



ENERGY SECTOR MANAGEMENT  
ASSISTANCE PROGRAM

**ANNUAL REPORT 2022**



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## ABOUT ESMAP

The Energy Sector Management Assistance Program (ESMAP) is a partnership between the World Bank and [24 partners](#) to help low- and middle-income countries reduce poverty and boost growth through sustainable energy solutions. ESMAP's analytical and advisory services are fully integrated within the World Bank's country financing and policy dialogue in the energy sector. Through the World Bank Group (WBG), ESMAP works to accelerate the energy transition required to achieve [Sustainable Development Goal 7](#) (SDG7) to ensure access to affordable, reliable, sustainable, and modern energy for all. It helps to shape WBG strategies and programs to achieve the [WBG Climate Change Action Plan](#) targets. Learn more at: <https://esmap.org>

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# ABBREVIATIONS

<b>ADB</b>	Asian Development Bank
<b>ADELE</b>	Access to Distributed Electricity and Lighting in Ethiopia
<b>AFdB</b>	African Development Bank
<b>AMI</b>	Advanced Metering System
<b>AREP</b>	Advancing Regional Energy Transformational Project
<b>BEIS</b>	UK Department for Business, Energy & Industrial Strategy
<b>BESS</b>	Battery Energy Storage System
<b>CCDR</b>	Climate Change Development Report
<b>CCF</b>	Clean Cooking Fund
<b>CCPT</b>	Clean Cooking Planning Tool
<b>CCUS</b>	Carbon Capture, Use, and Storage
<b>CEASP</b>	Chad Energy Access Scale-Up Project
<b>COP</b>	United Nations Climate Change Conference of the Parties
<b>CSP</b>	Concentrated Solar Power
<b>DOE</b>	Department of Energy
<b>DPV</b>	Distributed Photovoltaics
<b>EARF</b>	Energy Access Relief Fund
<b>ESP</b>	Energy Storage Partnership
<b>ESRF</b>	Energy Subsidy Reform Facility
<b>FCDO</b>	UK Government Foreign, Commonwealth and Development Office
<b>FCV</b>	Fragility, Conflict, and Violence (countries)
<b>FIEA</b>	Financial Innovation for Energy Access
<b>FY</b>	Fiscal Year
<b>Gavi</b>	The Vaccine Alliance
<b>GCF</b>	Green Climate Fund
<b>GERI</b>	Global Electricity Regulatory Index
<b>GFMG</b>	Global Facility for Mini Grids
<b>GHG</b>	Greenhouse Gas
<b>GW</b>	Gigawatt
<b>GWh</b>	Gigawatt Hour
<b>H4D</b>	Hydrogen for Development Partnership
<b>HDF</b>	Hydropower Development Facility
<b>IBRD</b>	International Bank for Reconstruction and Development
<b>IDA</b>	International Development Association
<b>IDP</b>	Industrial Decarbonization Program
<b>IEA</b>	International Energy Agency
<b>IFC</b>	International Finance Corporation
<b>ILHC</b>	Improving Livelihoods and Human Capital

<b>IRENA</b>	International Renewable Energy Agency
<b>Km</b>	Kilometer
<b>KPLC</b>	Kenya Power and Lighting Company
<b>LNBH</b>	Leave No One Behind
<b>MARCOT</b>	Electricity Markets, Grid Connectivity and Regional Trade
<b>MDTF</b>	Multi-Donor Trust Fund
<b>MFI</b>	Microfinance Institution
<b>Mtce</b>	Million tons of coal equivalent
<b>MTF</b>	Multi-Tier Framework
<b>NDC</b>	National Determined Contribution
<b>OMVG</b>	Organisation pour la mise en Valeur du fleuve Gambie
<b>PV</b>	Photovoltaics
<b>RISE</b>	Regulatory Indicators for Sustainable Energy
<b>ROGEP</b>	Regional Off-Grid Electrification Project
<b>SAIP</b>	Sustainable Agricultural Intensification and Food Security Project
<b>SAPP</b>	South African Power Pool
<b>SDC</b>	Swiss Agency for Development and Cooperation
<b>SDG</b>	Sustainable Development Goal
<b>SEforALL</b>	Sustainable Energy for All
<b>SIDS</b>	Small Island Developing States
<b>SRMI</b>	Sustainable Renewables Risk Mitigation Initiative
<b>TES</b>	Thermal Energy Storage
<b>TW</b>	Terawatt
<b>UN</b>	United Nations
<b>UNHCR</b>	United Nations High Commissioner for Refugees
<b>UNICEF</b>	United Nations Children's Fund
<b>UNOPS</b>	United Nations Office for Project Services
<b>USAID</b>	United States Agency for International Development
<b>WAPP</b>	West African Power Pool
<b>WBG</b>	World Bank Group
<b>WHO</b>	World Health Organization
<b>YEEAP</b>	Yemen Emergency Electricity Access Project

