the Caribbean has made significant efforts to promote the use of renewable energy in transport, but has paid little attention to the heating and cooling sector. When it comes to energy efficiency, there is a more consistent pattern in all regions, with policies focused for the electricity sector while heating and cooling, and transport are behind. Countries such as Chile, Mexico, Brazil and Uruguay stand out as leaders in the region with policies that seek to advance in the different dimensions presented by the implementation of SDG 7. In particular, the active role of the State as facilitator of the development of the energy sector should be reinforced based on the country's comparative advantages (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.

a. 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, it will be necessary to turn over to this end an important and permanent flow of economic resources, whether from public or private funds, multilateral banking or international cooperation. For this purpose, it is of fundamental importance that the respective governments generate appropriate institutional and regulatory frameworks, and that they develop human and organizational capacities that make an efficient allocation of these resources possible. In this sense, the inclusion of non-conventional renewable energy technologies in policies, programmes and projects for access to energy, particularly in rural areas, are playing an important role in the process of expanding electricity coverage and everything indicates that this path should be deepened. An approach that combines the development of rural electrification with the general provision of educational and health services within the framework of an integrated SDG agenda can help give the final impetus in this area.

b. In general terms, in terms of affordability and quality of service of the electricity supply, the region maintains a pending debt. The important weight of the energy bill with respect to the income of the most vulnerable sectors of the population raises the need to implement specific policies for these sectors. These policies should include a wide range of instruments to enable poor households to access electricity under advantageous conditions, such as the implementation of social tariffs, the promotion of energy efficiency both to improve housing conditions and to facilitate the acquisition of efficient electrical equipment, and the adoption of programmes to regulate illegal connections.

c. 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 their targeting. Not only does the potential impact on poor households depend on such targeting, but also the possibility of reasonably limiting distortions in consumption decisions that originate in subsidies and of redirecting resources to other priority uses.

d. Recent years have witnessed the implementation of policies that have contributed to the formation of more renewable electricity generation matrices, as a consequence of 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 results, it is imperative that these policies can be sustained over time, becoming true State policies. Furthermore, in order to capture the large investments (public and private) needed to increase the share of renewable energies, stable institutional and regulatory frameworks, clear

rules and transparent procedures will be required. 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.

e. Everything indicates that in several countries of the region traditional biomass will continue to occupy a prominent place in the uses of 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 aspects in which families live. On the other hand, experience indicates that the programs 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 and stimulate the innovative capacity of their organizations, and incorporate the gender dimension in the processes of elaboration, design and implementation of a technology.

f. For energy efficiency to develop, countries must have consolidated regulatory and organizational schemes, trained technical teams and well-oiled and robust financing mechanisms that allow them to ensure the continuity of their activities over time. f. In order for energy efficiency to develop, countries must have consolidated regulatory and organizational schemes, trained technical teams and well-oiled 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.

g. The region has significant experience in the development of energy efficiency programs and projects, and in the implementation of technical standards. But the lack of a comprehensive approach to the issue is often a source of inefficiencies and squandering of resources. To this end, the elaboration of National Energy Efficiency Plans, which define goals and provide instruments to achieve them, helps to break down the barriers that impede their development and to stimulate the development of market mechanisms that facilitate the participation of the private sector, for example, in the field of energy efficiency.

h. Adequate monitoring of the Plans requires a good base of energy statistics and a set of specific indicators that are methodologically consistent. In this sense, it would be propitious to improve and expand the information collection and processing processes and to develop useful energy balances to facilitate the ex-post evaluation of the programs.

i. It is of fundamental importance to deepen the development of energy efficiency standards for energy consuming equipment and elements, with the objective of generating energy labelling systems to inform users in order to promote a rational purchasing decision. Likewise, the implementation of minimum energy efficiency standards should be promoted in order to gradually eliminate from the market the most inefficient equipment and elements in terms of energy consumption.

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POLICY BRIEF #12

SDG 7 IN THE UN ECONOMIC COMMISSION FOR EUROPE REGION

Developed by

United Nations Economic Commission for Europe (UNECE)

In collaboration with

The World Bank and the International Energy Agency (IEA)

Key Messages

The ECE region is a diverse group of 56 countries in Europe, Central Asia, and North America. The fossil fuels industry is dominant, providing just over 80 per cent of total primary energy supply, and shaping national policy approaches and energy decisions. Combined challenges related to energy efficiency, access, heating service affordability, reliability of aging systems, and future resilience require a reconfiguration of the energy industry as a complex of service industries. This could unleash innovation, investment, and improved energy productivity.

Energy access

Access to electricity in the region is at almost 100 per cent, though this figure does not reflect differences in quality and cost, or the energy poverty affecting poor and rural populations during winter months when heating is essential. The region as a whole has 98 per cent access to clean fuels and technologies for cooking. Ensuring physical and economic access to quality energy services, however, requires investments throughout the energy value chain, and government policies and regulations that address a dynamically changing energy market while also protecting vulnerable groups.

Efficiency

Most countries in the region have National Energy Efficiency Action Plans, but have shown limited progress in implementing them. Improving energy efficiency is one of the most cost-effective options for meeting growing energy demand and attaining climate commitments, and there is a largely untapped potential for energy productivity improvements in the industry and transport sectors. National policy frameworks need to eliminate policies that create market-entry barriers, artificially lower energy prices (encouraging wasteful consumption), or maintain production and consumption subsidies that distort markets.

Renewable energy

Renewable energy represented 12 per cent of total final consumption in 2016 (11 per cent in North America, 17 per cent in Western and Central Europe, 24 per cent in Southeast Europe, and 5 per cent in Eastern Europe, the Caucasus, and Central Asia). The region has almost half of the world's installed renewable electricity capacity (869 gigawatts in 2016), close to half (388 GW) from large hydropower stations, 254 GW from wind, and 140 GW from solar photovoltaic systems.

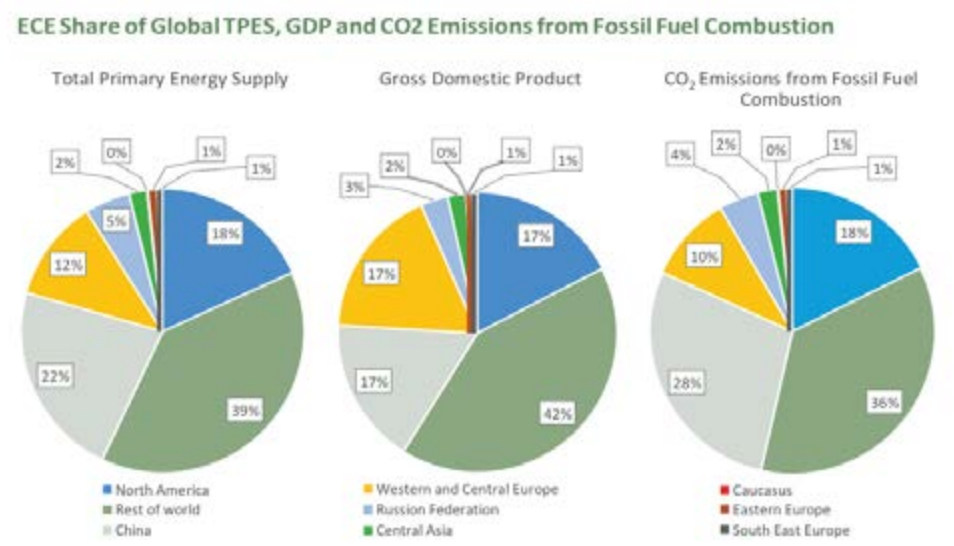
Most ECE member states have adopted renewable energy promotion policies for electricity and heating. For electricity, these include feed-in tariffs (FiTs) or premiums, tax reductions, investment incentives, and, recently, auction mechanisms to reduce the cost of introducing renewable energy. Promotion schemes within the heating sector are mostly used to encourage heat generation from solar thermal energy, followed by biogas/biomass and geothermal energy.

As renewable energy resources are become more cost-competitive, they offer a way to reduce the net carbon intensity of the energy sector, improve energy security, and encourage economic development. Wider uptake of renewables requires addressing barriers to fair competition against conventional technology (without long-term subsidies), implementing stable long-term energy policy frameworks for the future, and deploying innovative and targeted financial mechanisms.

Fossil fuel dependence creates challenges for meeting the 2030 climate objectives. Efforts to decarbonise the system risk aggravating regional energy poverty issues and need to take into account 'just transition' solutions, as well as energy security concerns (energy independence vs. integrated regional grids). New types of energy concerns are also arising due to increasing penetration of digital technology throughout the energy system (hacking, terrorist attacks) and with intensification of climatic events (fires, hurricanes, and rising oceans). These risks create an added imperative to address the challenge of resilience in terms of both planning and recovery.

Status of SDG7 in the ECE region

The ECE region comprises 56 countries with a population of 1.26 billion, or 17 per cent of the world's population. The region has four sub-regions: North America; Western and Central Europe; Southeast Europe; and Eastern Europe, Caucasus, and Central Asia. It is diverse, with high-, middle-, and low-income countries, countries with economies in transition, energy-rich countries, and others with few indigenous energy resources. In 2016, the region accounted for 41 per cent of global gross domestic product (GDP), 39 per cent of the world's total primary energy supply, and 36 per cent of carbon dioxide (CO2) emissions.



Energy access

The region has achieved close to 100 per cent physical access to electricity networks. As noted in the previous tracking report, ageing infrastructure, a lack of supply diversity, and increasing tariffs have led to poor power quality and, for some, energy poverty. This situation is particularly acute during the cold winter months in the Northern hemisphere, and disproportionately affects poor and rural populations.

Human comfort and safety depend on substantial heating services in most ECE countries, a reality not reflected in the statistics on electricity network access. There remains a significant challenge of older, inadequately insulated housing stock locked in to fossil fuel dependence. Many households spend more than 10 per cent of their income on energy.

The region as a whole had achieved 98 per cent access to clean fuels and technology for cooking by 2014, up from 95 per cent in 2000, but access is not homogenous across the region. North America, Europe, and the Russian Federation have achieved the highest levels of access to clean cooking fuels, but countries in the Caucasus and Central Asia regions still have people living in remote places and still rely on traditional fuels for cooking. The rate of access in the sub-region remains at 92 per cent.

Energy efficiency

Improvements in energy intensity continued in 2015 and 2016 at rates between -1.6 per cent (Southeast Europe) and -2.6 per cent (Western and Central Europe). The regional averages mask several countries in

which energy intensities increased, in some cases significantly (e.g., Sweden at +4.9 per cent and Bosnia and Herzegovina at +6 per cent). It must be noted that the energy intensity data do not reflect only progress on energy efficiency but also both cyclical and sustained shifts in economic sectors.

As noted in the previous tracking report, most countries in the region have National Energy Efficiency Action Plans, but have shown limited progress in their implementation. Improving building energy performance is slow, though there has been solid appliance efficiency progress in North America and the countries in the European Union. A largely untapped potential for energy productivity improvement in industry and transport exists across the region.

Renewable energy

Renewable energy in the ECE region grew to 12 per cent of total final consumption in 2016, with 11 per cent in North America, 17 per cent in Western and Central Europe, 24 per cent in Southeast Europe, and 5 per cent in Eastern Europe, the Caucasus, and Central Asia.

The ECE region had an installed renewable electricity capacity of 869 gigawatts (GW) in 2016, accounting for almost half of the world's installed renewable electricity capacity (1,971 GW, excluding pumped and mixed hydropower). Hydropower is the most established renewable energy technology for electricity generation, making up 412 GW (of which 388 GW was installed at large hydropower stations) of total renewable electricity capacity. Wind energy and solar photovoltaics (PV) are the second and third largest renewable energy electricity markets, with installed capacities of 254 GW and 140 GW, respectively. These two markets are also showing the most dramatic growth. Between 2013 and 2016, the compound annual growth rate for the wind energy market was 7.6 per cent, and 10.3 per cent for the PV market.

Most ECE member States have adopted renewable energy promotion schemes—49 member States have schemes in the electricity sector and 41 member States have them in the heating sector. In the electricity sector, the most widely established renewable energy promotion schemes are feed-in tariffs (FiTs) or premiums, tax reductions and investment incentives. More recently countries have been introducing auction mechanisms to reduce the cost of introducing renewable energy. Each of these policy instruments is in place in more than 40 ECE member States. Promotion schemes within the heating sector are mostly used to encourage heat generation from solar thermal energy, followed by biogas/biomass and geothermal energy.

Policy implications

Countries in the ECE have divergent economic development, resource availability, and energy mixes embedded in their national energy strategies. As a consequence, multiple national approaches and outcomes are found.

Existing infrastructure, including the physical, regulatory, policy, and organizational infrastructure of the energy industry, is shaping policy approaches and national energy decision making. There is evidence in the ECE region of challenges in heating service affordability, the reliability of aging systems, and future resilience needs. Truly transforming the energy system will require a creative shift in policy and regulation to unleash innovation, investment, and improved energy productivity. Yet, in many countries in the region, the current political, institutional, regulatory, and physical infrastructure are not yet ready for such a transformation.

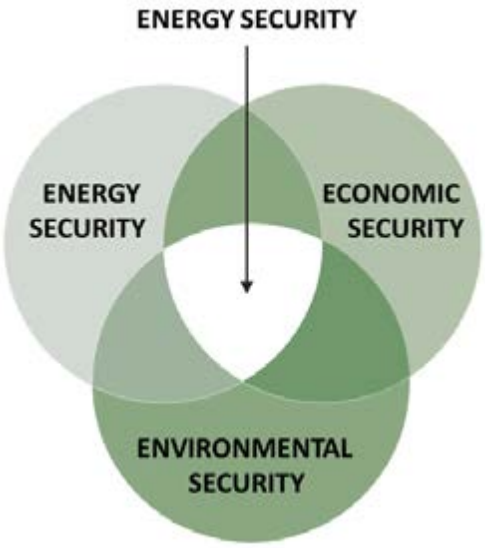
Fossil fuel dependency:

Fossil fuels dominate the region's energy mix and underpin today's energy access and economic development. The locked-in dependency on fossil fuels is a major challenge for any transformation as the social and economic fabric of many countries or regions within countries are based on activities linked to

fossil energy, and deep transformation will have enormous consequences. Beyond employment and the delivery of quality of life, energy can be critical for national incomes, balances of trade, and other geopolitical positioning. The TPES of ECE countries is just over 80 per cent fossil energy.

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 agenda to achieve the aspired decarbonisation of the future energy system. Inasmuch as energy poverty already is an issue in ECE member States, policies to attain climate commitments risk aggravating the issue. Integrated solutions, including "just transitions," require 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 CO_2, mainly from the combustion of fossil fuels, and methane emissions along the coal and gas value chains. The ECE region also is falling short on the relevant indicators for these emissions.



Energy security:

Some countries and sub-regions promote energy independence or self-sufficiency as a means to ensure their energy security, while others strive for efficient integration of energy markets. For the ECE region as a whole, promoting mutually beneficial economic-interdependence would accelerate attainment of the 2030 Agenda through integrative, nexus solutions that the notion of sustainable development offers. For energy, it is critical to think in terms of a wholly interconnected, complex system in which supply, demand, conversation, transport, and transmission interact freely and flexibly. Ensuring energy security as part of the ongoing deep transformation creates an imperative to mobilize needed investment in the energy system of the future that is rational and pragmatic socially, environmentally, and economically.

The concepts of energy security evolved over time from security of supply to a broader view of energy security embracing supply, demand, and transit. However, with increasing penetration of digital technology throughout the energy system and with intensification of climatic events, the energy system is exposed to new risks of either human or natural origins (hacking, terrorist attacks, or natural events like forest fires, hurricanes, and rising oceans). These risks create an added imperative to address the challenge of resilience in terms of both planning and recovery.

Constrained optionality:

Certain options for improving the overall performance of today's energy system are excluded in the

formulation of some national sustainable energy strategies for reasons of public perception, politics, imposed market distortions, or legitimate but possibly solvable concerns of safety or environment. Including them in the future would improve the potential to meet the 2030 Agenda.

Energy as a service, not energy as a commodity:

The energy industry has succeeded in raising quality of life around the world, most notably in the advanced economies but even in the developing world. The energy industry today is a commodity business in which players earn returns by producing and selling more. The existing infrastructure, including the physical, regulatory, policy, and organizational infrastructure of the energy industry, is shaping decisions about the future inasmuch as today's structures are expected to persist in the future. And yet consumer energy services are inadequate. There is evidence in the ECE region of challenges in energy efficiency, energy access, heating service affordability, the reliability of aging systems, and future resilience needs. What is needed for true sustainability is to reconceive the energy industry as a complex of service industries. Such a reconfiguration would unleash innovation, investment, and improved energy productivity. Truly transforming the energy system will require a creative shift in policy and regulation, yet in many countries the current political, regulatory, and industrial infrastructure is not yet ready for such a transformation.

Equitable access to modern energy services requires mobilising adequate resources:

Ensuring physical and economic access to quality energy services requires investment throughout the energy value chain, from primary energy development to end use. Enabling investment requires that governments have a long-term vision for providing sustainable energy services, and that they promulgate sustainable policies and regulations that allow producers and consumers to respond to a dynamically changing energy market. Such a vision should include provision of access to modern energy services for vulnerable groups as part of national poverty reduction strategies and social development policy.

Improving energy efficiency is one of the most cost-effective options for meeting growing energy demand and attaining climate commitments in most countries

Significant potential for improving energy efficiency exists in the ECE region, but attempts to improve energy efficiency often fall short because of flawed national policy frameworks: policies that artificially lower energy prices encourage wasteful consumption; production and consumption subsidies distort markets, housing stocks are poorly managed, land use management is inefficient, new participants face barriers to entry, there are inadequate norms and standards, and the statistics and information to manage energy use and track progress are incomplete. In addition, there is often a lack of public awareness and education about the long-term economic and social benefits of action to improve energy efficiency and productivity.

Renewable energy policies need to be redesigned

Renewable energy resources are becoming cost-competitive in comparison to conventional resources. They offer a way to reduce the net carbon intensity of the energy sector, improve energy security, and encourage economic development. Integrating renewables into the global energy mix will be important as future energy systems are optimized both on- and off-grid. However, wider uptake of renewables requires addressing barriers to fair competition vis-à-vis conventional technology (without resorting to long-term subsidies), implementing stable long-term energy policy frameworks in a future energy system context, and deploying innovative and targeted financial mechanisms. Policies should be designed in light of the economic circumstances and development challenges of countries with renewable energy potential.

POLICY BRIEF #13

ACHIEVING SDG 7 IN SMALL ISLAND DEVELOPING STATES—MID-TERM REVIEW OF THE SAMOA PATHWAY

Developed by

The Office of the High Representative for the Least Developed Countries, Landlocked Countries and Small Island Developing States

In collaboration with

United Nations Industrial Development Organization (UNIDO), the International Renewable Energy Agency (IRENA), the Rocky Mountain Institute, and Saint Lucia

Key Messages

Given the strong interdependence between climate, water, food and agriculture, poverty eradication, improving livelihoods, and access to sustainable energy, the issue of developing viable renewable energy resources coupled with genuine and durable partnerships remains a high priority for Small Island Developing States (SIDS).