## **WORLD BANK REGIONS**

<b>AFR</b>	Africa
<b>EAP</b>	East Asia and Pacific
<b>ECA</b>	Europe and Central Asia
<b>LCR</b>	Latin America and the Caribbean
<b>MNA</b>	Middle East and North Africa
<b>SAR</b>	South Asia Region

All currency is in United States dollars (US\$) unless otherwise indicated.

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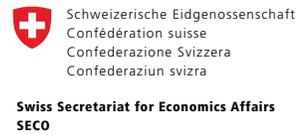
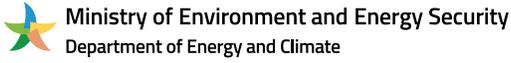
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# FOREWORD

Crises hit the most vulnerable the hardest. As a result of the COVID-19 pandemic, the energy and food crises that emerged from the Russian invasion of Ukraine, and extreme weather events triggered by climate change, the poorest and most remote populations have found themselves in impossible situations. These include not being able to obtain a COVID-19 vaccine because, among other obstacles, the vaccine cold chain seldom reaches rural areas; having to keep children at home due to school closures, yet lacking the electricity and internet access to connect students with virtual learning; having to revert to collecting forest wood for cooking because the price of liquified petroleum gas has sky-rocketed; and other stopgap measures.

In this 2022 Energy Sector Management Assistance Program (ESMAP) Annual Report, we highlight the human impact of ESMAP's work and the ways we are responding to the current polycrisis by seeking, supporting, and disseminating energy solutions that cater to the needs of those most impacted. To the new questions raised by the crises, and particularly the war in Ukraine, we seek to provide new answers: for example, how to alleviate the impact on the poor of massive surges in fuel prices; or how to tackle the consequences of high energy prices on other sectors, like agriculture.

Through ESMAP's 29 windows, we have worked hard to bring to life and move forward initiatives that target the most remote and the most vulnerable populations. These initiatives include projects to accelerate the deployment of solar off-grid and mini grids solutions, programs to electrify with renewables essential public buildings like health centers and schools, and partnerships to bring power to displaced populations.

We base our work on ESMAP's Energy Data and Analytics Hub data, which measure energy trends and impacts. The [2022 edition of Tracking SDG7](#) finds that progress toward universal energy access is slowing—and reversing: nearly 90 million people in Asia and Africa who had previously gained access to electricity can no longer afford to pay for their basic energy needs. This loss of momentum is a result of the COVID-19 crisis but also, and maybe more fundamentally, is occurring because the last mile is hard to reach. Our [2022 RISE report](#), which assesses and compares energy policies and regulatory frameworks, is a source of optimism, indicating that many countries have embedded in their COVID-19 recovery plans new policies to increase energy independence and minimize energy costs as well as to continue introducing policy and regulatory measures to transition faster to clean energy sources.

We also produced in FY2022 two reports that present the current critical opportunity to bridge the energy gap with distributed renewable energy. According to the [Off-Grid Solar Market Trends Report 2022: Outlook](#), the off-grid solar sector is expected to grow by 5 percent annually. But greater availability of pay-as-you-go consumer financing, strategic investor engagement, diversified “beyond energy” business models, and an increase in subsidies and concessional finance could significantly accelerate the pace of electrification with off-grid solutions. This would help meet the targets of [Sustainable Development Goal \(SDG\) 7](#), to ensure access to affordable, reliable, sustainable, and modern energy for all, as well as other SDGs, like SDG 13 on Climate Action.

Similarly, [Mini Grids for Half a Billion People: Market Outlook and Handbook for Decision Makers](#) shows that the deployment of solar mini grids has accelerated significantly, from around 50 per country per year in 2018 to more than 150 per country per year today, particularly in countries with the lowest rates of access to electricity. This is the result of falling costs of key components of mini grids, the introduction of new digital solutions, a large and expanding cohort of highly capable mini grid developers, and growing economies of scale. But with the right policies and about US\$220 billion of investment to build around 210,000 mini grids, mini grids have the potential to provide electricity to as many as 500 million people by 2030.

Climate change poses a major threat to development. Tackling climate and development challenges together is a key tenet of ESMAP. The climate crisis affects all countries, but it does not affect them equally. Indeed, climate solutions need to be customized to suit countries at different stages of development. Transitioning the highest emitting countries away from fossil fuels, in particular, coal—the world’s most carbon-intensive source of energy which accounts for more than 40 percent of energy-related carbon dioxide emissions—is crucial to ensuring a clean energy future. A well-managed “just” transition will ensure that countries can prepare now to exit fossil fuels in a way that protects people, communities, and the environment. ESMAP’s work puts people and communities at the center of the transition.

One of the strong messages from COP27 is that a just transition requires harmonizing decarbonization and energy access. ESMAP’s [business plan](#) is built on this principle. A strong example of this is the foundational work ESMAP teams have done to enable the Komati project in South Africa. For several years, ESMAP has been supporting the South African utility Eskom in preparatory work for the decommissioning and repurposing with renewables of four coal power plants, including Komati. ESMAP financed and provided expert support to technical, economic, and environmental assessments; a socioeconomic baseline for the plants and all surroundings; as well as the design of reskilling programs for Eskom staff and other workers. ESMAP also helped unlock US\$500 million in financing from the Climate Investment Funds and partnered with the Global Energy Alliance for People and Planet and the UK’s Department for Business, Energy & Industrial Strategy (BEIS) to provide an additional US\$10 million for worker and community support activities and other key components of the project.

This year’s annual report showcases how ESMAP’s unique business model enables the program to produce cutting-edge knowledge on energy access and decarbonization as well as work with World Bank operations to deliver that knowledge to our client countries and turn it into actions that improve people’s daily lives. This would not be possible without the generosity of our donor partners, who year after year continue to support and steer ESMAP in the right direction.

To our [24 donor partners](#), a big thank you!

Gabriela Elizondo Azuela

ESMAP Manager

**SECTION I**

# ESMAP AT A GLANCE



## ABOUT ESMAP

ESMAP is a partnership between the [World Bank](#) and [24 partners](#) to help low- and middle-income countries reduce poverty and boost growth through sustainable energy solutions.

ESMAP's analytical and advisory services are fully integrated within the World Bank's country financing and policy dialogue in the energy sector. Through the World Bank Group (WBG), ESMAP works to accelerate the energy transition required to achieve Sustainable Development Goal (SDG) 7 to ensure access to affordable, reliable, sustainable, and modern energy for all. ESMAP helps to shape WBG strategies and programs to achieve the [WBG Climate Change Action Plan](#) targets.

## HOW ESMAP WORKS

ESMAP carries out the following program [activities](#):

- Provide grants and technical assistance to countries through the World Bank Group operational units
- Maintain an active portfolio of about \$197.4 million (as of June 30, 2022), with FY2021–22 average annual commitments of about \$93.5 million, compared to the average annual commitments of \$28.8 million for FY2017–18, the first two years of the previous business plan
- Deliver key global knowledge products for country engagements
- Develop external partnerships with international organizations, research and development institutions, and industry associations
- Collaborate across the World Bank Group Regional Energy units and sectors, such as transport environment, urban, water, health, and gender
- Mobilize donor resources for World Bank-Executed Activities (co-financed with IBRD and IDA operations) ESMAP raised \$688.6 million in concessional and climate finance in FY2021–22 for activities in the FY2021–24 Business Plan