In 2014, the international community gathered in Samoa for the Third International Conference on SIDS, which resulted in an intergovernmental agreed outcome document "SIDS Accelerated Modalities of Action (SAMOA) Pathway." One of the priority areas of the SAMOA Pathway is sustainable energy, recognising that dependence on imported fossil fuels has been a major source of economic vulnerability and a key challenge for SIDS. In September 2019, the General Assembly will convene a meeting to review progress in implementing the SAMOA Pathway.

The sustainable energy sector (renewable energy and energy efficiency) offers considerable potential for SIDS, as their dependence on fossil fuel imports leads to some of the highest electricity tariffs in the world, making them extremely vulnerable to fluctuating global energy prices and high transportation costs. SIDS have large potential to use renewable energy sources such as solar, wind, geothermal, hydropower, and tidal power, and to improve their generation, transmission, and demand side efficiency.

The deployment of sustainable energy technologies is considered an effective tool to raise productivity and competitiveness, energy security, energy access, and affordability, and to address the negative externalities of conventional energy systems (e.g., GHG emissions) in an integrated way. However, looking at the moderate growth rates of sustainable energy over the last years, the overall share remains low in a number of SIDS. Therefore, SDG 7 and SDG 13 cannot be attained by 2030 in business-as-usual scenarios.

Despite growing investments over the past decade, sustainable energy markets have not reached economies of scale in SIDS. The deployment of renewable energy and energy efficiency solutions remains hindered by a broad range of barriers and shortcomings related to inadequate policy and regulation: lack of fiscal and non-fiscal incentives; technical limitations; economic challenges; lack of access to affordable finance; limited human and institutional capacity; and inadequate infrastructure, research and development, and innovation frameworks.

SIDS have set ambitious targets to become less reliant on fossil fuels, and require support from international development partners and new partnerships to leverage investments and access new technologies to support their transition to renewable energy, while at the same time strengthening their energy security and resilience. There is a need for stronger regional and SIDS-SIDS cooperation. SIDS markets for sustainable energy products and services remain often small and fragmented. Regional cooperation coupled with harmonised standards and incentives can be important accelerators.

Improved access to affordable finance also remains critical for achieving SDG 7 in SIDS. This includes simplifying the procedures that SIDS need to go through to access climate finance and providing enhanced support for SIDS to navigate the complex climate finance system.

1. Small Island Developing States and the Midterm Review of the SAMOA Pathway

Small Island Developing States (SIDS) are a distinct group of 38 UN Member States and 20 Non-UN Members / Associate Members of regional commissions facing unique social, economic, and environmental vulnerabilities. The three geographical regions in which SIDS are located are the Caribbean, the Pacific, and the Atlantic, Indian Ocean and South China Sea (AIS).

In 2014, the international community gathered in Samoa for the Third International Conference on SIDS to forge a new pathway for the sustainable development of SIDS. The Conference resulted in an intergovernmental agreed outcome document "SIDS Accelerated Modalities of Action (SAMOA) Pathway." The SAMOA Pathway (A/CONF.223/3) reaffirmed that SIDS remain a special case for sustainable development, recognizing SIDS's ownership and leadership in overcoming these challenges. One of the priority areas of the SAMOA Pathway is sustainable energy acknowledging that dependence on imported fossil fuels has been a major source of economic vulnerability and a key challenge for small island developing states for many decades and that sustainable energy, including enhanced accessibility to modern energy services, energy efficiency, and use of economically viable and environmentally sound technology, plays a critical role in enabling the sustainable development of small island developing States.

300 multi-stakeholder partnerships were announced at the Conference in Samoa. More than 15 of these global SIDS partnerships focus on renewable energy and energy efficiency. For example, in line with the established SAMOA Pathway Partnership in 2014, The United Nations Industrial Development Organization (UNIDO) and the Small Island Sustainable Energy and Climate Resilience Organization (SIDS DOCK) established a network of regional sustainable energy centers for SIDS in Africa, Caribbean, Pacific, and Indian Ocean. The network is fully operational. The established centers are operating in the ownership of regional organizations (CARICOM, SPC, ECOWAS). The Caribbean Centre for Renewable Energy and Energy Efficiency Centre (CCREEE) is operating in Bridgetown, Barbados; the Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE) in Nuku'alofa, Tonga; and the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) in Praia, Cabo Verde.

Furthermore, as a direct follow-up of Conference in Samoa, the SIDS Lighthouses initiative was launched at the United Nations Climate Summit in 2014. The initiative, facilitated by the International Renewable Energy Agency (IRENA), brings together SIDS and development partners in a framework for action to support SIDS' energy transformation. Another initiative, the Small Island Developing States Global Business Network (SIDS-GBN), launched by UN-OHRLLS and its partners, is an online platform and resource hub to share best practices in support of private sector partnerships for SIDS. Renewable energy is a cross-cutting themes of the SIDS-GBN, which provides an important bridge to enable closer private sector ties between the three SIDS regions, and also with the international business community.

On 27 September 2019, the General Assembly will convene a one-day high-level meeting to review progress made in addressing the priorities of SIDS through the implementation of the SAMOA Pathway. The Mid-Term Review of the SAMOA Pathway builds on the regional and inter-regional preparatory process as well as the Samoa Partnership Dialogue, that have taken place in 2018.

2. Achieving access to affordable, reliable, sustainable, and modern energy for all in SIDS

Small Island Developing States (SIDS) face additional geographic barriers to economic as well as sustainable energy development. SIDS generally rely heavily on imported fossil fuels for both transportation and electricity generation, while their remoteness poses logistical and financial challenges to trade. The disproportionate reliance on fossil fuels in SIDS renders them highly vulnerable to fluctuations in global

oil prices and directly results in these nations having some of the highest electricity tariffs in the world. This leads to higher costs of living for families and increases in the cost of doing business. Most SIDS rely on widespread use of fossil fuel based (e.g., diesel, heavy fuel) generators for electricity, and with small, dispersed populations, the grid does not always reach all inhabitants, particularly in rural areas. At the same time, SIDS have the potential to access several renewable energy sources, such as solar, wind, geothermal, hydropower, and tidal power, and have the potential to transition to renewable energy by adopting national renewable energy strategies, building the enabling environment, scaling up existing initiatives, establishing new partnerships, adopting new technologies, and gaining better access to financing. Moreover, many SIDS have vast opportunities to decrease their electricity peak demand by improving generation, transmission, and demand-side efficiency through the introduction of standards and labelling schemes (e.g., buildings, appliances, lighting, technical, and economic losses).

In 2017, the proportion of population with access to electricity in SIDS was 82 per cent, representing a small increase from 78 per cent in 2014. The disparities between urban and rural and remote areas remain wide and in 2017, 95 per cent of urban population had access compared to 61 per cent of rural population.

Many SIDS are working towards transitioning to more sustainable energy sectors, where improved energy efficiency and renewable energy play an increasing role. In 2016, 17.6 per cent of the electricity in SIDS was derived from renewable sources.However, a large part of this is still from hydropower and to an even greater extent the traditional use of solid biofuels (mainly for cooking). Since the adoption of the SAMOA Pathway, many SIDS have made moderate progress in renewable energy uptake. The SIDS Lighthouses initiative tracks data on renewable energy for 36 SIDS partners. According to this data, SIDS have installed 280 MW of solar PV and 59 MW of wind between 2014 and 2017. The total installed capacity of renewable energy sources in the power sector (bioenergy, geothermal, solar, wind, and hydropower) increased form 2409 MW in 2014 to 2775 MW in 2017. However, renewables still only account for approximately 10 per cent of total installed capacity in the power sectors of SIDS partners of the initiative and most of their potential remains untapped. Further efforts are therefore required to accelerate the energy transformation in SIDS.

SDG 7 also aims to ensure access to affordable energy for all. Nevertheless, average electricity rates in SIDS still tend to be costly and therefore represent the highest electricity tariffs in the world. More specifically, referring to data from 2018, the average electricity rates of Solomon Islands, Vanuatu, and Cook Islands respectively are 0.99 US$/kWh, 0.60 US$/kWh, and 0.50 US$/kWh. This in contrast to countries such as Germany, the United States, and India, representing electricity rates of 0.33 US$/kWh, 0.13 US$/kWh, and 0.08 US$/kWh in average. High electricity rates in SIDS negatively impact electricity access and hinder socio-economic development.

3. Island ambition to become frontrunners in the renewable energy uptake

Many SIDS are emerging as frontrunners in the pursuit of renewables-based energy systems building on the abundant local and natural resources. Mini-grid and off-grid solutions provide new opportunities to SIDS, given that their populations are spread across tens of thousands of islands. Also, the declining cost of renewable energy and energy efficiency technologies has opened the door for new opportunities to switch to clean energy.

Several SIDS have included in their national plans ambitious targets on increasing the share of renewable energy in their power mix. Additionally, many of them have also set ambitious targets in their Nationally Determined Contributions (NDCs) under the Paris Agreement. For example, Samoa set a conditional target of achieving 100 per cent renewable electricity generation by 2025, through 12 MW of bioenergy, 6 MW of grid-connected solar PV, 3.5 MW of hydropower, and 0.55 MW of wind. Samoa has made noteworthy progress towards meeting this target and when completed, Samoa targets to save about 36 million liters of diesel per year.

To accelerate the progress in achieving SDG 7 in SIDS, the SAMOA Pathway underlines the importance to support actions facilitating access to existing financing mechanisms to increase capital flows for the

implementation of sustainable energy projects in Small Island Developing States for renewable energy and energy efficiency; enhancing international cooperation and cooperation among Small Island Developing States for research and technological development; and for the implementation of appropriate renewable energy, energy-efficient, and environmentally sound technologies for Small Island Developing States, and supporting investment in initiatives by and for Small Island Developing States.

SIDS Dock, SIDS Lighthouses Initiative facilitated by IRENA, and Rocky Mountain Institute's Islands Energy Program have provided valuable support to SIDS in renewable energy uptake. This uptake can be expanded even further by pursuing a few key steps:

- Achieving alignment among national governments and electric utilities in SIDS around a shared vision for the country's energy sector;
- Preparing and updating analytical, long-term plans, such as an Integrated Resource Plan, to identify the optimal energy mix and project portfolios that will achieve the shared vision;
- Improving access to affordable finance and increasing human and institutional capacities; and
- Before projects can be pursued, adequate preparation must be completed to de-risk future projects to enhance their commercial viability. This is in addition to pursuing the required regulatory reform to ensure that any projects developed will ultimately benefit the general population in SIDS.

Pursuing these key steps will greatly enhance the ability of SIDS to achieve SDG 7. Nonetheless, they still face a number of challenges in accessing investment to meet this vital sustainable development goal. The climate finance landscape remains complex and fragmented, placing a considerable burden on SIDS as it relates to their ability to navigate climate financing options and arrangements and to make effective use of available funds. Particular obstacles also include high transaction costs for accessing resources and changing criteria for eligibility, access, implementation, monitoring, and reporting. International Financial Institutions (IFIs) also tend to prefer larger projects over smaller or medium sized, which places SIDS in a disadvantaged position.

Moreover, in a number of SIDS the inability of the domestic private sector to supply sustainable energy quality products and services under competitive prices has become a bottleneck for the uptake of sustainable energy markets. The domestic manufacturing and servicing sector remains weakly developed and growing demand remains underserved by international suppliers and supply chains due to high market entry costs and risks. Moreover, policies and technology transfer programs tend to focus on creating demand for sustainable energy products and services and tend to ignore supplier-oriented actions focused on strengthening domestic innovation systems, productive capacities and entrepreneurship.

Such trends raise concerns regarding the inclusiveness of technology transfer processes. This offers opportunities, but also bears the risk that the local value and job creation effects of such investments remain low and are not sustained in the long-run. Particularly in SIDS even basic equipment and services (e.g., consulting, energy auditing, installation, and maintenance) continue to be imported. The absence of domestic suppliers and service providers questions the long-term sustainability of already undertaken renewable energy investments in various SIDS. The lack of domestic R&D and entrepreneurship hinders the commercialisation of sustainable energy and climate technology (SECT) solutions adapted to the realities of SIDS.

4. Linkages between sustainable energy in SIDS and SDGs to be reviewed in High-Level Political Forum 2019—focus on SDG 13 climate change

Among the sustainable development goals to be reviewed in depth during the 2019 High Level Political Forum is SDG 13: Take urgent action to combat climate change and its impacts. Although SIDS are among

the least responsible for climate change, they are at the forefront of its devasting impacts. For SIDS, climate and energy are inextricably linked. On one hand, the energy sector is the largest contributor to global greenhouse gas emissions, which in turn have contributed to increasing global temperatures and many adverse effects in SIDS. On the other hand, exploitation of the abundant natural renewable energy resources in SIDS can contribute to enhancing energy security and build their resilience, as well as to the achievement of SDGs 7 and 13 and overall sustainable development. It is critically important to look at the energy climate nexus therefore, with a view to exploring integrated approaches to policy development across relevant sectors.

According to the IPCC "Special Report 2018," temperature rise to date has already resulted in profound alterations to human and natural systems, including increases in droughts, floods, and some other types of extreme weather; sea level rise; and biodiversity loss. It is noted that these changes are causing unprecedented risks to vulnerable persons and populations, small islands among them. Recognising the existing and potential impact of these unprecedented risks, SIDS have continually taken the lead in climate action, with early ratification of the Paris Agreement and active engagement in the NDC process. SIDS have championed mitigation measures in their countries, with highly ambitious NDCs with the deployment of about six GW of renewables envisaged.

Ambitious renewable energy targets have been set by SIDS, as a means of minimizing dependency on fossil fuel consumption, while at the same time utilizing their significant energy resources toward sustainable economic growth. Recognising SIDS vast ocean spaces, marine energy, including advances in renewable offshore technologies, have the potential to provide clean energy to SIDS in the future. For SIDS, harnessing local resources such as solar, hydro, wind, and geothermal also has the potential to enhance resilience to the adverse impacts of climate change, including extreme weather events, such as hurricanes. Greater resilience is achieved by developing these resources in a distributed manner to reduce the vulnerability of the electricity system to failures that occur at single points on the grid (single point failures). Benefits are also achieved through increased diversification of the power supply and improved energy access, which lowers the risk of a single resource having an adverse impact on the supply of energy. There is therefore room for further exploration of the possible synergies in policy development in SIDS in the areas of climate and sustainable energy. More coordination on these issues could help SIDS achieve their commitments under the Paris Agreement, as well as the accelerated implementation of the SAMOA Pathway and the SDGs.

5. Making progress: regional experiences and sustainable energy success stories

By looking at the moderate growth rates of sustainable energy and climate technology markets in many SIDS, it becomes obvious that SDG 7 and SDG 13 cannot be attained by 2030 in business-as-usual scenarios. There is need for economies of scale and speed. Regional cooperation and integrated regional markets following harmonised standards and incentives can be important accelerators.

The establishment of a network of regional sustainable energy centers for SIDS in Africa, the Caribbean, the Pacific and the Indian Ocean at the UN Third International Conference on SIDS in Samoa in 2014, was a step towards this direction. The Caribbean Centre for Renewable Energy and Energy Efficiency Centre (CCREEE), the Pacific Centre for Renewable Energy and Energy Efficiency (PCREEE), and the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) aim to accelerate the energy and climate transformation by creating economies of scales, equal progress, and spill-over effects between countries. Through cross-border approaches and methodologies, the centres complement and accelerate national efforts in the areas of policy and regulation, capacity development, knowledge management, awareness raising, as well as the promotion of investment, innovation, and entrepreneurship. The centres serve as a hub for all kind of domestic and international partnerships. Under the Global Network of Regional Sustainable Energy Centers (GN-SEC) platform, the centers cooperate on common island energy issues and adapted solutions.

Over the last 5 years, numerous SIDS have taken steps to increase their uptake of sustainable energy

through national level integrated energy plans, as well as pilot and large-scale projects that build off those plans. Two leading examples include Saint Lucia, and Saint Vincent and the Grenadines. In 2016, non-profit organization Rocky Mountain Institute (RMI) partnered with the Government of Saint Lucia and the electric utility, Saint Lucia Electricity Services Limited (LUCELEC), to develop the country's National Energy Transition Strategy (NETS)—a roadmap that outlines how the electricity needs of Saint Lucia will be met over time while transitioning to renewables and at the same time improving grid reliability, reducing system costs, and increasing energy independence for the country. The NETS identified least-cost energy mix to be pursued to advance the sustainable energy goals of Saint Lucia. This led to the development of a 3 MW solar PV project completed in 2018, representing the island's first utility scale renewable energy project, which was secured at the lowest solar PV price point in the Eastern Caribbean to date. Following this project, the lessons learned and expertise gained proved instrumental in stimulating further clean energy projects in Saint Lucia in collaboration with other partners, including a 10 MW solar PV project, a 12 MW wind project, and a utility scale battery energy storage project, which are all either under development or are undergoing a tender process to select the vendor.

In Saint Vincent and the Grenadines, RMI's collaboration with the Government of the Saint Vincent and the Grenadines, and the local utility Saint Vincent Electricity Services Limited (VINLEC) led to the creation of the 2017 Saint Vincent and the Grenadines National Electricity Transition Strategy (NETS). The document outlined the most cost-effective pathways and clean energy projects for achieving a sustainable energy transition over a 25-year period. Following this, the country pursued plans for a 5 MWh battery storage project—the first energy storage project on the island. Additionally, the Grenadines islands are transitioning away from diesel and towards renewable energy, particularly on the island of Mayreau and Union Island, where microgrids consisting of high penetration solar PV and battery storage were recently commissioned. Combined with the development of a 500 kW solar PV facility near the international airport and the future construction of a 10 MW geothermal plant, Saint Vincent and the Grenadines is well on its way to almost completely reducing its dependence on imported fossil fuels and relying primarily on renewable resources for electricity.

SIDS Lighthouses initiative provides a best practice of a global level partnership. Over the last five years, SIDS partners have gained access to (1) policy, regulatory and technical advisory services for renewable energy roadmaps, assessments and grid stability analyses, as well as project planning, identification, structuring and execution; (2) capacity building for local policy makers, utilities, private sector, financing institutions and other relevant actors; (3) funding for early-stage transactions and project finance, aiming to attract private investments in renewable energy projects; and (4) a platform to share information, knowledge, lessons learned, and good practices.

The initial targets of SIDS Lighthouse for capacity installation by 2020 (i.e., 100 MW of new solar and 20 MW of new wind power) have been exceeded three years ahead of schedule. Taking into consideration the commitments of SIDS and the evolution of their energy context, new priority areas were endorsed in September 2018, and the next phase of the Initiative was launched.

6. Scaling-up progress in the next 5 years

While significant strides have been made in SIDS to advance their sustainable energy development, there is still a need to create and implement action-oriented policy that can spur further advancements. There are 3 key areas where recommendations are of greatest need and benefit for SIDS over the next 5 years:

- sustainable energy regulatory reform;
- organic and local stimulation of sustainable energy initiatives; and
- use of cleaner energy sources in end-use sectors.