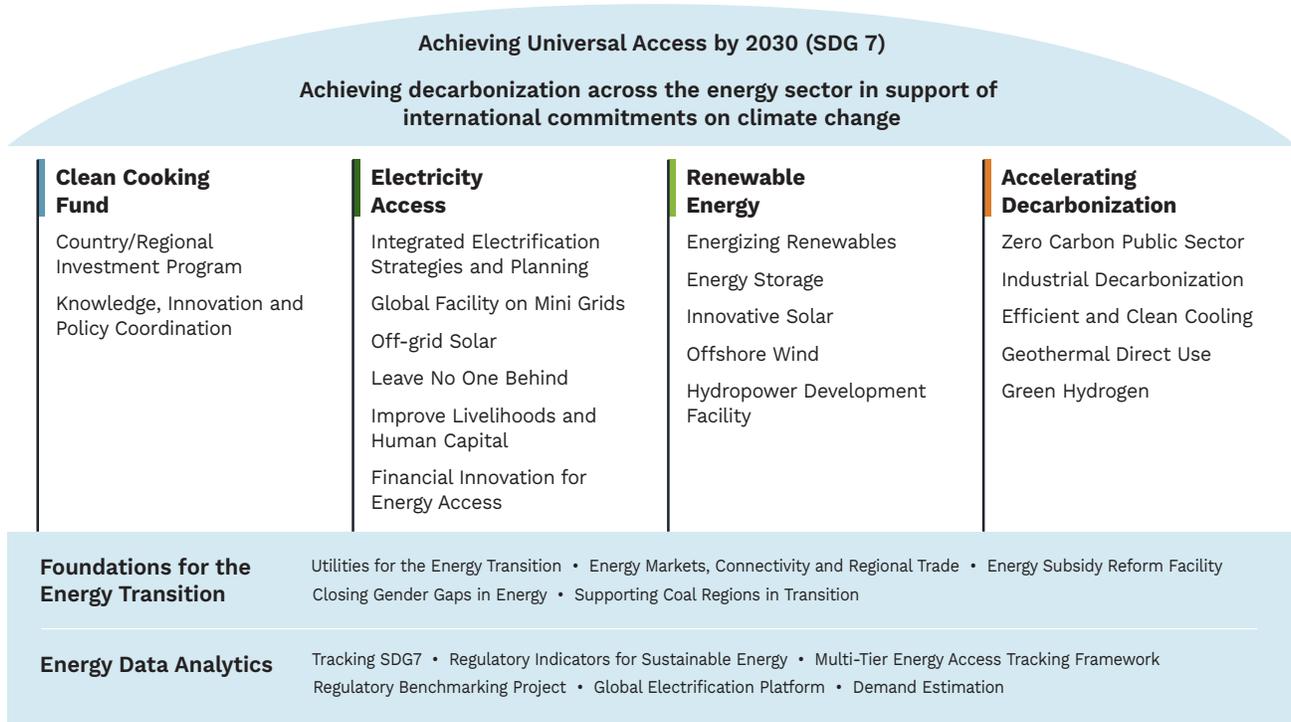
## ESMAP 2021–24 BUSINESS PLAN STRUCTURE

ESMAP is implementing a four-year [business plan \(FY2021–24\)](#) structured around 29 technical windows (or programs) organized under four thematic pillars and two cross-cutting thematic blocks—achieving universal energy access by 2030 and advancing decarbonization in support of international commitments on climate change, consistent with the World Bank Group's mission of ending extreme poverty and boosting shared prosperity. ESMAP's current business plan was conceived and approved in calendar year 2019, before the COVID-19 pandemic.

To accomplish its business objectives, ESMAP works within four overarching and interlinked programs, which focus on Clean Cooking, Electricity Access, Renewable Energy, and Decarbonization. These are underpinned by two cross-cutting programs: Foundations for the Energy Transition and Energy Data and Analytics.