In many SIDS, electricity is generated through a standard and common approach—an electric utility and/or

independent power producers (IPPs) generate electricity often through centralized means from large power plants using fossil fuels or first-generation renewables such as hydropower to benefit from economies of scale. The reduction in the cost of renewable energy technologies such as solar PV and wind, as well as the introduction of implementation tools to make energy efficiency more viable, have disrupted the standard model for electricity generation. However, the policies and regulations which govern the generation of electricity have not fully adapted to the changing landscape in many SIDS. As a result, the use of newer, cleaner, and more cost-effective technologies may not be fully realized in SIDS due to expensive import duties on certain materials, and regulations which stymie the use of microgrids and other forms of distributed energy resources (DERs). It is therefore recommended that regulatory reform should be pursued with the aim of identifying the most cost-effective and beneficial ways of delivering electricity to consumers and advancing policies which enable this. Policy reform by key stakeholders could take shape at many levels: At the highest level, governments can develop legislation to remove import duties or taxes on materials used for the advancement of sustainable energy—solar panels, energy efficient light bulbs, batteries for energy storage, and inverters, among others. Additionally, concurrent legislation can be passed to expand the ability to generate electricity to entities other than utilities or IPPs, while changing the incentive structures for most utilities away from depending on electricity sales for revenue, and towards revenue earned based on other objectives such as reliability performance or renewable energy targets hit. The incentivization of energy efficiency through legislation can also be done, as this is often the cheapest and most effective method for managing electricity use in the energy sector.

Even if policies and regulations are enacted to encourage sustainable energy development in SIDS, there may still be a need to stimulate this growth at the local level. In many developing countries, projects focused on renewable energy, energy efficiency, and energy access are often implemented through external organizations which possess the expertise for these projects. Such initiatives are excellent for pilot projects and initial undertakings of complicated ventures, however involvement at the local level can ensure that sustainable energy development matures in SIDS. This could first be done by developing hubs for knowledge sharing of sustainable energy through platforms that are easily accessible by locals. One current example of this is the CARILEC Renewable Energy Community (CAREC), which brings together over 1,000 energy professionals and stakeholders representing over 50 countries from the Caribbean, Indian Ocean, and Pacific—including several continental countries, in an online platform, where they are able to share and learn about energy development best practices across various countries, and both share and increase their knowledge on relevant topics though webinars, podcasts, trainings and conferences. Most importantly, CAREC facilitates South-South exchange, which enables SIDS to learn from each other—resulting in less reliance on external consultants. Developing such platforms at the local level in SIDS will help to stimulate interest in sustainable energy and encourage innovation and creativity around sustainable energy technologies and concepts that can be used in SIDS.

Provided that sustainable energy advancements lead to high penetrations of renewable energy and energy efficiency, as well as increased energy access, benefits in other sectors can be more fully realized. In many SIDS, the transport sector is one of the most polluting sectors, with most transport types dependent on some form of fossil fuel. The pathway to improving this outcome involves a few steps. Firstly, relevant studies should be carried out to establish the extent of vehicle use, health and emissions impact, and uptake of electric vehicles (EVs) in respective SIDS. Once this is completed, the applicability of electric vehicles can be tested through pilot projects for organized groups such as those involved with public transportation, government vehicle fleets, or utility vehicle fleets. This should help to determine the key stress points for the integration of EVs as well as the infrastructure requirements. Once piloted and deemed ready for large-scale implementation, policies can be put in place to incentivize the use of EVs while not disadvantaging undeserved groups in SIDS. Some policy examples include rebates for electric vehicles and reducing time of use rates to encourage charging of EVs at times that support rather than cause stress to the electricity grid. The potential results of such a move could lead to drastic reductions in local emissions, and potentially greater uptake of more efficient forms of transport, either through the use of public transport, or electric

vehicles themselves.

These elements will be vital for making progress in the remaining 5 years of the Samoa Pathway. However, SIDS will also require support from international development partners and new partnerships to leverage investments and access to new technologies to support their transition to renewable energy and at the same time build resilience of SIDS. Also increased support to access climate finance will be critical in scaling-up the progress.

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POLICY BRIEF #14

ACHIEVING SDG 7 IN LANDLOCKED DEVELOPING COUNTRIES

Developed by

The Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries, and Small Island Developing States (UN-OHRLLS)

In collaboration with

United Nations Industrial Development Organization (UNIDO)

Key Messages

There are 32 landlocked developing countries (LLDCs) with special development challenges due to their lack of access to the sea, remoteness, and isolation from world markets. They face high transit costs and difficult procedures in having to cross neighbouring transit countries, which themselves are often affected by similar economic and infrastructure challenges.

The average proportion of the LLDC population with access to electricity rose from 34.5 per cent in 2000 to 56.3 per cent in 2017, but with wide disparities between urban and rural areas, and between countries in Africa compared to those in Latin America and the Euro-Asia region.

Investments in renewable energy infrastructure, along with information and communications technology, are priorities for LLDCs in order to structurally transform their economies towards growth and sustainable development. The renewable energy share in total final energy consumption is close to 62 per cent. However, about 350 million people out of a total population of 500 million rely on biomass for cooking, underscoring the urgent need for improved access to clean and modern cooking energy.

In 2014 the UN General Assembly adopted the Vienna Programme of Action for LLDCs for the Decade 2104-2024 (VPoA), which stressed the importance of access to affordable, reliable renewable energy for economic development. A comprehensive high-level midterm review on the implementation of the VPoA will be held in December 2019, as a plenary meeting of the General Assembly.

Many of the LLDCs have adopted sustainable energy targets in the context of the Paris Agreement's Nationally Determined Contributions or other policy documents. However, despite growing investments over the past decade, sustainable energy markets have not reached economies of scale in LLDCs, and SDG 7 targets cannot be attained by 2030 in business-as-usual scenarios.

While fossil fuel technologies like diesel generators are widely available, the supply chains and logistics for sustainable energy technologies remain underdeveloped and they are often not available, lacking in quality or perceived as not mature enough. Moreover, the lack of a domestic renewable energy industry has led to severe sustainability and maintenance issues for energy projects in various LLDCs.

Many policies and programmes to promote sustainable energy focus on creating demand for products and services, and tend to ignore supplier-oriented actions to strengthen domestic innovation systems, productive industrial capacities and entrepreneurship. Therefore, the domestic and job creation effects along the value chain of sustainable energy investments (in manufacturing and distribution, project planning and development, construction and installation, operation and maintenance, and decommissioning and recycling) remain very limited. Equipment and services continue to be imported, further catalysed by export-driven donor programmes, and lack of business and sustainability models.
Since markets for sustainable energy products and services in LLDCs tend to be small and fragmented, there is a need for cross-country partnerships, cooperation, and integrated markets to address some of the existing demand and supply barriers for sustainable energy market development.

UNIDO, in partnership with various regional organisations and communities, launched the Global Network of Regional Sustainable Energy Centres (GN-SEC) Programme to create and operate sustainable energy centres. Through cross-border approaches and methodologies, the centres can complement and accelerate national efforts in the areas of policy and regulation, capacity development, knowledge and data management, and awareness raising, as well as increased and targeted investment, innovation, and entrepreneurship.

Action-oriented policy recommendations for Landlocked Developing Countries for the next 5 years to promote energy connectivity and energy security.

LLDCs and transit developing countries need to accelerate preparation of power projects (including renewables) and scale up projects on cross border inter-connectors to enable LLDCs experiencing power shortfalls to purchase power from neighboring countries and regional power pools to ensure energy security. The international community is called upon to provide technical and financial support to these efforts.

LLDCs and transit developing countries with support from their development partners should support expansion and upgrading of supply, transmission and distribution, infrastructure and increase investments in improving energy efficiency.

LLDCs should strive to improve transformational energy access that goes beyond meeting basic household needs but includes electricity for productive use that can transform the economies of LLDCs including through renewable energy mini-grids and off-grids.

LLDCs need to intensify the implementation of Rural Electrification Programmes to promote universal access to electricity. These can be funded through state fiscal mechanisms and by international and regional development aid.

It is important to urgently increase access to clean and modern cooking energy, in order to reach universal access to clean cooking by 2030.

LLDCs and transit developing countries with support from their development partners are encouraged to support creation of regional sustainable energy centres and their efforts to boost integrated and inclusive regional LLDCs markets for sustainable energy products and services through joint interventions in the areas of policy and standards, knowledge management, and capacity building, as well as promotion of investment, entrepreneurship, and innovation.

Encourage private sector participation in the development of country's energy sector, in a manner that promotes use of energy in productive sectors.

LLDCs need to strengthen sustainable energy entrepreneurship and innovation, including the promotion of women entrepreneurs.

The international community is called upon to provide technical assistance and capacity building support to strengthen the capacity of LLDCs to develop bankable project proposals in order for them to take full advantage of climate funding for energy projects.

The United Nations systems in particular UNIDO, OHRLLS, and UNFCCC should consider providing platforms and other practical measures to foster enhanced sharing of experiences amongst LLDCs on enhancing sustainable energy.

Landlocked Developing Countries and the Midterm Review of the Vienna Programme of Action

The **32 landlocked developing countries (LLDCs),** with a total population of 500 million, face development challenges related to their geographical disadvantages. Lack of territorial access to the sea, remoteness and isolation from world markets, multiple border crossings, cumbersome transit procedures, inadequate infrastructure and high transit costs continue to impose serious constraints on the overall socio-economic development of landlocked developing countries. Sustainable energy plays a particularly valuable role in helping LLDCs tackle these issues.

The deployment of sustainable energy technologies is considered as an effective tool to tackle economic productivity and competitiveness, energy security, energy access and affordability, and negative externalities of conventional energy systems (e.g., GHG emissions, local pollution) simultaneously and in an integrated way. Sustainable energy is also needed to support faster customs clearance, border crossing, and tracking of shipment that is in transit and other trade facilitation processes that are important for lowering trade costs. Investment in energy infrastructure, along with information and communications technology, is a key priority for LLDCs as it underpins the ability of LLDCs to structurally transform their economies. Furthermore, renewable energy will promote growth and sustainable development and help LLDCs transition towards a low carbon economy.

The importance of sustainable energy is clear. However, the LLDCs still face daunting challenges in achieving universal access to energy, energy efficiency, and in scaling up renewable energy production and use. While the average proportion of population with access to electricity rose from 34.5 per cent in 2000 to 56.3 per cent in 2017, wide disparities between urban and rural areas exist in LLDCs. Furthermore, about 350 million people rely on biomass for cooking, underscoring the urgent need for improved access to clean and modern cooking energy. Other challenges include: lack of adequate financial resources to invest in expanding access, improving efficiency and increasing renewables, capacity constraints in policy formulation and effective implementation, and regulatory institutions. Addressing these challenges is beyond the reach of governments alone.

In an effort to link LLDCs to global opportunities and accelerate their economic and social development, the United Nations General Assembly adopted in 2014 the Vienna Programme of Action for the LLDCs for the Decade 2014-2024 (VPoA). The VPoA has 6 clearly defined priorities and encapsulates a unified stance by the international community on a broad array of crucial issues. This includes concrete steps toward the structural transformation of LLDCs' economies and infrastructure development to improving international trade and bolstering regional integration and cooperation.

The VPoA stresses that energy infrastructure and access to affordable, reliable and renewable energy and related technologies are critically important for modernizing information and communications technology and transit systems, reducing delays and enhancing productive capacity to achieve sustained economic growth and sustainable development.

Additionally, the 2030 Agenda for Sustainable Development acknowledges that the most vulnerable countries, including LLDCs, deserve special attention and makes specific reference to the LLDCs on SDG 7. This is important for enhanced implementation of the Paris Agreement, where nations pledged to constrain their greenhouse gas emissions, with the aim of keeping global warming well below 2°C.

To accelerate progress in this priority area, a High-Level Meeting on "Accelerating Sustainable Energy for All in LLDCs through Innovative Partnerships" was held in 2016, in Vienna, Austria. This was a joint effort by the Government of Austria, the Office of the High Representative for LDCs, LLDCs and SIDS (UN-OHRLLS), and the United Nations Industrial Development Organization (UNIDO). The event provided an opportunity to discuss in detail potential strategies and important recommendations to address existing barriers for enhancing energy access and the deployment of renewable energy and energy efficiency in LLDCs.

Further, the General Assembly of the United Nations decided, in its resolutions 72/232, and 73/243 to convene a comprehensive high-level midterm review on the implementation of the VPoA, to be held in December 2019 in New York, as a plenary meeting of the General Assembly. It will assess the progress made, identify obstacles and constraints encountered, and find ways to further accelerate implementation of the VPoA. It is in this context that this policy brief is being prepared to analyze the progress made since the adoption of the VPoA.

Achieving SDG7 in Landlocked Developing Countries and linkages with other SDGs

Access to electricity

The average proportion of population with access to electricity in LLDCs increased from 49.5 per cent in 2014 to 56.3 per cent in 2017, however the LLDCs still lag behind the world average of 88.8 per cent in 2017. Further disaggregation by region shows that the Euro-Asia region has been able to achieve greater access with an access rate of greater than 98 per cent, followed by Latin America with an access rate of 95 per cent, whilst the African LLDCs are trailing behind with an average access rate of 32 per cent.

Although the LLDCs experienced an increase in electricity in rural areas between 2014 and 2017, the rural urban gap is still significant with 87.6 per cent of the population in urban areas having access, compared to 42.7 per cent in rural areas.

Access to clean cooking solutions

Access to clean fuels and technologies for cooking has gradually improved globally to reach 60 per cent in 2017, from 49 per cent in 2000. However, in LLDCs, the share increased from 28.1 per cent in 2015 to 28.8 per cent in 2017. This reflects that a large proportion of the population in LLDCs remain unable to utilize the benefits of clean energy to improve their health and overall social and economic development.

Renewable energy

The share of renewable energy in total energy consumption increased slightly from 44.8 per cent in 2015 to 45 per cent in 2016. Large part of this is from the traditional use of solid biofuels (mainly for cooking and heating). Despite the potential that renewable energy has for LLDCs, the share of renewable energy has remained rather constant, with only 1 percentage point increase between 2010 and 2016.

Energy efficiency

Energy intensity, measured in terms of primary energy and GDP, has exhibited steady improvement over the period 2000-2016. The global level of primary energy intensity fell from 6.6 in 2000 to 5.1 in 2016 (MJ/US$ 2011 PPP). LLDCs have demonstrated a long-term steep decline in energy intensity, falling from 13.33 in 2000 to 7.5 in 2016. It is important for LLDCs to continue to improve energy intensity in order to achieve SDG target of doubling the rate of improvement in energy efficiency.

Despite growing investments over the past decade, sustainable energy markets have not reached economies of scale in LLDCs. By looking at the moderate growth rates, it becomes obvious that SDG 7 on affordable and clean energy, and SDG 13 on climate action cannot be attained by 2030 in business-as-usual scenarios. Many of the LLDCs have adopted sustainable energy targets in the context of the NDCs or other policy documents. However, the implementation of these commitments lags behind due to manifold barriers related to policy and regulation, fiscal and non-fiscal incentives, technical limitations, economics, finance, capacity, quality infrastructure, R&D and innovation frameworks, knowledge, and awareness. Granting that each country's transition to a sustainable energy sector involves a unique mix of resource opportunities and challenges there are crucial universal areas that can accelerate this transition which require the focus of LLDCs and their partners.

According to the 2018 HLPF Review of the implementation of SDG 7, emerging evidence suggests that off-grid and mini-grid renewable energy solutions are crucial in increasing access to electricity of people in rural areas in the developing world and complementing grid electrification. New business models and a growing number of best practices are accelerating the transformation of the energy systems in many countries. Tailored de-risking and financial instruments addressing sustainable energy investments in urban and rural areas are important. Improving access to technologies, knowledge, and data, as well as strengthening domestic research and development of adapted solutions is crucial. Similarly, improving capacities and qualification frameworks and improving quality standards and certification for products and

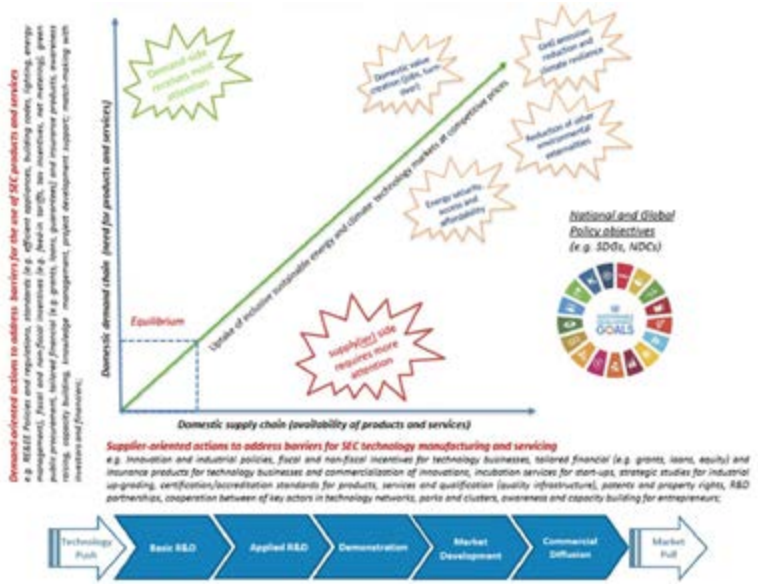
services is necessary.

SDG 7 and SDG 13 have an important SDG 9 dimension, which is critical for LLDCs. Sustainable energy is an important tool to improve the competitiveness and productivity of key industries (manufacturing, generation and distribution of power and energy services, construction, fisheries and agro-processing, tourism, transport, and waste management). The domestic manufacturing and servicing sector remains weak and the growing energy demand remains underserved by international suppliers and supply chains due to high market entry costs and risks. In contrast to fossil fuel-based solutions (e.g., diesel generators), the supply chains and logistics for sustainable energy solutions remain underdeveloped and products and services are either not available or they lack quality. Quality issues and the perception that solutions are not mature enough have been the backdrop for various renewable energy technologies in different parts of the world (e.g., solar thermal, PV). Moreover, the lack of a domestic industry has led to severe sustainability and maintenance issues of energy projects in various LLDCs (e.g., mini-grids).

Countries have introduced a number of policies and regulatory frameworks to promote sustainable energies. However, many policies and programs tend to focus on creating demand for sustainable energy products and services and tend to ignore supplier-oriented actions focused on strengthening domestic innovation systems, productive industrial capacities, and entrepreneurship. Therefore, the domestic and job creation effects along the value chain of sustainable energy investments (i.e., manufacturing and distribution, project planning and development, construction and installation, operation and maintenance, and decommissioning and recycling) often remain very limited.

Equipment and services continue to be imported, further catalyzed by export-driven donor programs and the lack of business and sustainability models. Therefore, it is important to mainstream sustainable energy sector as an important area of industrialization policies of LLDCs. Such trends raise concerns regarding the inclusiveness of technology transfer processes. This offers opportunities, but also bears the risk that the local value and job creation effects of such investments remain low and are not sustained in the long-run. The absence of domestic suppliers and service providers questions the long-term sustainability of already undertaken renewable energy investments in various LLDCs, particularly in sub-Saharan Africa. The lack of domestic R&D and entrepreneurship hinders the commercialisation of SECT solutions adapted to the realities of LLDCs

Figure 1. The uptake of inclusive sustainable Energy markets in LLDCs requires equal emphasis on demand- and supply(ier)-side actions (UNIDO)



Source: UNIDO

Sustainable energy and women's empowerment are mutually reinforcing goals. Energy poverty in LLDCs disproportionally impacts women, especially due to domestic dependence on biofuels, traditional gender roles, and the related health problems. For women to be key agents of sustainable energy, they need to be empowered and fully engaged at all levels of decision-making processes. Therefore, SDG 5 on women's empowerment and SDG 7 on sustainable energy must be tackled jointly through an integrated approach that promotes women's transformational roles in providing innovative energy solutions. Increased financing and policy action are required to accelerate gender mainstreaming of energy interventions, and women's empowerment through sustainable energy solutions. There is need for supporting women as sustainable energy entrepreneurs. Availability of gender disaggregated indicators will be important for monitoring and evaluating all sustainable energy initiatives.

Regional experiences and success stories from Landlocked Developing Countries

Markets for sustainable energy products and services in LLDCs remain often small and fragmented. There is need for economies of scale and speed. Regional partnerships, cooperation, and integration can be effective tools to address some of the existing demand and supply barriers for sustainable energy market development. Integrated markets, which follow joint standards and a common framework, are an important prerequisite for the reduction of investment risks and the uptake of trade with sustainable energy products and services.

In many LLDC regions, the institutional capacities to coordinate and promote regional sustainable energy cooperation and integration are weakly developed. The traditional regional organisations/communities (RECs) and their energy institutions (e.g., regional utility organisations and regulators) are dealing with wider energy and/or interconnection issues and focus often more on traditional energy sources (e.g., gas, coal, and large hydro).

To make regional sustainable energy and climate cooperation and integration a priority, UNIDO, in partnership with various regional organisations/communities, launched the Global Network of Regional Sustainable Energy Centres (GN-SEC) Programme. Under a common framework, UNIDO assists regional organisations in the creation and operation of sustainable energy centres. The GN-SEC is an innovative south-south and triangular multi-stakeholder SDG 7 partnership to accelerate the energy and climate transformation in developing countries. Some of the barriers for the development of SECT markets can be addressed more effectively and at lower cost at sub-regional level.

The gradually expanding partnership comprises a sub-network of centres for the African and the Arab region (in cooperation with the EAC, SADC, ECOWAS, and the Arab League). Currently, the network is expanding to Central America, Central Asia, and the Himalaya-Hindukush region. The ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE), the Regional Centre for Renewable Energy and Energy Efficiency for the Arab region, the Southern African Centre for Renewable Energy and Energy Efficiency (SACREEE), and the East African Centre for Renewable Energy and Energy Efficiency (EACREEE) are covering many LLDCs in Africa.

The regional sustainable energy centres aim to accelerate the energy and climate transformation by creating economies of scales, equal progress and spill-over effects between countries. In partnership with member states and other sub-regional players (e.g., power pools, utility organisations, regulatory authorities, and regional banks), the centres work towards the creation of integrated and inclusive regional markets for SECT products and services. This is being done by setting common targets, policies, standards, and incentives, as well as the de-risking of investments through the provision of reliable data, analytics, bundling of projects, and convening power.

Through cross-border approaches and methodologies, the centres complement and accelerate national

efforts in the areas of policy and regulation, capacity development, knowledge and data management, and awareness raising, as well as the promotion of investment, innovation, and entrepreneurship. The centres serve as a hub for all kind of domestic and international partnerships. They can complement regional banks when it comes to the addressing of "soft" issues hindering the de-risking and long-term sustainability of investments (e.g., policy, standards, laws, qualification, and certification). These issues have usually too high transaction costs for banks and/or lead to unfavourable financing terms (e.g., interest rates).

For example, ECREEE, with the support of UNIDO and other partners, has implemented a comprehensive regional policy process which resulted in the adoption of regional renewable energy, energy efficiency, and energy access targets by 2030. Under the coordination of ECREEE, all member states developed national action plans on renewable energy, energy efficiency, and energy access. In the partnership with DFIs and investors, sustainable energy investment prospectuses were developed. Based on the policies and rural electrification targets, the World Bank is currently developing a US$ 200 million decentralized solar market development program in partnership with ECREEE, EBID, and BOAD.

In the **Africa region**, a number of national power generation and cross border interconnector plans have been adopted, with most of the key projects adopted as part of the master plans for the Regional Economic Communities (RECs) (namely COMESA, EAC, ECCAS, ECOWAS, and SADC) as regional projects, under the auspices of PIDA, the African Development Bank, and other partners. For example, Ethiopia is currently working on a new dam. A key part of the Ethiopian project is the planned interconnector line linking the power station to the Kenyan grid.

Examples of interconnectors projects include the following: the North-South Power Transmission Project extending from Egypt and passing through Sudan, South Sudan, Ethiopia, Kenya, Malawi, Mozambique, Zambia, and Zimbabwe to South Africa, with the Ethiopia—Kenya line being the most advanced having secured funding; the West African Power Pool (WAPP), Cote d'Ivoire-Liberia-Sierra Leone-Guinea (CLSG) Interconnection Project; the Zimbabwe-Zambia-Botswana-Namibia Interconnector; and the Mozambique-South Africa Power Interconnector.

A number of generation plants have been successfully commissioned since 2014, namely: the Kaleta Dam Project (240 MW) in Guinea, the Gibe III Project in Ethiopia (1 800 MW), the Grand Ethiopian Renaissance Dam Project (6 000 MW), the Lauca Hydro-power project (670 MW) and Soyo thermal power project (750 MW) in Angola, the Morupule B thermal power project (120 MW) in Botswana, the Kusile Thermal Power Project (1200 MW) in South Africa, and the Kinyerezi gas fired power project (240 MW) in Tanzania.

The focus has been on preparation of projects to bankability as a key basis for the mobilization of resources. In order to augment power capacity in Africa, a number of renewable energy projects have also been developed in almost all states, including LLDCs. Owing to long gestation periods of power projects, the pace of completion of these projects has been frustratingly slow.

Euro-Asian LLDCs seem, overall, to have done much better than their counterparts in other regions of the world at improving access to electricity. Significant progress has been made in areas such as oil and gas line connectivity, hydro power production and connectivity, and increased public-private partnerships. However, Euro-Asian LLDCs need to increase renewable energy production and use. In 2014, access to electricity in this region reached 100 per cent in 10 of the 14 LLDCs. Exceptions were Lao PDR, a hydro-power surplus country, and Mongolia and Nepal, reflecting the difficult to reach terrain in the latter two LLDCs. Numerous encouraging examples exist across the Euro-Asian LLDCs in accelerating progress in achieving SDG 7. For example, Bhutan has a current installed capacity of 1600 MW, 70 per cent of which is exported to India. During the dry season, Bhutan becomes an energy importing country and Nepal has renewed its efforts in developing and expanding hydropower electricity.

Conclusions

There is need to accelerate the rate of access to electricity and make targeted efforts to close the rural-urban gap so as to reach universal access by 2030. Greater efforts are required to increase access particularly in the Africa region. In the Euro-Asia region, there is need to increase production of renewable energy. In Latin America, further efforts are required to achieve universal access. There is a need to fast track sustainable energy projects in all regions although it is a known fact that energy projects are investment intensive and have long gestation periods.

While great efforts are being made in developing energy infrastructure and connectivity, LLDCs continue to face several challenges in developing energy infrastructure and connectivity. Lack of long-term energy development strategy, policies and programmes have hindered the growth of energy sector. Outdated and inefficient grid and transmission systems result in transmission and distribution loss. Transmission and distribution systems are often managed and run inefficiently, leading to considerable financial losses for energy companies that are mostly state-owned in the LLDCs. Cross-border energy trade is still at its early stages of development, often with the lack of investment resources acting as a binding constraint. Revenue generated by exploitation of oil and gas resources are most often diverted to nonproductive use.

LLDCs are encouraged to create and support enabling environments that facilitate public and private sector investment in relevant and needed cleaner energy technologies. LLDCs should improve coherence between energy, industrial, human resource, research, innovation and export policies, and support instruments. Cross-sectoral approaches need to facilitate the mainstreaming of sustainable energy solutions into key industries (e.g., agro-business, tourism, fishery, construction, and transport). National policy processes should take advantage of regional processes. The experience in Europe and West Africa has demonstrated, that regional policies and implementation processes can be an important tool to accelerate the development and implementation of national policies and standards.

Regional utility organizations (e.g., power pools) in partnership with regional development banks are encouraged to scale-up investments into regional generation and transmission projects. In addition, there is strong need to strengthen technical capacities of regional organizations to support member states effectively in addressing the barriers for sustainable energy markets, industries and innovation.

To accelerate progress, a holistic approach which addresses all the key issues simultaneously, is needed. This will require multi-stakeholder partnerships of many different stakeholders with individual comparative advantages. Strategic shifts in policies are important to create and enforce predictable and coherent demand and supply and regulatory and incentive frameworks.

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World Bank energy access database- Tracking SDG7: The energy progress report 2019

POLICY BRIEF #15

TRACKING SDG 7.1 WITH THE MULTI-TIER FRAMEWORK MEASURING ENERGY ACCESS

Developed by

The World Bank

Key Messages

To date, the SDG 7.1 target on access to affordable, reliable, and modern energy for all is measured through two binary indicators: the proportion of the population with access to electricity and the proportion of the population with access to clean cooking fuels and technologies.

Although convenient, these indicators do not report on the affordability and reliability aspects of people's energy access, leading to a discrepancy between the definition of the goal and the indicators used. Affordability is particularly important, as availability of energy becomes meaningless if the user cannot afford it, whereas inadequate quantity and quality of supply will significantly lower the usefulness of the energy access provided.

The Multi-Tier Framework (MTF) was developed by The World Bank's Energy Sector Management Assistance Program (ESMAP), in consultation with international partners under the Sustainable Energy for All (SEforALL) initiative. It goes beyond the traditional binary measurement of energy access to capture the multidimensional nature of energy access at the end user level, and the vast range of technologies that can provide energy access, while accounting for the wide differences in user experience.

The MTF offers a clear definition of what affordable, reliable, and modern energy access means, and proposes clear measuring indicators. It defines energy access as the ability to obtain energy that is adequate, available when needed, reliable, of good quality, affordable, formal, convenient, healthy, and safe for all required energy applications. It then defines 6 tiers of access, ranging from Tier 0 (no access) to Tier 5 (full access). Energy access is also measured across enterprises and community institutions, not just households, since energy is essential for enterprises in every sector, as well as for community institutions.

Currently available data do not allow for more elaborate indicators to track the SDG 7.1. MTF surveys have been (or are being) conducted in 17 countries so far, and surveys in 6 more countries will be initiated in the near future. Country Diagnostic Reports using the MTF approach have been published for several countries, providing more accurate, granular, and disaggregated data on the level of energy access of households, enterprises, and community institutions.

Countries are strongly encouraged to track energy access in a way that captures its multidimensional nature, by conducting MTF surveys to obtain baseline data and repeating data collection over time to track progress toward their own SDG 7.1 targets. To this end, a short MTF energy module that can be integrated into existing national household surveys is also being developed as a long-term tracking tool for SDG 7.1, in collaboration with the World Bank Living Standards Measurement Study (LSMS) team and the World Health Organization (WHO).

The MTF is shaping up to become a powerful tool for tracking SDG 7.1 progress, and for informing policy and investment decisions. In addition to being a useful tool for setting SDG 7.1 targets and tracking progress toward achieving them, the MTF aims to provide insight into the types of policy reforms and project interventions that drive higher levels of access to energy, while also facilitating monitoring and evaluation. In this way, MTF data analysis offers useful input for policy formulation, investment strategies, project design, utility performance accountability, and evaluations of project impact.

Background

The Energy Sector Management Assistance Program (ESMAP), in consultation with international partners under the Sustainable Energy for All (SEforALL) initiative, developed the Multi-tier Framework (MTF) to monitor and evaluate energy access by following a multi-dimensional approach. Their valuable support and advice have contributed in enhancing the robustness of the MTF approach as a tracking tool for the SDG 7.1. The MTF aims to improve the measurement of energy access, by going beyond the traditional binary measurement of energy access—for example, having or not having a connection to electricity, using or not using clean fuels for cooking—to capture the multidimensional nature of energy access and the vast range of technologies and sources that can provide energy access, while accounting for the wide differences in user experience.

In 2016, energy was included in the new Sustainable Development Goals (SDG), and energy access became the SDG 7.1, which aimed at ensuring 'access to affordable, reliable and modern energy for all.' Achieving such goal not only requires a wide range of interventions by various stakeholders, including international organizations, governments, and the private sector, but also a tool to measure progress toward this multi-dimensional goal.

In support of the UN high-level political forum 2018, policy brief #27 on SDG 7 indicators, acknowledged the need for complementary indicators to capture affordability, reliability and quality of access (UNDESA 2018). It stated that current indicators could be refined and that data collection capacities needed to be enhanced. Also, the adoption of international methodologies for statistics and indicators was seen as a prerequisite for improved analytical quality, global coverage, and comparability. Finally, it stressed the need to consider the broader concept of energy for sustainable development, and measure progress towards all energy-related SDGs to reflect cross-cutting interconnections.

How can the MTF track SDG 7.1 and beyond?

To date, the SDG 7.1, defined as 'access to affordable, reliable and modern energy for all,' is measured through two binary indicators: the proportion of population with access to electricity and the proportion of population with access to clean cooking fuels and technologies, as available data do not allow for a more elaborate measure (Angelou et al. 2013; World Bank and IEA 2015; World Bank 2017a; World Bank 2018a). Although convenient, these indicators do not report on the affordability and reliability aspects of energy access, leading to a discrepancy between the definition of the goal and the indicators used. Being based on the attributes of energy access, the MTF offers a clear definition of what an affordable, reliable, and modern energy access means, it proposes clear measuring indicators for each aspect, as well as a method for combining all these aspects into one indicator to facilitate tracking (Figure 1).

Figure 1. MTF as a tool for tracking progress toward SDG 7.1

Source: Authors

Affordability is a key aspect, as energy access becomes meaningless if the user cannot afford to consume energy and, therefore, cannot benefit from the energy services. Affordability refers to whether users are able to pay for the energy they need. Affordability entails a complex interaction between the quantity of energy consumed, the price of energy, and the ability of the consumer to pay for the energy consumed. The ability to pay is a function of the income level as well as the expenditure priorities of the user. To overcome a series of measurement challenges that affordability entails, the MTF considers that in order for electricity access to be considered affordable, a standard consumption package of 365 kWh per year should amount less than 5 per cent of the household's income. Similarly, the MTF considers access to clean cooking solutions affordable if households spend less than 5 per cent of their expenditures on cooking fuels. Additional indicators for Affordability are suggested for energy access in enterprises and community institutions (for more details, see Bhatia and Angelou 2015).

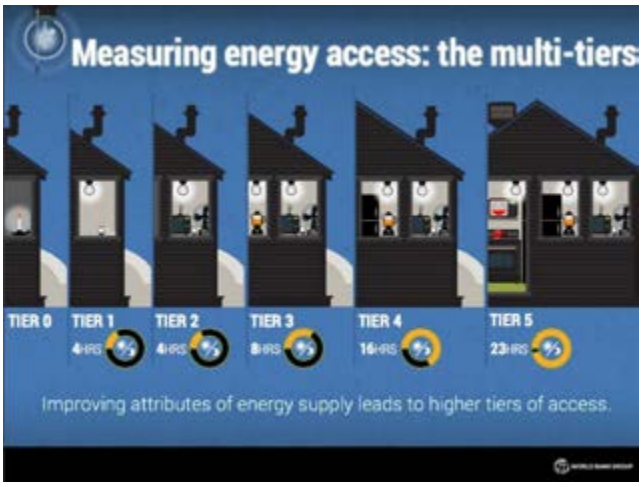
Reliability within the SDG 7.1 appears to be defined in a broader term, suggesting that energy supply should be available when needed. Indeed, inadequate quantity and quality of supply significantly lower the usefulness of energy access provided. The MTF refers to several indicators to measure such term. For electricity, it considers availability—measured by the amount of time during which electricity is available each day and during the evening; reliability—measured by the frequency and duration of unscheduled outages; and quality—measured by the occurrence of voltage issues preventing the use of desired appliances. With regards to access to clean cooking solutions, availability is considered adequate when the primary cooking fuel is readily available for most of the year. Several indicators are based on continuous variables and cannot be categorized into a binary metric, and thus need to be measured through multiple tiers (for more details, see Bhatia and Angelou 2015).

Modern energy usually refers to clean, safe, and, to a certain extent, convenient energy sources. Electricity is by definition a convenient energy source and is often considered a clean source, at least at the point of use. The MTF considers that electricity access is safe if the wiring installation in the household (or other facility) is done according to national standards, ensuring that people are protected from hazards that may arise from the operation of electricity. Safety is measured through the occurrence of past accidents (Bhatia and Angelou 2015). With regards to access to clean cooking solutions, the MTF defines modern energy through Cooking Exposure and Cookstove Efficiency (Padam et al. 2018; Dave et al. 2018; Koo et al. 2018). Cooking Exposure assesses personal exposure to pollutants from cooking activities, which depends on stove emissions, ventilation, and contact time. Cookstove Efficiency assesses the performance of the stove in regard to its thermal efficiency. Convenience is also considered, measured through the time spent acquiring fuel, as well as preparing the fuel and the stove for cooking. Finally, Safety is measured through the occurrence of past accidents.

How does the Multi-Tier Framework measure access to energy?

The MTF defines energy access as the ability to obtain energy that is adequate, available when needed, reliable, of good quality, affordable, formal, convenient, healthy, and safe for all required energy applications across households, enterprises, and community institutions. Based on this definition, the MTF measures energy access provided by any technology or fuel, based on a set of attributes that capture key characteristics of the energy supply that affect the user experience. Based on those attributes, it then defines 6 tiers of access, ranging from Tier 0 (no access) to Tier 5 (full access) (Figure 2).

Figure 2. The MTF approach



Source: Authors

Access to electricity is measured based on 7 attributes: capacity, availability, reliability, quality, affordability, formality, and safety. Tier 0 refers to households that receive electricity for less than 4 hours per day (or less than 1 hour per evening) or that have a primary energy source with capacity of less than 3 watts. Tier 1 refers to households with limited access to small quantities of electricity provided by any technology, even a small solar lighting system, for a few hours a day, enabling electric lighting and phone charging. Higher tiers are defined by higher capacity and longer availability of supply—enabling the use of medium- and high-load appliances (such as a refrigerator, washing machine, or air conditioner)—as well as by adequate affordability and reliability, quality, formality, and safety. A grid is the most likely source for achieving a higher tier, though a diesel generator or a large mini-grid may also do so. Technological advances in photovoltaic solar home systems (SHS) and direct current-powered energy-efficient appliances also make higher access possible.

Access to modern cooking solutions is measured based on 6 attributes: cooking exposure, cookstove efficiency, convenience, safety of the primary cookstove, affordability, and fuel availability. Attributes directly related to the cooking solution (cookstove and fuel), such as cooking exposure, cookstove efficiency, and safety of the primary cookstove, are the main concern in the lower tiers. Households with a 3-stone stove or traditional biomass stove are mostly in Tier 0 (no access), households with an improved biomass stove are more likely to reach Tiers 1–3, and households with a cookstove fueled with electricity, biogas, liquified petroleum gas (LPG), or natural gas reach Tier 4 or 5. Additional attributes—such as convenience, affordability, and fuel availability—come into play in higher tiers.