The overall budget target for the ESMAP Business Plan FY2021–24 was initially \$1.3 billion, of which \$540 million would be for Bank-executed activities (primarily advisory services and analytics) and about \$740 million for recipient-executed grants (primarily co-financing IBRD/IDA operations). The largest initiatives of the projected recipient-executed grants are (1) \$450 million for the [Clean Cooking Fund](#); and (2) about \$100 million for the COVID-19 response, to electrify health facilities through renewable energy, to support an energy access relief fund, and the deployment of climate-friendly cold chains to deliver COVID-19 vaccines in client countries.

**Figure 1.1. ESMAP Business Plan FY2021–24 Structure**



In Section I, this annual report articulates how ESMAP worked toward implementing its business plan in FY2022 (July 1, 2021–June 30, 2022), during global challenges of great magnitude, including the COVID-19 pandemic, the Russian invasion of Ukraine, the growing need for action to limit global warming to 1.5° Celsius, and the need to scale up efforts significantly to meet the SDG 7 targets by 2030.

Section II follows the structure of the business plan, reporting on ESMAP activities within each workstream.

Section III contains a financial review, including a breakdown of lending activities by region and thematic area.

## BY THE NUMBERS FY2022

Fiscal Year 2022 (July 2021 to June 2022) marked the second year in the implementation of ESMAP's four-year business plan.

As of the end of June 2022, ESMAP's active portfolio reached \$204.9 million, encompassing 291 activities implemented in more than 73 countries.<sup>1</sup> ESMAP is helping to achieve the World Bank Group strategies by shaping global energy policies while supporting its development financing. Concrete program results are illustrated throughout the report.

In FY2022, ESMAP allocated **\$103.1 million**<sup>2</sup> to support global knowledge work and provide additional financing to existing activities and financing for new activities, including co-financing for World Bank projects as recipient-executed grants.

Resources allocated to new activities in FY2022 totalled **\$40.1 million**<sup>3</sup> with:

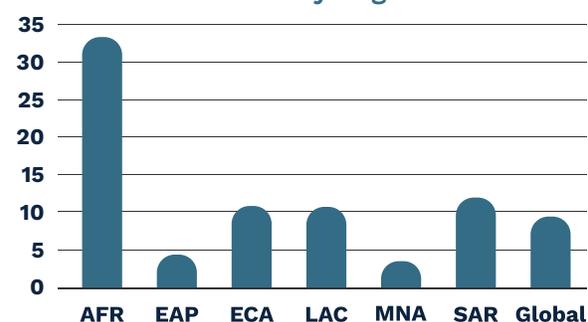
- 57 activities in 37 countries (excluding regional activities)
- 17 activities with a regional focus
- 9 activities with a global focus

### Regional Profile of New ESMAP Activities Approved, FY2022

ESMAP Grant Amount by Region (US\$ million)



Number of Activities by Region



### ESMAP Grant Amounts by Thematic/Cross-Cutting Areas for New Activities, FY2022 (US\$ million)



1 The active portfolio excludes allocations to cover Program Management & Administration, Monitoring & Evaluation, Communications, and Knowledge Management, totaling \$2.9 million.

2 Existing activities includes allocations to cover program management activities as noted above.

3 New activities exclude additional financing for existing activities (i.e., activities approved in prior FYs) and recipient-executed grants pending approval of the World Bank's Board of Executive Directors, amounting to \$63.0 million.

**SECTION II**

# OUR IMPACT IN FY2022



# OUR IMPACT FY2022

---

**\$10.5 BILLION**

in World Bank development financing informed

**\$8.6 BILLION**

external financing mobilized, including \$2.5 billion from private sector, \$4.6 billion from public financing, and \$1.5 billion from multilateral development banks (MDBs) and external trust funds

**\$6.3 BILLION**

in climate finance informed

---

**5 GW of renewable energy**

expected to be installed

**200 MILLION MT of CO<sub>2</sub>**

emissions expected to be reduced

**327 MILLION MWh**

projected lifetime energy and fuel savings to be achieved

---

**45 MILLION PEOPLE**

expected to gain access to electricity, of which 34 million people will gain access to renewable energy