Along with reflecting the multi-dimensionality of energy access, the MTF also accounts for the wide range of energy access technologies—from solar lanterns to national grids and from 3-stone fires to LPG cookstoves—recognizing the significant differences in the performance of the energy supply from different solutions. The multi-tier approach is designed to be technology and fuel neutral, and captures all underlying factors that impact the user's experience while measuring energy access as a continuum of improvement (as opposed to a binary metric), by setting multiple tiers of access (from Tier 0 to Tier 5).

Beyond the attributes of energy supply, the MTF survey collects data on several related aspects of energy access such as consumption levels, appliance ownership, and energy expenditures, including on backup solutions. It also examines user perception of barriers to grid connection and willingness to pay (WTP) for a grid connection, a SHS, and an improved cookstove (ICS). Demographic and economic data pertaining to households (or enterprises) may be used to complement the diagnostic analysis. MTF data can be disaggregated by urban and rural areas, income quintile and gender of head of household, facilitating policy formulation targeting specific groups, such as the poor and female-headed households.

Beyond households, the MTF measures access to enterprises and community institutions as well. Energy is not only needed at the household level, but is also essential for enterprises in every sector, as well as for community institutions. Energy is one of the key inputs of the production process for most, if not all, enterprises. Access to energy for productive uses increases income, productivity, and employment, while delivering higher-quality and lower-priced goods. It often translates into higher energy demand density and more reliable capacity to pay. Access to energy for community infrastructure (such as schools, health facilities, and government offices) is fundamental for socioeconomic development, as it drives improvements in human capital, and governance. Healthier and better educated people with access to basic community infrastructure have better chances of escaping the poverty trap. The MTF developed specialized matrices measuring access to energy in enterprises, health facilities, schools, and other community infrastructure (Bhatia and Angelou 2015). Similar to households, it captures the multiple attributes that influence access to energy for enterprises and community institutions, in order to inform policy and investment. Access to energy to community services also relates to the achievements of other SDGs.

How can policy makers and private investors use the MTF?

The MTF aims to provide insight into the types of policy reforms and project interventions that would drive higher levels of access to energy, along with facilitating monitoring and evaluation. The richness of MTF data can provide valuable market intelligence for the private sector to identify the market potential. In several countries, results from the MTF survey are helping to deepen sector dialogue and inform policies and investments to meet ambitious access targets. As such, MTF data analysis offers useful input for policy formulation, investment strategies, project design, utility performance accountability, and evaluations of project impact. The MTF is also a useful tool for setting SDG 7.1 targets and track progress toward achieving them.

Inform project design. More accurate measurement of energy access and an improved understanding of the underlying shortfalls are crucial for the success and sustainability of energy projects. MTF data can inform project design during preparation and provide better ex-ante estimation of the likely impact of projects on access. In addition, MTF data on energy consumption, WTP, and several socio-economic variables for households and firms complement and enhance upstream planning activities such as geospatial electrification planning, market assessments for off-grid technologies, assessment for the potential for productive uses development, and demand forecasting for least cost planning. For example, following MTF survey results, the World Bank Renewable Energy Project in Rwanda intends to support the uptake of off-grid systems through the promotion of purchases in instalments. MTF data indicate that the average household expenditure on traditional energy sources for lighting (candles, dry-cell batteries, and kerosene) by households without access to electricity is US$ 1.25 per month. When looking at the richest 40 per cent of off-grid households, the average expenditure rises to US$ 2.5 per month. This implies that about 750,000 off-grid households would be able to afford solar lighting products at an instalment of around US$ 2.5 per month (World Bank 2017c). Under the Ethiopia Electrification Program, an affordability study using MTF data and a geospatial least-cost plan, will be conducted to inform the government's 2019 connection cost policy (World Bank 2018b). In Kenya, MTF data collected in 14 underserved counties were used in designing the Kenya Off-Grid Solar Access Project (KOSAP) in 2016. The MTF data established a baseline and provided nuanced information on the off-grid solar use and potential for scale up. The data were also useful in understanding the WTP and developing a financial plan (subsidies and instalments) that would be affordable for the communities: the analysis showed that over half a million households could theoretically afford a Tier 1 SHS; and that pay-as-you-go (PAYG) is beginning to find its way into underserved counties, as 37 per cent of households that bought a (Tier 1) solar lighting system indicate that they paid in instalments (World Bank 2017d).

Prioritize investment and interventions. By shedding light on the constraints that prevent energy end-users

from achieving higher tiers of access, MTF data can be used to prioritize investments and interventions aiming to move users into higher tiers. MTF data help identify specific gaps and assess deficiencies in the performance of the energy supply, as well as spot opportunities in improving energy access of specific target groups. For example, policy makers could consider increasing electricity generation to increase duration of supply in areas where grid-connected customers are held back in lower tiers due to short duration of electricity supply. For instance, in Rwanda, the data suggest that increasing evening availability and addressing the causes of voltage fluctuations could move most of the households from Tier 3 to a higher tier and enable greater benefits from electricity consumption. Similarly, households that primarily cook with an LPG stove but continue to rely on charcoal as secondary solution, due to frequent shortages of LPG cylinders for instance, could benefit from interventions aiming to improve LPG supply chains, which may lift them into higher tiers of access.

Setting country-specific energy access targets. The multi-tier measurement of energy access enables governments to set their own SDG 7.1 targets, by selecting any energy access tier above Tier 0. Such targets will depend on the country's current context, its development status, the needs of its population, and the budget available. Where funding is limited, governments will need to make trade-offs, for example between moving more people to Tier 1 or 2 and raising some percentage of the population to higher tiers. Both Ethiopia and Rwanda are using the MTF terminology to set or adjust their energy access targets. In 2016, the government of Rwanda started reframing the country's access target following the MTF methodology. It set the ambitious target of reaching Tier 1 electricity access for all by 2020: the overall access target rate of 70 per cent included 31–35 per cent on grid access, 13–17 per cent off grid access through systems providing at least Tier 2 access, and the remaining 22 per cent off grid access through systems providing at least Tier 1 access (World Bank 2017b; World Bank 2017c). In Ethiopia, the MTF helped the World Bank team to advise the government to adjust its definition and measurement of energy access. In the past, the Ethiopian government tracked access at the village, town, or community levels only (through the existence of a MV/LV interconnection). The MTF encouraged the government to shift its approach and track energy access at the household level. The MTF also assisted the government in adopting a tiered (and not binary) tracking framework for electrification. Also, the government recognized the importance of off-grid services as integral part of its electrification program. This resulted in a new baseline for Ethiopia electrification rate at 44.3 per cent in 2018, compared to the historically underestimated rate of 20 per cent.

Support policy formulation. The MTF captures detailed information on the quantity and quality of energy access. MTF data show the distribution of energy access technologies across the country, including grid and off-grid solutions, as well as the range of cooking solutions (cookstoves and fuels) used, and report on the attributes of the energy supply and other related energy aspects. Thus, detailed baseline data can help support policy formulation. For example, in Rwanda, MTF data revealed that the main barrier preventing households from connecting to the grid was the high connection fee. In response to this issue, Rwanda's Ministry of Infrastructure revised its grid connection policy in 2017, to ease the connection requirements for customers that could not afford to pay upfront the US$ 50 connection fee. The amount required could instead be paid in instalments over a number of years (Republic of Rwanda 2018). The government of Rwanda has also initiated public awareness campaigns on the benefits of off-grid electrification, which, coupled with measures improving affordability of low-income households, shall lead to higher electricity consumption (World Bank 2017b). Also, affordability analysis by income quintile can shed light on the impact of energy price increases on households' expenditures.

Assessing the contribution of broader energy interventions in improving energy access. Defining and measuring energy access by considering attributes of energy supply yields a better understanding of how various interventions improve access (Angelou and Bhatia 2014). Energy access projects are typically thought of as those that either provide additional grid connections or disseminate off-grid systems, such as solar lanterns or SHS. However, other types of projects also contribute to improving energy supply and may have a positive effect on access. For example, a generation project may allow for longer hours of supply

and address voltage issues; an energy efficiency intervention may increase the duration of energy supply or improve affordability.

Tracking progress toward SDG 7.1 and beyond. Regular and sustained data collection can be used to evaluate the progress made by a given country toward achieving the SDG 7.1, as well as reflect the contributions of various projects toward improving energy access. In addition, MTF data may lead to a better assessment of the linkages between energy access and economic growth, poverty reduction, human development, and gender equality. The National Institute of Statistics of Rwanda (NISR) has already integrated a part of the MTF short survey module into the national household survey (EICV 5) to track the progress in the tier distribution.

Current MTF survey implementation status

MTF surveys are currently implemented in a growing number of countries, and data will be available on energydata.info and the upcoming MTF website. Country Diagnostic Reports analyzing MTF data have been published for Ethiopia, Cambodia, and Rwanda (Padam et al. 2018; Dave et al. 2018; Koo et al. 2018). As a long-term tracking tool for SDG 7.1, an MTF energy module and a guidance note for statistical offices on how to integrate energy questions into existing national household surveys is also being developed with the World Bank Living Standards Measurement Study (LSMS) team and the World Health Organization (WHO) (World Bank and WHO, Forthcoming). By providing more accurate, granular, and disaggregated data on the level of energy access of households, enterprises, and community institutions, the MTF is gearing up to become a powerful tool for tracking the SDG 7.1, informing policy and investment decisions.

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POLICY BRIEF #16

DIGITALIZATION AND THE FUTURE OF ENERGY SYSTEMS

Developed by

The International Institute for Applied Systems Analysis (IIASA)

In collaboration with

The International Energy Agency (IEA)

Key Messages

Digitalisation offers huge potential to help deliver essential services (e.g., lighting, thermal comfort, communication needs, and mobility) in a more resource-efficient manner and support the achievement of the SDG 7 targets: providing electricity access to everyone (7.1), enabling higher shares of renewable energy (7.2), and supporting improvements in energy efficiency (7.3).

Today, digital technologies can be found in all energy demand and supply sectors, helping to improve the safety, productivity, accessibility and sustainability of energy systems worldwide.

On the energy supply side, the oil, gas, and electricity producers, as well as heavy industries, are using large IT systems to improve safety and productivity. Digital technologies are also influencing efficiency gains in the energy consumption, for example, through smart metering applications in buildings and car sharing systems. Meanwhile, transformative technologies such as autonomous cars are on the horizon in the transport sector, with potentially large but uncertain impacts on overall energy use. Digitalisation could also fundamentally transform the energy system by breaking down boundaries between energy sectors, increasing flexibility, and enabling integration across systems through: (1) smart demand response; (2) improved integration of variable renewable energy sources, (3) implementation of smart charging for electric vehicles (EVs); and (4) improved coordination of distributed electricity resources. Digital technologies and mobile networks can also unlock new business models to support rural electrification, providing electricity services to the 990 million people without electricity access today.

Appropriate policies are crucial to realising the full benefits of digitalisation and its role in achieving SDG 7, especially in terms of increased energy efficiency and integration of renewable energy into energy systems, while also managing potential risks around security, privacy, and rebound effects. With vast volumes of data being collected and processed, questions arise about which data will be critical and prioritised, who should own it, and how best to balance the risks and opportunities of data-driven solutions.

There is an urgent need to bring the sustainability and the digital/technology communities together to align the direction of social and economic change with the 2030 Agenda and a sustainable future, and implement forward-looking roadmaps and governance structures that allow the mitigation of potential trade-offs, particularly relating to impacts on the workplace, social cohesion, and human dignity.

To maximise the potential benefits that digitalisation can bring to the global energy system, policy makers need to build their own skills and knowledge of digital technologies, so that policy responses can be developed from a more informed position. Improved access to data will also open opportunities to realise the benefits from digitalisation, with governments well placed to develop frameworks and structures to access robust, verifiable and secure access to data, and to understand the impact that digitalisation is having on energy demand.

Overview

Digital technologies can support the transition to zero-carbon, circular and resilient societies. They are both indicators used for tracking the SDGs in themselves (e.g., Internet or mobile coverage) and enabling technologies to harness efficiency gains and inducing life style changes, for example in the energy system (e.g., smart metering, car sharing), related to environmental quality and health (e.g., water or air pollution monitoring).

Opportunities

A key element of a sustainability transformation is the notion that wellbeing does not necessarily rely on the consumption of resources per se but is rather derived from the services and amenities these resources help providing. Across a variety of resources (energy, water, land, materials) end-use demand is the ultimate driver and associated improvements in efficiency and reductions in waste therefore offer the largest leverage effects. The digital revolution offers huge potentials to make accessible these services in a much more resource efficient manner (Figure 1).

Figure 1. The rapid progress of information and telecommunication technologies could be an indication of the path-breaking potential of next-generation digital technologies and their clustering in new activities and associated behaviors. A smart phone needs between 2.2 Watts in standby to some 5 Watts in use, while the numerous devices portrayed in the figure that it replaces need up to hundred times more power. Bundling of services from various devices in the smart phone can be seen as an example for the power of the digital revolution and the huge potential of increasing the resource efficiencies through new technologies and behaviors. Graphic courtesy of Nuno Bento based on data in Grubler, Wilson et al. (2018) and visualization of Tupy (2012).

The energy sector has been an early adopter of large IT systems, notably in oil and gas, electricity, and heavy industry. Today, digital technologies can be found in all energy demand and supply sectors, helping to improve the safety, productivity, accessibility, and sustainability of energy systems worldwide. Rapid advances in data, analytics, and connectivity are accelerating the digitalization of energy, opening the door to new models of producing and consuming energy while also raising new security and privacy risks (IEA 2017).

Transport is becoming smarter and more connected, improving safety and efficiency. Digitalization could have its biggest impact on road transport, where connectivity and automation (alongside further electrification) could dramatically reshape mobility. The overall net impacts on energy use are highly uncertain, hinging on the interplay between technology, policy, and behaviour.

In buildings, digitalization could cut energy use by about 10 per cent by using real-time data to improve

operational efficiency (IEA 2017). For example, smart thermostats can anticipate the behaviour of occupants (based on past experience) and use real-time weather forecasts to better predict heating and cooling needs. Digital energy services could also allow consumers to become more active participants in the energy system.

In industry, many companies have a long history of using digital technologies to improve safety and increase production. Further cost-effective energy savings can be achieved through advanced process controls, and by coupling smart sensors and data analytics to predict equipment failure. 3D printing, machine learning, and connectivity could have even greater impacts.

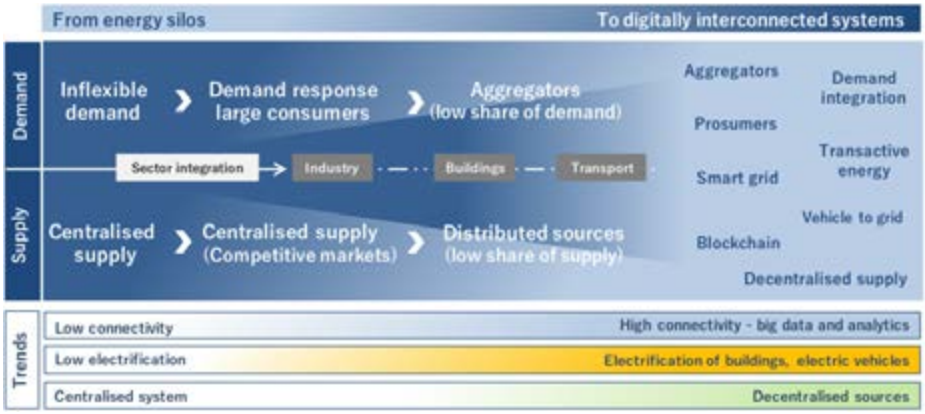
The oil and gas industry has long used digital technologies, notably in upstream, and significant potential remains for digitalization to further enhance operations. Widespread use of digital technologies could decrease production costs between 10 per cent and 20 per cent, including through advanced processing of seismic data, the use of sensors, and enhanced reservoir modelling (IEA 2017).

In the coal industry, digital technologies are increasingly being used in geological modelling, process optimisation, automation, predictive maintenance, and to improve worker health and safety. However, the overall impact of digitalization may be more modest than in other sectors.

In the power sector, digitalization has the potential to save around US$ 80 billion per year, or about 5 per cent of total annual power generation costs (IEA 2017). Digital technologies can help to reduce operation and maintenance costs, improve power plant and network efficiency, reduce unplanned outages and downtime, and extend the operational lifetime of assets.

Digitalization could fundamentally transform the energy system by breaking down boundaries between energy sectors, increasing flexibility, and enabling integration across systems. The electricity sector is at the heart of this transformation, where digitalization is blurring the distinction between generation and consumption (Figure). Digitalization enables four interrelated opportunities: (1) smart demand response and increased system flexibility; (2) greater integration of variable renewables; (3) smart charging of EVs to provide further grid flexibility; and (4) better coordination of distributed energy resources (e.g., rooftop solar PV panels and storage) (IEA 2017).

Figure 2. Possible steps in the digital transformation of the electricity system. The deployment of digital technologies is creating a more interconnected and responsive electricity system, with the potential to help increase flexibility, efficiency and reliability.



Source: IEA (2017).

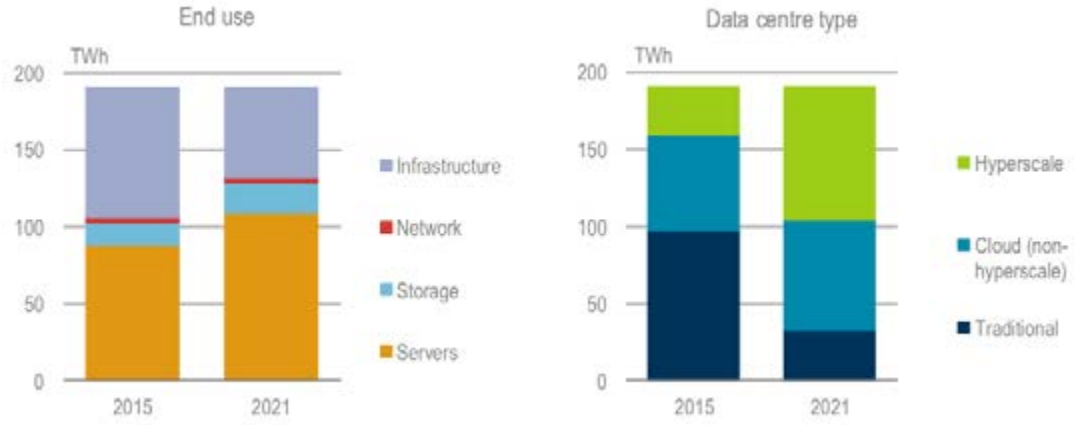
Challenges

As the world becomes increasingly digitalized, data centers and data transmission networks are emerging as

an important source of energy demand (Figure 3). Global data center electricity demand in 2015 amounted to an estimated 191 TWh, or about 1 per cent of global final demand for electricity (IEA 2019). Despite a projected tripling of data center IP traffic and workloads, global data center energy demand is projected to remain flat to 2021, thanks to continued efficiency improvements and a shift to much greater shares of highly efficient cloud and hyperscale data centers. Data networks consumed around 185 TWh globally in 2015, or another 1 per cent of total electricity demand, with mobile networks accounting for around two-thirds of the total.

Given the rapid pace of technological progress and change, providing credible forecasts of data center and network electricity use beyond the next five years is extremely challenging. While demand for these ICT services are expected to continue to grow strongly, how this affects electricity demand will continue to be largely determined by the pace of energy efficiency gains, which will be influenced by government policy.

Figure 3. Global data center electricity demand by end use and data center type.



Source: IEA (2019).

While digitalization can bring many positive benefits, it can also make energy systems more vulnerable to cyber-attacks. Cyber-attacks are becoming easier and cheaper to organise, and the growth of the Internet of Things (IoT) is increasing the potential "cyber-attack surface" in energy systems. Privacy and data ownership are also major concerns for consumers, especially as more detailed data are collected from a growing number of connected devices and appliances. At the same time, aggregated and anonymised individual energy use data can improve understanding of energy systems, such as load profiles, and help lower costs for individual consumers.

All energy sector stakeholders have a role to play in enhancing the digital resilience and security of an increasingly connected energy system. With solutions and processes producing and using vast volumes of data, questions remain around how best to balance the risks and opportunities of data-driven solutions. Digitalizing traditional energy infrastructure will require careful management, given the inherent limits to interoperability.

Implications on the achievement of SDG 7, other SDGs, and the Paris Climate Agreement

The world requires universal access to modern energy services together with a decisive drop in CO_2 and other greenhouse gas emissions. Almost a billion people do not have access to electricity and some 3 billion to clean cooking (IEA 2018). This leads to about 4 million premature deaths, especially women and children who spend most time indoors (WHO 2014). Universal access is essential for development and environmental

sustainability. Positive effects on reduction of greenhouse emissions are likely due to better combustion and shift toward renewables, but are far from sufficient at current rates of progress. The rapid diffusion of mobile phones in the developing world could unlock new business models to provide electricity services to the 990 million people without electricity access today (IEA 2018). Digital technologies can also enable the integration of greater shares of renewables and facilitate harnessing energy efficiency opportunities (see above), supporting the achievement of SDG 7. New digital tools can promote sustainability, including satellites to verify greenhouse gas emissions and technologies to track air pollution at the neighbourhood level.

Policy implications and Recommendations

- **Energy efficiency, increasing the share of renewable energy and carbon capture and storage all play a key role in decarbonizing the energy system while providing access to modern energy for all.** Achieving the Paris Agreement is still possible but only if combined with focus on a broader set of SDGs. Constraints set by the SDGs require a rapid phase-out of fossil-based power generation: more than 70 per cent of electricity will likely need to be produced with zero and low-carbon technologies in 2030 and about 100 per cent in 2050 (TWI2050 2018). This can only be achieved together with a rapid increase in energy efficiency. At the same time, carbon dioxide-removal strategies need to be implemented.
- **Science, technology and innovations (STI) are a powerful driver but the direction of change needs to support sustainable development.** The digital revolution symbolizes the convergence of many innovative technologies, many of which are currently ambivalent in their contribution to sustainable development, simultaneously supporting and threatening the ability to achieve the SDGs. There is an urgent need to bring the sustainability and the digital and technology communities together to align the direction of change with the 2030 Agenda and a sustainable future beyond. There is also a need to implement forward-looking roadmaps and governance structures that allow the mitigation of potential trade-offs of a STI revolution, particularly relating to its impact on the workplace, social cohesion, and human dignity.
- **All energy sector stakeholders have a role to play in managing emerging risks and enhancing the digital resilience of an increasingly connected energy system**. With solutions and processes producing and using vast volumes of data, questions remain around which data will be critical and prioritised, who should own it, and how best to balance the risks and opportunities of data-driven solutions. Digitalizing traditional energy infrastructure will require careful management, given the inherent limits to interoperability found in digital business models.
- **There are a number of actions that policy makers can take to maximise the potential benefits that digitalisation can bring to the global energy system.** Foremost amongst these is policy makers building their own skills and knowledge of digital technologies, so that policy responses can be developed from a more informed position. Improved access to data will also open opportunities to realise the benefits from digitalisation, with governments well placed to develop frameworks and structures to access robust, verifiable, and secure access to data. Improved data access will also improve the ability of policy makers to understand the impact that digitalisation is having on energy demand, because at present forecasting and understanding these impacts remains a challenge.
- **Policies are crucial in shaping a more secure, more sustainable, and smarter energy future.** Several recommendations are not unique to energy, such as related to digital skills or data availability, privacy and security. Others are more specific, such as monitoring the impact of digitalization on energy demand, broadening the discussion on digitalization beyond the energy sector as sectors become more intertwined, designing flexible policies which can accommodate for new technologies and pilot them together with novel technologies to learn from case studies.

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ACTION BRIEF #1

GLOBAL ENERGY INTERCONNECTION

Developed by

Global Energy Interconnection Development and Cooperation Organization (GEIDCO)

In collaboration with

UNFCCC, Sustainable Development Solutions Network, SEforAll, and Regional Center for Renewable Energy and Energy Efficiency

Summary

Global Energy Interconnection (GEI) provides an infrastructure platform through which clean energy can be largely developed, transmitted, and consumed globally using a combination of 'smart grid + ultra high voltage grid + clean energy.' Its aims are to replace fossil fuels with renewable energy in electricity generation, and to replace fossil fuels with clean electricity for energy consumption. The results will be increased electrification levels and energy efficiency for end users, less use of fossil fuels for energy production and as industrial raw materials, lowered carbon emissions, an accelerated energy transition, and advances in sustainable development throughout the world.

Call to action

Concept comprehension: Build consensus and involvement by the United Nations and national governments, incorporate the GEI initiative into multilateral international cooperation frameworks and national energy development strategies, and encourage engagement from both private and public sectors in project investment and implementation.

Cooperation establishment: Call for international cooperation to facilitate policy making to serve the GEI power market, relating to clean energy planning, development, trade, and operation.

Project promotion: Speed up the energy transition pace by developing a pipeline of mature economic and investment projects featuring clean development, electrification, power integration, and smart grids.

Description of the GEI Action Platform

Global Energy Interconnection (GEI) is a clean energy-dominant, electric-centric modern energy system that is globally interconnected, jointly constructed, and mutually beneficial to all. As an action platform, GEI will foster large-scale clean energy exploitation and utilisation, and improve energy efficiency, economy, and sustainability. GEI will help realise an economic, clean, and efficient energy utilisation system, providing a fundamental solution for achieving SDG 7 and sustainable energy for all.

GEI is an innovation to realise world sustainable development

Currently, the world is facing major challenges such as resource scarcity, environmental pollution, climate change, and populations experiencing power poverty and health poverty, together with excessive consumption and reliance on fossil energy. GEI is a groundbreaking innovation that serves as an infrastructure platform, on which clean energy can be largely developed, transmitted and consumed globally. In essence, GEI is "smart grid + Ultra High Voltage grid + clean energy." It aims to achieve the replacement of fossil fuels by renewable energy in electricity generation and replacement of fossil fuels by clean electricity in energy consumption, therefore increasing the electrification level and energy efficiency for end users and limiting the use of fossil fuels as industrial raw materials. GEI is a systematic solution to mitigate over-reliance of fossil energy and heavy carbon emissions, accelerating energy transition and sustainable development of the world.

Building GEI leads to comprehensive benefits

First, it promotes energy transition. In the GEI roadmap, the proportion of clean energy to primary energy consumption worldwide will exceed 70 per cent, and the installed power generation capacity of clean energy will account for 83 per cent, meeting global power demand with clean and green energy.

Second, it solves power poverty. Through large-scale clean energy development and power grid interconnection, annual electricity costs will decrease by US$ 1.8 trillion globally, and the world energy access rate will rise, with electricity provided to 0.1 billion people experiencing power poverty, thus realising sustainable energy for all.

Third, it mitigates climate change. In the GEI roadmap, global carbon dioxide emissions are estimated to reach a peak value in 2025, drop to less than half of the value of 1990 by 2050, and reach zero emissions in 2065, thus meeting the target of controlling temperature rise to within 1.5°C.

Fourth, it addresses environmental pollution. GEI optimises the use of fossil fuels, and directly reduces the emissions of major air pollutants such as sulfur dioxide, nitrogen oxide, and fine particles by 70 per cent, improving the ecological environment.

Fifth, it balances global development. Building GEI encourages energy cooperation. By accelerating clean energy exploitation in less developed regions and turning resource strengths into economic advantages, GEI will foster economic development, minimise discrepancies, and realise inclusive growth worldwide.

GEI achievements

The Global Energy Interconnection Development and Cooperation Organization (GEIDCO) has released significant research studies including: "GEI Backbone Grid Research, GEI Development Index," "GEI Standard System Research," "GEI Technology & Equipment Innovation Outline," and major regional clean development planning reports for Africa, Northeast Asia, and ASEAN countries, in connection with establishing a clean energy development and power interconnection network.

The GEI initiative is recognised by the United Nations. The UN Secretary-General, Mr. António Guterres, commended GEI as a way to achieve world sustainable development and inclusive growth, urging all governments to step up efforts for participation. GEIDO has partnered with key UN entities such as UN DESA, the UNFCCC secretariat, UN Environment, and UN-OHRLLS. GEIDCO has presented the "GEI Action Plan to Promote the 2030 Agenda for Sustainable Development," "GEI Action Plan for Promoting the Implementation of Paris Agreement," "GEI Action Plan for Promoting Global Environmental Protection," and "GEI Action Plan for Addressing Population without Power Access, Poverty and Health Issues" on the occasion of the UN High-level Symposium, and at COP 24, UNEA4, and the Global Conference on Scaling-up Energy Access and Finance in LDCs, respectively. GEIDCO is dedicating efforts to aligning with the 17 SDGs and promoting sustainable development.

GEIDCO has established cooperation ties with major international organisations, such as the African Union Commission, ASEAN Union, League of Arab States, and Gulf Cooperation Council Interconnection Authority (GCCIA), as well as many governments, enterprises, institutions, and universities. GEI is part of several international cooperation frameworks and is ready for implementation.

Specifically, GEIDCO is seeking to speed up some clean energy development and cross-country interconnection projects, such as the exploitation and distribution of hydropower from the Congo River, the Northeast Asia power grid interconnection, the China-Myanmar-Bangladesh power grid interconnection, and the Gulf Region-East Africa power grid interconnection. Moreover, to advance business operations for Africa, Southeast Asia, and Latin America, GEIDCO proposed the coordinated development of electricity, mining, metallurgy, industrial parks and trade, activating the engine for investment, resource exploitation, industrial production, export, and economic benefits. It provides a packaged solution to energise the market and empowers the capability for project financing.

ACTION BRIEF #2

GLOBAL ENERGY AND HEALTH PLATFORM OF ACTION

Developed by

World Health Organization (WHO), United Nations Development Programme (UNPD)

In collaboration with

International Renewable Energy Agency (IRENA)

Summary

WHO and UNDP, together with other key stakeholders such as the World Bank, IRENA, Sustainable Energy for All, the United Nations Foundation, and the Clean Cooking Alliance, are currently building a mechanism for enhanced cooperation among health and energy actors through the establishment of a multi-stakeholder Health and Energy Platform of Action (HEPA).

HEPA's first objective is to mobilise high-level political and financial attention, and commitments to support energy access, particularly for clean cooking and electrification of health care facilities, by bringing together group of 10 to 15 'health and energy champions.' This group will raise awareness about health and energy linkages, provide strategic leadership, call upon policy makers for action, and ensure broad communication and outreach about these issues.

Second, HEPA aims to build a consortium of energy and health practitioners to provide direct support to countries in designing, implementing, and monitoring progress for a 'healthy' sustainable energy transition.

Third, HEPA will develop and disseminate a set of health-targeted communications materials, focused on clean household energy and electrification of healthcare facilities, and aimed at local communities, building on WHO's Breathe Life Campaign and the advocacy work of other partners like IRENA, ENERGIA, Hivos, and the Clean Cooking Alliance.

Health and energy linkages

Well into the 21st century, over 3 billion people around the world still rely on polluting fuels and technology combinations to meet their basic daily energy needs for cooking, heating, and lighting. Almost 4 million deaths per year are attributed to household air pollution from cooking alone. In addition, an estimated 1 billion people rely on health facilities that operate without electricity, which seriously limits access to basic health services. Lack of modern and sustainable energy services in homes and communities has major adverse effects in terms of air pollution, health issues, and social inequities.

SDG 3 (Health) targets:

- 3.2: Reducing neonatal and under-5 mortality rates
- 3.4: Reducing the mortality rate attributed to cardiovascular diseases, cancer, chronic respiratory disease
- 3.8: Achieving universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all
- 3.9: Reducing the mortality rate due to household and ambient air pollution

Given the important linkages between closing the energy access gap and improving people's health and wellbeing, it is critical to have integrated approaches to health and energy challenges, and to address energy-health nexus issues more effectively, particularly in the context of countries with acute energy access gaps. This integration will also provide positive co-benefits in other areas, such as climate, environment, and gender issues. Such integrated approaches will be refined by the HEPA partners over the next year.

Vision for HEPA

The Agenda for Sustainable Development 2030 provides the political impetus to act decisively in addressing energy and health linkages, especially clean cooking challenges and the lack of energy access in healthcare

facilities, and globally aiming to ensure the accelerated deployment of sustainable, scalable, and replicable solutions.

The overall objective of the new Health and Energy Platform of Action is to strengthen the cooperation between different stakeholders working in the health and energy sectors. This will help improve the health and wellbeing of billions around the world through the adoption of clean and sustainable energy.

HEPA's specific objectives:

- **Calling for commitments and mobilizing support**

A lack of high-level political and financial attention and commitments creates critical barriers for achieving SDG 7 energy access targets, particularly clean cooking and electrification of health care facilities. A first step of the HEPA is the establishment of a high-level group on energy and health. The aims of this group of 10 to 15 health and energy champions will be to raise awareness about health and energy linkages, provide strategic leadership, and call upon policy makers for action. This group will play a critical role in ensuring broad communication and outreach about these issues.

Building a network of sustainable energy and health partners for enhanced technical cooperation and knowledge sharing among energy and health actors

There are numerous actors working on energy access and/or related public health issues, but often these efforts are unaligned, under-utilised and/or running in parallel or competing with other initiatives with similar objectives. The HEPA aims to build a consortium of energy and health practitioners, equipped with specialised knowledge and tools, that can be called on to provide direct support to countries in designing, implementing, and monitoring progress for a 'healthy' sustainable energy transition.

- **Strengthening public awareness about the health impacts and other benefits of clean energy, particularly clean cooking and electrification of health facilities, through focused advocacy and outreach at the local, regional, and global level**

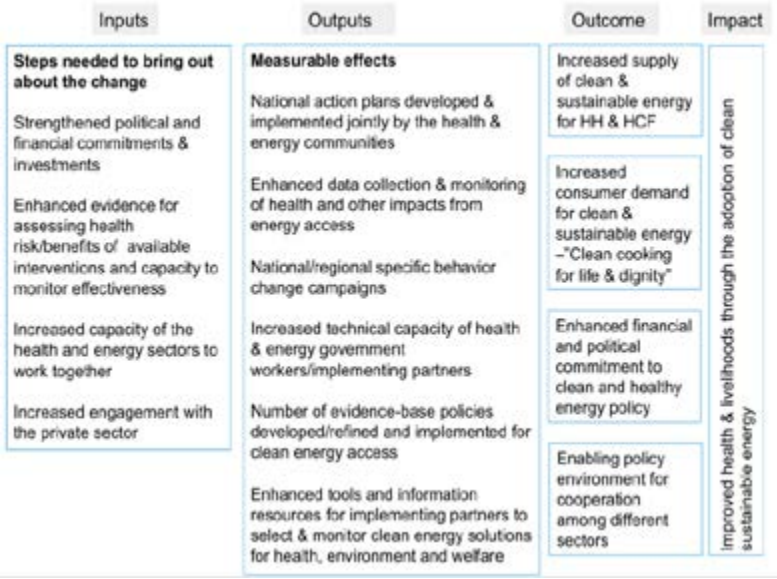
A lack of awareness about the health and other benefits of clean cooking and access to energy in healthcare facilities is a critical barrier at the political level and at the end user / community level. Utilising the strong communications network and branding of WHO's Breathe Life Campaign, and complementing the strong advocacy work of other partners like IRENA, ENERGIA, Hivos, and the Clean Cooking Alliance, a set of health-targeted communications materials focused on clean household energy and electrification of healthcare facilities will be developed and disseminated via the web and various public fora, aimed at local communities.

Priority areas of action

Two initial 'health and energy' priorities for HEPA will be: achieving universal access to clean cooking, as called for in the Ministerial Declaration of the 2018 UN High Level Political Forum;[1] and promoting renewable energy solutions to healthcare service provision in un-electrified and under-electrified areas.

Draft framework overview

1 https://www.un.org/ga/search/view_doc.asp?symbol=E/HLS/2018/1&Lang=E



How will HEPA facilitate, foster, and promote cooperation between the health and energy sectors?

A secretariat will lead consultations and facilitate interactions between technical support teams and countries. Technical support teams will capitalise on and harness existing initiatives in the field of sustainable energy access for clean cooking and healthcare facilities.

Priorities

To catalyse the scale of results required to achieve SDG 3 on health and SDG 7 on energy, the inclusive platform will initially focus on clean cooking and electrification of healthcare facilities by:

- **Mobilising significant political commitments, support, and resources, and finding ways of encouraging new public and private commitments** from the energy and health sectors, as well as from the climate change action arena.
- **Developing global implementation roadmaps** for the priority areas of action identified for and by this platform.
- **Demonstrating leadership** by initiating significant actions and initiatives, in partnership with relevant stakeholders.
- **Conducting advocacy and outreach efforts to strengthen the** high-level engagement opportunities related to SDGs, especially on health, energy, environment, gender, and climate change.
- **Promoting an interdisciplinary approach** engaging a variety of stakeholders at the global, regional, and national level and building on existing initiatives while avoiding duplication of effort, fostering alignment, and creating strong synergies.
- **Working in close cooperation** with the SDG 7-TAG and drawing on the experience and commitments of UN-Energy members, international and national organizations such as the World Bank Group, and many other relevant existing health, energy, and gender networks and civil society organisations, including Hivos and ENERGIA.

Levels of action

Three key levels of support have been identified to advance energy and health collaboration to meet the SDG 3 and 7 targets:

At the political level:

- A high-level group of champions will raise awareness on the impacts of clean energy and mobilise needed political and financial commitments (both public and private investments).
- This group will engage (and facilitate interaction) with governments and legislators, as well as other stakeholders, including financing institutions, donor countries, and foundations.
- The group will also build a network for enhanced political cooperation on policies and implementation.

At the technical level:

- Cooperation will be reinforced between governments and other representatives of health, energy and other sectors (e.g., environment, social welfare, and financing institutions) to develop and implement national action plans for accelerating the transition to clean and sustainable energy, starting with clean cooking and electrification of health facilities.
- A common set of tools and resources for the health and energy sectors will be developed and disseminated to plan, monitor, and evaluate health and other impacts of energy interventions.
- A 'community of practice' will be established for health, energy, and environmental actors to share and exchange information.

At the community level:

- Mechanisms will be set up to increase awareness through local targeted communications campaigns.
- Clinicians, nurses, and community health workers will be encouraged to support the dissemination of clean and sustainable energy interventions.
- The role of the energy sector in speaking about health and clean energy issues will be strengthened.
- Access to finance and affordability may also need to be considered to ensure sustained adoption.

Next steps

In the upcoming year, to advance the development and roll-out of this new Platform of Action, meetings will be organised with a variety of stakeholders to see how to best ensure the maximisation of each partner's contribution to the platform. Consultation processes have already been started to capture government and country priorities, as well as to harness the strengths of the various partnering organisations.

Efforts will focus on building high-level political support and understanding of the health and other benefits of the clean energy transition, including by establishing the high-level group on energy and health. Virtual meetings will be used as a mechanism to kick off the high-level group, followed by face-to-face meetings and consultations at high-level events.

The platform will soon begin working in certain countries to develop an enhanced understanding of the different stakeholders, policies, and programmes on energy and health issues at the country level.

ThepPlatform will also continue to strengthen public awareness about the health and other benefits of clean energy, particularly clean cooking, through focused advocacy and outreach at the local, regional and global level.

ACTION BRIEF #3

GLOBAL NETWORK ON ENERGY AND JOBS

Developed by

The International Renewable Energy Agency (IRENA), and the International Labour Organization (ILO)

In collaboration with

European Commission, United Nations Industrial Development Organization (UNIDO), Global Green Growth Institute, PowerForAll, The World Bank

Summary

IRENA recently initiated the creation of an Energy and Jobs Platform, with the ILO, European Commission, UN Industrial Development Organization, Power for All, Global Green Growth Institute, and the World Bank. As employment opportunities related to renewable energy and energy efficiency expand, it is important to consider how to ensure a just transition regarding different regions, countries, communities and workers.

The initial objectives of the Platform include: improving knowledge about challenges and opportunities; bringing together stakeholders for cross-disciplinary dialogues; sharing best practices and data; strengthening capacity building regarding policies, regulations, and approaches; and enhancing advocacy, communications and outreach to help countries conduct evidence-based dialogues.

Activities would initially build on the ongoing work of the partners, such as: compiling data on the employment implications of the energy transition, including job gains and losses and reskilling efforts; improving knowledge of occupational skills requirements, and measures to ensure everyone is included; assessing the implications of the energy transition for productive uses, industrial development, and regional development; and examining the challenges of a 'just energy transition,' including gender gaps in employment.

The output of the platform could involve creation of an online (data) portal, workshops, case studies and analytical reports, capacity building and training, and outreach and advocacy engagement through international dialogues.

The Energy and Jobs Platform

As the energy transition gathers pace, understanding the importance of socio-economic dimensions is critical. Although conventional energy sources still play a major role, the dynamics of technical innovation, investment patterns, government policies and regulations, and energy market design are poised to give renewable energy and energy efficiency an ever-growing role. Research indicates that the number of jobs in both areas is expanding, while employment in fossil fuels is largely stagnant or declining. Transition scenarios indicate possible pathways over the coming decades, and economic modelling offers an indication of the benefits and challenges along the way, for different regions, countries, and communities.

However, the linkages between energy and employment find expression in multiple additional ways. Important questions concern labour policies, education policies, skills training strategies, workplace quality, and decent jobs policies, as well as ways to empower women and accord equal opportunities in hiring, retention, and career advancement. Ensuring greater energy access is another critical dimension and creates new jobs when new supply chains for mini-grid and off-grid technologies are developed, and when productive energy use supports local jobs and livelihoods. Globally, policies enabling the deployment of renewables need to be accompanied by industrial policies to develop viable supply chains (energy and non-energy related); this is important for broader employment creation and for supporting regional economic development. Finally, the energy-employment nexus needs to aim for a just transition for all.

A number of actors have been active in this field of work for a number of years and produced valuable contributions in the form of knowledge products, workshops, case studies and analytical reports, and capacity building and trainings. Several of these partners have worked together under the SDG 7 Technical Advisory Group to develop the policy brief on the interlinkages between SDG 7 and jobs. To further advance the work on SDG 7 and SDG 8, one of the conclusions was that increased collaboration is needed between partners in this field. As a result, IRENA initiated the creation in early 2019 of an Energy and Jobs Platform. As of today, partners of the platform include the International Labour Organization (ILO), European Commission, UN Industrial Development Organization (UNIDO), Power for All, the Global Green Growth Institute (GGGI), and the World Bank.

At this initial stage, the following tentative objectives have been identified to guide the work of the Platform:

improve knowledge and understanding of key challenges and opportunities;

bring together key stakeholders and stimulate a cross-disciplinary dialogue aimed at addressing varying views, needs, and proposed policies;

share best practices, experiences and quality data;

strengthen capacity building with regard to policies, regulations, and approaches needed to effectively manage the energy-employment interlinkages and their implications for other SDGs; and, finally,

enhance advocacy, communications, and outreach to help countries conduct evidence-based dialogues and facilitate broad-based implementation of SDG 7 and SDG 8.

A mapping of activities and priorities in the field has taken place in early 2019 and, based on these key joint activities, expected outcomes will be identified. Such activities may include discussion of concepts and methodologies, review of report drafts and other partner inputs, joint events, etc.

Some of the previous work of the partners of the platform is highlighted below.

Suggested potential activities for the Energy and Jobs Platform

In order to address the interlinkages between energy and jobs in more detail and further develop analytical insights and policy recommendations, the platform aims to bring together key stakeholders with demonstrated experience in the topic and stimulate a cross-disciplinary dialogue aimed at addressing varying views, needs, and proposed policies.

Activities would initially be conducted building on the ongoing work carried out by all partners. The undertaken activities could include:

- Compiling data on the employment implications of the energy transition, including job gains in renewable energy and energy efficiency, job losses in conventional forms of energy, and reskilling efforts as needed to facilitate job transitions.
- Improving knowledge of occupational and skills requirements, including measures to avoid the emergence of skills gaps and measures to ensure everyone is included (gender, youth, age, and minority and/or disadvantaged groups).

- Analysing broader policies and measures that can maximise the socio-economic benefits of the transition.
- Assessing the implications of the energy transition for industrial development and regional development efforts, including opportunities for leveraging and enhancing domestic capacities along the value chain.
- Examining the challenges and opportunities of a 'just energy transition,' including developing a clear definition and undertaking analysis of the implications for countries, regions, and communities.
- Refining knowledge of qualitative employment aspects.
- Studying the employment and livelihood opportunities in the context of improving energy access and enhanced productive uses of energy.
- Assessing the gender dimension of the energy transition, including gaps between women and men in recruitment, retention and advancement, and the overall talent pool.

Potential activities of the platform could involve an online (data) portal, workshops, case studies and analytical reports, capacity building and trainings, and outreach and advocacy engagements vis-à-vis relevant international dialogues and fora.

ACTION BRIEF #4

GLOBAL PLAN OF ACTION FOR SUSTAINABLE ENERGY SOLUTIONS IN SITUATIONS OF DISPLACEMENT

Developed by

The UN High Commissioner for Refugees (UNHCR), International Organization for Migration (IOM), the UN Institute for Training and Research (UNITAR), the World Food Programme, the UN Food and Agriculture Organization, UNDP, UNEP-DTU, GIZ, the UN Foundation, the Clean Cooking Alliance, Practical Action, the Moving Energy Initiative, SEforAll, and IRENA

Summary

Over 131 million people are in need of humanitarian assistance due to conflict, natural disasters, and other complex global challenges. Current energy practices in situations of displacement are often inefficient, unsafe, expensive, and inadequate for displaced people, harmful to the surrounding environment, and costly for implementers. Therefore, there is a need for systemic actions to address the challenges of integrating sustainable energy solutions into the humanitarian program cycle.

The Global Plan of Action for Sustainable Energy Solutions in Situations of Displacement (GPA) was created in 2018 to address current challenges that impede energy access in humanitarian settings, and to provide a framework that will deliver concrete actions for a more systemic, collaborative approach towards the vision of "safe access to affordable, reliable, sustainable, and modern energy services for all displaced people by 2030."

A Work Plan, launched in 2019, outlines a set of concrete actions to deliver on the recommendations outlined in the GPA Framework Document. The purpose of the work plan is to provide clear, coordinated, and measurable activities, led by sector professionals, to deliver real, lasting, and progressive change that supports humanitarian actors and the displaced people they serve.

Status of Energy Access for Displaced People: need for systemic actions

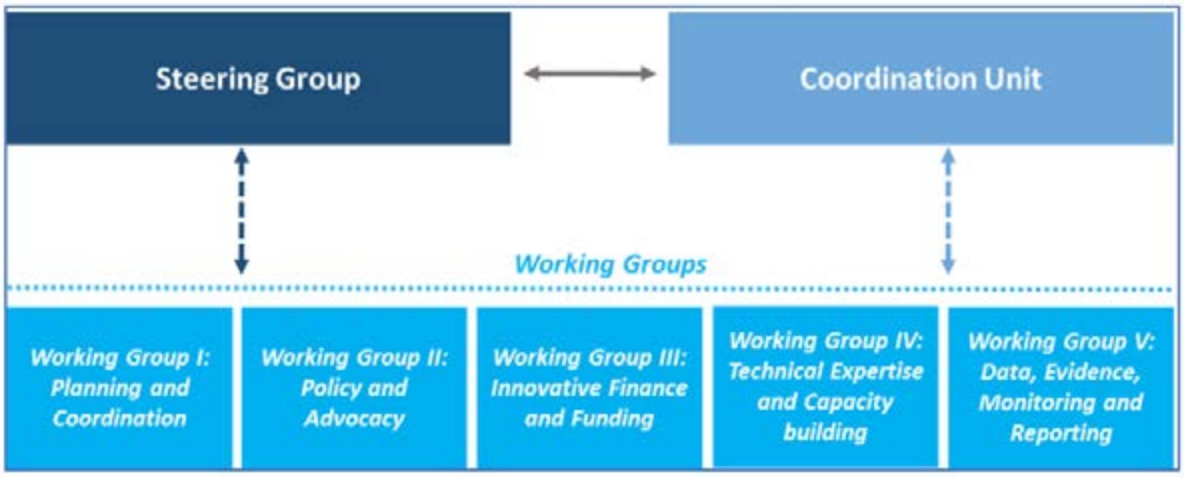
The UN estimates that in 2019, over 131 million people are in need of humanitarian assistance (UN OCHA, 2019) due to conflict, natural disasters, and other complex global challenges. Access to fuel and energy is critical to essential activities such as cooking meals, heating shelters, cooling vaccines, charging communication devices, and powering humanitarian operations. Current energy practices in situations of displacement are often insufficient, inefficient, unsafe, and expensive for displaced people, harmful to the surrounding environment, and costly for implementers.

Given the complex nature of humanitarian operations and the challenges of integrating sustainable energy solutions into the humanitarian program cycle, there is a need for systemic actions to mobilise resources, build capacity, raise awareness, and use the opportunity for energy solutions to enhance positive impacts in protection, health, food security, education, and WASH (water, sanitation, and hygiene) sectors.

In July 2018, the Framework Document of the Global Plan of Action for Sustainable Energy Solutions in Situations of Displacement (GPA) was launched to address the current challenges that impede energy access in humanitarian settings. It provides a basis for a more systemic, collaborative approach towards the vision of "safe access to affordable, reliable, sustainable, and modern energy services for all displaced people by 2030." The document was the result of extensive consultation among humanitarian and development organisations, the private sector, governments, academia, and other stakeholders involved in the provision of fuel and energy to displacement settings.

In October 2018, a Steering Group and a Coordination Unit was established to develop a Work Plan and steer the activities foreseen in 5 Working Groups.

The Work Plan, launched in 2019, is a set of concrete actions that deliver the recommendations outlined in the GPA Framework Document. The purpose of the Work Plan is to provide clear, coordinated, and measurable activities, which are led by sector professionals, to deliver real, lasting and progressive change that supports humanitarian actors and the displaced people they serve.



Interlinkages with other Sustainable Development Goals

Environment

Improving energy response in displacement settings has a direct link to the environment. With access to renewable, reliable energy sources, negative environmental impacts of traditional energy use, such as forest degradation from firewood collection, and CO_2 and short-lived-climate emissions from burning solid fuels for cooking and from the use of diesel generators, can be mitigated.

Economic Development

Having access to sustainable energy enables livelihood opportunities. For example, micro-businesses like barbers and tailors can operate machinery, and use increased hours of light for income generating activities.

Gender Equality

Energy poverty directly impacts the quality of life and economic opportunities of women and girls, as they are traditionally the family members responsible for cooking. The hours spent procuring fuel and cooking over traditional fires or inefficient stoves negatively impacts their ability to attend school, generate income, or engage in rest and leisure. Collecting firewood, often over long distances in remote locations, additionally exposes them to the risk of sexual and gender-based violence, including rape and sexual assault. The lack of fuel for cooking and other household needs can also increase tensions, the risks of intimate partner violence, and conflict with surrounding communities.

Education

Reducing the burden of firewood collection on children and young people can improve school attendance and retention, increasing access to education.

References

UN OCHA (2019), 2019 Global Humanitarian Overview, Geneva.

More information about the Global Plan of Action: https://www.unitar.org/ptp/sustainable-energy

ACTION BRIEF #5

DECENTRALIZED RENEWABLE ENERGY FOR ACCESS

Developed by

HIVOS, The Netherlands, BMZ, and Kenya

In collaboration with

Multi-stakeholder partners

Summary

The Ministerial Declaration of the 2018 High-Level Political Forum[2] underlined the potential of decentralised renewable energy solutions for closing the energy access gap. As a result, a Global Action Plan for Decentralised Renewable Energy was established, which aims to catalyse the full potential of decentralised renewable energy in: 1) reaching universal energy access by 2030; 2) ensuring the provision of decentralised renewable energy in line with needs for inclusive sustainable growth, productivity and employment; and 3) advancing achievement of the other SDGs.

The Action Plan has four priorities: supportive policy and regulation; unlocking finance; working in a multistakeholder approach; and strengthening the role of people. The Action Plan will provide a platform for bringing together key stakeholders and initiatives to discuss energy system transformation and the design of future energy systems, taking into account the essential roles of individual citizens, and the changing roles of finance, governments and utilities.

To enable the acceleration of the deployment of decentralised renewable energy (DRE), the actors involved in the Action Plan call upon business, knowledge institutes, civil society and governments to increase their commitment to support the uptake of DRE solutions. Experts, organisations, platforms and associations that have the capacity to increase the uptake of DRE are asked to join or support the working group.

Background and Achievements of the Global Action Plan for Decentralised Renewable Energy

By 2030, more than 71% of new electricity connections will be via off-grid or mini-grid solutions, according to IEA estimates. Currently, 28 out of 54 RISE (regulatory indicators for sustainable energy) access deficit countries, mainly in sub-Saharan Africa, are lagging behind in the provision of enabling policies and financing facilities for DRE solutions. In addition, SEforAll research shows that only 1.3% of the total tracked financial flow for energy access goes towards DRE. It is thus crucial to accelerate the deployment of DRE through supportive regulatory, financial and policy frameworks, by involving all stakeholders, and by enabling a decentralised and citizen-oriented organisation of the energy sector.

Investing in DRE solutions has a lot of benefits:

- it leapfrogs the fossil fuel phase
- it unlocks co-benefits in areas related to other SDGs (such as education, food security, health, gender, jobs) to wider socio-economic development (through productive use of energy), and to the Paris Agreement
- it fuels a disruptive transformation of the energy sector towards a multi-actor set-up, involving communities.

A broad group of stakeholders working on the topic of DRE indicated support for the Action Plan, from the private sector, civil society, academia, governments and international (financial) institutions. These include UNIDO, IRENA, PowerforAll, BMZ/GIZ, Schneider Electric, SNV, the University of Bergen, REN21, the European Commission, The World Bank, KFW, AfDB, University College London, ENERGIA, GET.Pro and UNDP.

Representatives of DGIS The Netherlands, the Ministry of Energy Kenya and civil society organisation Hivos lead the Action Plan, supporting the sharing of knowledge and best practices, as well as identifying major

2 https://www.un.org/ga/search/view_doc.asp?symbol=E/HLS/2018/1&Lang=E

opportunities to strategise and prototype possible solutions.

A few work streams have been created under the four identified priorities to accelerate the uptake of DRE. Working in a multistakeholder way will be a cross-cutting theme for all work streams:

1. Energy transformation and future design of the energy sector. Topics and initiatives include:

- Crowd-Grid pilots in Tanzania, giving communities control over their energy costs (and potential revenue) and providing energy for productive uses with possibilities for income generation – Energy Change Lab Hivos and the International Institute for Environment and Development (IIED)
- DRE Data network, consisting of a group of research institutes – focus area of PowerforAll, University of Bergen (Centre for Climate and Energy Transformation)
- Better Power - Research on how increased transparency and accountability can spur the energy transition – Hivos and IIED
- Utility of the Future - pilots on potential business models – PowerforAll, Shell Foundation
- Bottom-up community-led initiatives including strong focus on working in a multistakeholder way - as seen in countries such as Indonesia, Cambodia and Nepal – Research by IRENA & Sumba Iconic Island Initiative in Indonesia by Hivos and Government of Indonesia

2. Strengthening the role of people throughout the energy value chain, from producers to users, from consumers to prosumers. This work stream will cover topics and initiatives like:

- Campaign on jobs in the DRE sector led by Schneider Electric and PowerforAll
- Strengthen Productive Use of Energy – focus area of The World Bank, Hivos
- Energy for life - SDG 7 as an enabler of multiple nexuses including health, agriculture and water, developing catalytic actions to unlock productive use of energy – research in Kenya initiated by the Ministry of Energy of Kenya
- Youth energy leadership programme – Energy Change Lab Hivos and IIED
- Green People's Energy Initiative focusing on DRE solutions for rural communities, by involving (local) authorities, supporting investments and creating new, future-proof jobs – BMZ Germany.

3. Supportive policy and regulation. Initiatives include:

- Collect and learn from emerging ways to roll out DRE at scale notably through auction processes – focus area of the AfDB
- Using the RISE framework - outreach on the data highlighting best practices – The World Bank
- Classification of supportive measures for accelerated deployment of mini-grids, along with policy analysis and showcasing trends, best practices and challenges - IRENA
- Providing support to developers and policy makers through the Green Mini-Grid Helpdesk – an initiative of the AfDB
- The Cooperation On Science and Technology (COST) Action European Energy Poverty: Agenda Co-Creation and Knowledge Innovation.

4. Adequate Finance Instruments. Initiatives include:

- High level platform on sustainable energy investments serving as the Task Force for the Africa-Europe Alliance for Sustainable investments and jobs – led by the European Commission
- Creating a level playing field for different electricity solutions, including through results-based financing approaches – focus area of the AfDB
- Developing ways to provide funding to strengthen off-grid players and to enhance community based energy access – KFW, Hivos, Selco
- Development of energy access solutions that meet the special needs of the poor – EnDev
- Results-based finance incentives to drive business-led innovation in using decentralised renewables towards universal energy access – SNV, DGIS and EnDev.

Call to Action

To enable the acceleration of DRE deployment, the actors involved in the Action Plan call upon business, knowledge institutes, civil society and governments to increase their commitment to support the uptake of DRE solutions, raise the profile of DRE and strengthen the focus on DRE in finance, policy and regulation, and ensure a people-centred and multistakeholder approach.

To be more specific:

- Countries with a large energy access deficit will need to increase support for mini-grid and off-grid in national electrification plans, and address shortcomings in regulatory, financial and administrative frameworks for renewables.
    1. Policy and regulation: create policies and regulations at the local and national level which will support DRE and stimulate productive uses of DRE
    2. Financial: promote incentives which support DRE deployment
    3. Institutional: create a dedicated institution to display DRE deployment as a policy goal and, hence, attract the attention of key public and private actors, including investors
    4. Administrative: deploy standard procurement documents to fast-track contractual arrangements
- Increase the focus of integrated energy planning and monitoring on value maximisation, considering both grid improvement and extension as well as decentralised electrification of rural areas. The international community will need to refine the instruments for multistakeholder participatory planning and monitoring of SDG 7.
    1. This implies understanding the entire value chains affected by DRE deployment. One should abstract from sole cost of energy as $ per kWh to also consider the provision of energy services and embrace further related benefits linked to SDGs achievement.
    2. It also means targeting job creation and developing human capital, with special attention for youth and women.
    3. Special attention needs to be paid to operation and maintenance, recycling and proper waste management.
- The financial landscape needs to shift towards inclusive financial frameworks and smart financial incentives, taking into account the needs of local SMEs and more remote and poor people to generate, distribute and sell DRE. For governments, this translates into introducing clear investment frameworks tailored to different DRE solutions, cost-reflective tariff settings or provision for viability gap funding,

and dedicated funding facilities.

1. Feasible business models that include local SMEs, productive use of energy, as well as (small) commercial and industrial end-users should be developed. Local producers should be trained accordingly to create transformation at the local scale
2. Incentivise the discussion on impact vs. volume of financing for the off-grid sector and find smart ways and scalable approaches for IFIs, donors and domestic governments.

- Going forward, it will be critical to strengthen the role of people throughout the entire energy supply chain—from producers to users —to achieve a long-lasting, equitable transformative change in energy access, by:
  1. Including local communities, women and youth and empowering them with knowledge of sustainable energy to drive the transformation from the bottom up.
  2. Ensuring planning based on demand, driven by consumers and entrepreneurial needs, with joint planning and budgeting from different ministries and donor departments, and integrated with the wider development agenda.

Experts, organisations, platforms and associations that have the capacity to increase the uptake of DRE are asked to join the working group, share experiences and support the transition to DRE solutions in countries and regions of need, thus ultimately supporting the achievement of the Agenda 2030 and Paris Agreement.

ACTION BRIEF #6

SUSTAINABLE WATER AND ENERGY SOLUTIONS NETWORK

Developed by

UN DESA

In collaboration with

ITAIPU Binacional and Multi-stakeholder partners

Summary

Water and energy are essential for human development, and inextricably linked. With 90,per cent of global electricity generation requiring intense water output, and the water sector requiring energy to distribute, purify, and recycle water, the need for more sustainably managed natural resources has never been more urgent. To mobilise and scale up multistakeholder action towards this goal, the United Nations Department of Economic and Social Affairs (UN DESA) and Itaipu Binacional (the Brazil-Paraguay dam management entity) launched the Sustainable Water and Energy Solutions Network at the UN Climate Change Conference (COP 24) in Katowice, Poland.

The network will work towards the sustainable use and management of water and energy resources so that more people have access to safe drinking water and clean energy, while also making the water and energy industries themselves more carbon neutral. Partners within the Solutions Network will leverage their skills, share best practices and quality data on water-energy interlinkages, and strengthen capacity building with a focus on planning, designing, implementing, and monitoring policies and business models that effectively address current shortcomings.

Stakeholders from all regions are invited to join the network to promote integrated approaches to SDG 6 (water) and SDG 7 (energy) in support of the achievement of the 2030 Agenda.

Background and Description of the Action Platform

The 2030 Agenda for Sustainable Development recognises that improved access to both water and energy is needed in advancing sustainable development. Progress on SDG 6 on water and SDG 7 on energy will also have an effect on a range of other Sustainable Development Goals, such as those on 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.

Recognising the need to address the interlinkages between water and energy and their contributions to the advancement of other SDGs, UN DESA and ITAIPU Binacional, have joined efforts in a partnership entitled 'Sustainable Water and Energy Solutions' to promote water and energy sustainability and other SDGs. The initiative calls for a global sustainability network on SDG 6 and SDG 7 interlinkages, with a large number of stakeholders from all regions and constituencies. The aim is to bring together all stakeholders to promote integrated approach to SDG 6 and SDG 7 in support of the 2030 Agenda for Sustainable Development.

Vision

The Sustainable Water and Energy Solutions Network works toward the vision of a world where there is an equitable and sustainable use and management of water and energy resources for all, in support of human wellbeing, ecosystem integrity and a robust, inclusive economy, under the umbrella of the 2030 Agenda for Sustainable Development.

The goal of this multistakeholder network is to provide a global platform for all stakeholders to enhance capacities and signal their high-level commitment to the integrated approach to SDG 6 and SDG 7 in support of the SDGs achievement. More specifically, the objectives will be to:

- Share best practices, experiences, and quality data on the water-energy interlinkages and their contributions to other SDGs.
- Strengthen capacity building with a focus on the planning, designing, implementing and monitoring of policies, regulations, business models, and investment to effectively manage the water-energy interlinkages and their implications on other SDGs.

- Mobilise and scale up multistakeholder actions aimed at stimulating integrated water-energy response addressing cross-sectoral barriers in other development sectors.
- Enhance advocacy, communications and outreach to help countries conduct evidence-based dialogues and facilitate broad-based implementation of SDG 6 and SDG 7.

Activities and Deliverables

During the initial phase of 2 years, it is proposed that the Network will undertake, the following activities, among others:

- Compile a series of case studies that present concrete examples of integrated responses to water (SDG 6) and energy (SDG 7), including impacts on other SDGs.
- Develop operational principles and practical guiding materials for designing, implementing, and monitoring integrated responses to water (SDG 6) and energy (SDG 7), building, inter alia, on findings from the case studies.
- Promote integrated sustainable water and energy solutions by creating incentives in the form of grants, research fellowships, internships, etc.
- Undertake capacity building workshops, using the case studies and operational principles/tool kit as background materials.
- Conduct global outreach and advocacy engagements to inform relevant international dialogues including the UN High Level Political Forum, UNFCC COP, UN Decade for Sustainable Energy for All 2014-2024, and the International Decade for Action: Water for Sustainable Development 2018-2028, as well as other potential global, regional, and national related events.

A more detailed work plan will be developed with a group of initial partners. At the end of the initial phase (2 years), a forward-looking review of the Network will be conducted to take stock of key lessons and inform next steps.

Partners

To achieve its mission and vision, the Sustainable Water and Energy Solutions Network aims to partner with a wide range of stakeholders with demonstrated experience in managing water-energy interlinkages for sustainable development. This includes, among others, UN system entities and other international organisations, governments and government agencies at national and sub-national level, private sector companies, civil society organisations, academia, and others.

Besides UN DESA and Itaipu Binacional, initial members of the network include the Government of Spain, the UN Framework Convention on Climate Change, the International Hydropower Association, the World Energy Council, the National Water Agency of Brazil, TERI School of Advanced Studies, the International Centre for Hydropower, the Sugar Association of Guatemala, the UN Economic Commission for Europe, the UN Economic and Social Commission for Western Asia, and UN-Habitat.

The inaugural meetings of the network will take place on 13-14 May 2019 in Paris, in the margins of the World Hydropower Congress.

Call to Action

Stakeholders from all regions are invited to join the network to promote integrated approaches to SDG 6 (water) and SDG 7 (energy) in support of the achievement of the 2030 Agenda. The objective is to enhance capacities, dialogues and cooperation at all levels, for enabling cross-sectoral approaches, advocacy and knowledge management that address SDG 6 and SDG 7 and interlinkages with other SDGs holistically, in order to accelerate progress towards the 2030 Agenda for Sustainable Development.

Partners will directly or indirectly support the activities of the Network on a voluntary basis, and help leverage skills, expertise and other resources that will support and advance its mission. While every effort will be made to leverage the existing capacities of the partners to undertake the activities, it is anticipated that the Network will require some financial resources to facilitate its work. Partners are therefore encouraged to consider direct or indirect contributions, or to support mobilisation of the resources from other donors on an as-needed basis.

ACTION BRIEF #7

GLOBAL FUEL EFFICIENCY INITIATIVE

Developed by

FIA Foundation

In collaboration with

Multi-stakeholder partners

Summary

The Global Fuel Economy Initiative (GFEI) is the world's leading partnership working to help governments set policies for cleaner and more efficient vehicles. GFEI brings together experts from the transport and energy sectors with detailed technical, modelling, and analytical expertise, and provides capacity building support to help countries introduce policies to improve vehicle fuel economy.

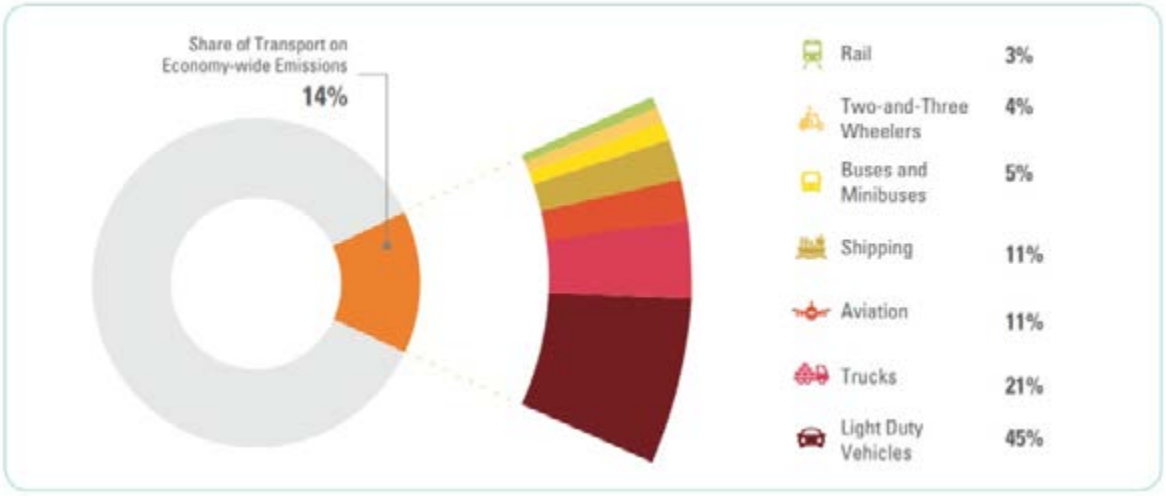
GFEI was founded in 2009 as a partnership of the world's leading transport and energy organisations. There are now 6 GFEI partners: the International Energy Agency (IEA); UN Environment; the International Transport Forum of the OECD (ITF); International Council on Clean Transportation (ICCT); Institute for Transportation Studies at University of California, Davis (UC Davis); and the FIA Foundation, which hosts the secretariat.

GFEI's main goal for passenger vehicles, in line with SDG 7.3, is to double the energy efficiency of new vehicles by 2030. This will also help mitigate climate change by reducing harmful CO_2 emissions. For this reason, GFEI has been recognised by SEforALL as an accelerator initiative, and by SLoCaT (the partnership on Sustainable Low-Carbon Transport) as a 'quick win' at the COP 21 climate talks. GFEI also provides support to the G20 Transport Task Group.

GFEI has shown that progress is possible, but it requires continued focus, drawing on the latest technologies and evidence, as well as political will to secure the huge benefits that are available from improved vehicle fuel economy.

Achievements of the Global Fuel Efficiency Initiative

Fuel economy refers to the amount of fuel required to complete a journey. More efficient vehicles—both light and heavy duty—require less energy, thus saving money on fuel, and releasing less carbon dioxide, which contributes to climate change. This is essential, as these two sectors account for the largest shares of transport emissions, as Figure 1 below shows.



GFEI has worked with over seventy countries, ranging from large economies such as the EU and China, and smaller nations such as Mauritius or Nepal.

Chile was one of GFEI's original pilot countries and adopted a mandatory fuel economy labelling scheme in February 2013—becoming the first Latin American country to do so. It has also adopted fiscal incentives

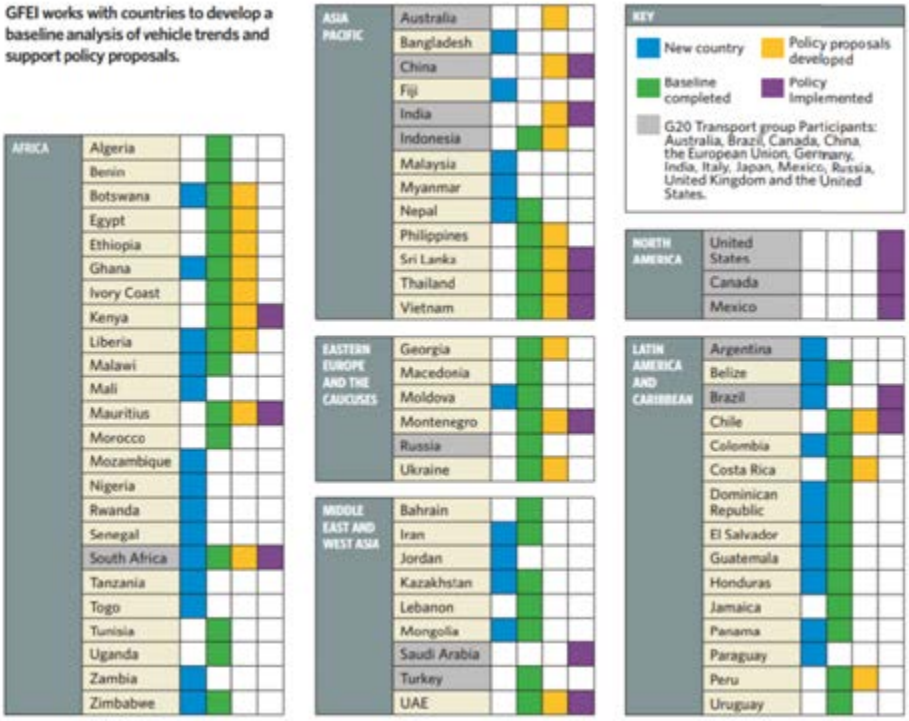
to promote cleaner, more efficient vehicles. Similarly, Sri Lanka has worked closely with GFEI to set import taxes that led to a significant increase in the proportion of hybrid vehicles on the road.

GFEI has also been supporting inter-country learning, organising global networking events, and also regional workshops. This has led to new fuel economy roadmaps being developed in the ASEAN (South-East Asia) and ECOWAS (West Africa) regions, which are bringing together countries to agree a coordinated approach. In ASEAN, Thailand and Vietnam have both recently introduced new fuel economy labelling policies, and Malaysia has announced plans to introduce its own type-approval testing to check vehicle fuel economy.

Other recent new policies include a new fuel economy label in Montenegro, Heavy Duty Vehicle fuel economy standards in India, tax reforms in the Ukraine to promote electric vehicles, and new reforms proposed in Zambia.

Significantly, in the EU, new fuel economy standards have also recently been proposed for 2030. This includes standards that would cut carbon emissions from new cars and vans in the EU by 15 per cent in 2025 and 37.5 per cent in 2030, compared to 2021 levels (with a 31 per cent reduction for vans). The world's largest car market, China, has set future fuel economy standards which include a mandate for zero emission vehicles.

Fuller details of GFEI's activities are contained in the table below.



GFEI's main goal, in line with SDG 7.3, is to double the energy efficiency of new vehicles by 2030. This will also help mitigate climate change by reducing harmful CO_2 emissions. For this reason, GFEI has been recognised by SE4ALL as an accelerator initiative and by SLoCaT (the partnership on Sustainable Low-Carbon Transport) as a 'quick win' at the COP21 climate talks. GFEI provides support to the G20 Transport Task Group, most recently at the Argentina G20 meetings, where it has been providing 'deep dive' support on HDV fuel economy.

GFEI is having an impact. GFEI's research shows that fuel economy continues to improve globally, although the rate of improvement has slowed in recent years, in part because of a shift towards larger vehicles—so more effort is needed. The improvement in fuel economy between 2005 and 2015 led to an annual saving of

1.5EJ of energy, equivalent to the entire transport-related energy use of Italy per year (see Table KF1 below).

			2005	2010	2015	2017	2030
Advanced (Gasoline price ≥ USD 1/L)	average fuel economy (Lge/100km)		7.4	6.5	5.8	5.8	4.4
	annual improvement rate (% per year)		-2.4%	-2.5%	-0.1%		
			-2.0%				
Advanced (Gasoline price < USD 1/L)	average fuel economy (Lge/100km)		11.0	9.5	8.6	8.6	
	annual improvement rate (% per year)		-2.9%	-1.9%	-0.4%		
			-2.0%				
Emerging	average fuel economy (Lge/100km)		8.6	8.5	7.8	7.5	
	annual improvement rate (% per year)		-0.2%	-1.6%	-2.3%		
			-1.2%				
Global average	average fuel economy (Lge/100km)		8.8	8.0	7.4	7.2	
	annual improvement rate (% per year)		-2.0%	-1.5%	-1.4%		
			-1.7%				
GFEI target	Required annual improvement rate (% per year)	2005 base year	-2.8%				
		2017 base year				-3.7%	

For Heavy Duty Vehicles, GFEI has set a target of improving average fuel economy by 35 per cent by 2035. This would save 9 million barrels of oil per day, and 1-2 billion tonnes of CO_2 per year by 2035. Half of these savings would come from just two countries—China and India—which would save around a quarter each.

To mark its ten year anniversary in 2019, GFEI is celebrating what has been achieved so far over the past decade, but also redoubling its efforts to support governments in using policy to improve the efficiency of road vehicles – to save money, energy and cut carbon emissions. GFEI will continue to work with governments around the world, increasingly integrating policies for electric vehicles into policy frameworks. In addition, GFEI is expanding it' focus to support electrification in light-duty (passenger) vehicles, heavy-duty vehicles (such as trucks), and also urban buses and motorcycles. GFEI has shown that progress is possible, but it requires continued focus, drawing on the latest technologies and evidence, as well as political will to secure the huge benefits that are available from improved vehicle fuel economy.

Endnotes

1 Estimates for investment needs per year until 2030 are from the 2015 SEforAll Global Tracking Framework (IEA & WB, 2017). These estimates align with the SDG7/SEforAll objectives. In this brief, the estimates have been updated for electrification (IEA, 2017a). Other estimates of investment needs have been modelled, for example the IEA New Policies and IRENA REMap Doubling Case scenarios, as stated in the 2017 SEforAll Global Tracking Framework (IEA & WB, 2017). However, since these estimates do not all align with the SDG 7 objectives, they are not used in this brief.

2 The IEA counts investment in energy efficiency as the additional cost of an "energy efficient good" relative to an "average efficiency good." In effect, this efficiency premium is the additional investment required to drive efficiency improvements and subsequent energy savings. The efficiency premium is calculated in different ways for the sectors.

3 Figures for MDBs refer to WB, IDB, EIB, EBRD, AFDB, and ADB

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