**8 MILLION PEOPLE**

gained access to electricity

**28 MILLION BENEFICIARIES**

(households, communities, public facilities, utilities, industrial enterprises, etc.) expected to be reached by ESMAP-informed World Bank development financing

*Impact indicators illustrate ESMAP's contributions to the development objectives by informing WBG lending operations. ESMAP will source the data for impact indicators from the project appraisal or other official documents of the lending operations. These indicators are cross-cutting and capture both direct and additional (indirect) contributions from multiple ESMAP initiatives (for example, energy access directly contributes to the number of people with access and may additionally contribute to metric tons of CO<sub>2</sub> emissions expected to be reduced). Because the additional contributions of the initiatives will be determined by the appraisal documents of the lending operations, ESMAP will not set targets for the impact indicators. Cumulative impact/expected results are available on [ESMAP's Results Dashboard](#).*

# ENERGY DATA



Accessible, timely, and quality energy information and data are key to accelerating access and the transition to clean energy. Without up-to-date, detailed end-user and supply-side data, governments have a hard time understanding consumers' needs and identifying interventions that are most likely to be effective.

ESMAP's [Energy Data and Analytics Hub](#) is an all-inclusive data and knowledge platform that offers free access to energy-related information from the data websites it manages. For more than a decade, it has been at the forefront of collecting and curating data on energy access, including attributes such as (1) reliability, quality, affordability, and convenience; (2) electricity uses and cooking practices, including fuel/stove stacking for clean cooking; (3) energy policy and regulatory frameworks; and (4) enhanced socioeconomic inclusiveness of energy access, among others. ESMAP's Energy Data and Analytics Hub also includes data visualizations, tools, and applications from the World Bank and partner organizations on an open-source platform—[EnergyData.info](#).

Through data collection and analysis, ESMAP and partners uncovered this year the full impact of the COVID-19 crisis on energy access rates, deployment of renewable energy and progress with energy efficiency, as well as on the contribution of energy to immediate response and rebuilding efforts. These same data collection efforts will reveal the impact of the Russian of Ukraine and the ensuing energy crisis in the next few years. The work of the Data and Analytics Hub is central to the development community's efforts to reach universal access to clean energy. Its overarching objective is to inform policy and investment decisions and enhance transparency, which will increase progress toward ensuring access to affordable, reliable, sustainable, and modern energy for all by 2030.

In the context of the UN High-Level Dialogue on Energy, the ESMAP Energy Data and Analytics team took a leading role in compiling the [Theme Report on Energy Access](#). One of the key recommendations of the report was the need to improve the availability and quality of open-source, verifiable energy information and data pertinent to national, subnational, and local contexts.

Years of experience have taught the ESMAP Data and Analytics Hub a number of lessons, which the hub systematically applies in its data gathering: (1) engaging operational energy teams, National Statistical Offices, governments, and development partners in the countries where data are collected; (2) enhancing capacity building to collect data sustainably and apply more effectively the findings to policymaking; (3) maintaining transparency on the methodology used to ensure the credibility of the findings and messages; and (4) fostering collaboration between agencies to enable more effective and rapid dissemination.

Significant energy data shortfalls, particularly in poor countries, still exist; at the same time, ESMAP efforts pay particular attention to using data more effectively to improve development outcomes, particularly for poor people in poor countries.

## ENERGY DATA AND ANALYTICS HUB PRODUCTS

The Energy Data and Analytics Hub produces four synergetic products that track the progress toward achieving SDG 7: the [Tracking SDG 7: Energy Progress Report](#), the [Multi-Tier Framework, Regulatory Indicators for Sustainable Energy](#) (RISE), and the Energy Demand Estimation.

# 41%

Many countries have included considerations in their COVID-19 recovery packages to minimize disruptions to electricity access, quality, and affordability: about 41% of the 140 countries surveyed for the RISE report have mechanisms for end users, 39% have provided financial support to service providers, and 44% have backed the electrification of public institutions.

**Tracking SDG 7: Energy Progress Report.** This report is produced annually by the five SDG 7 custodian agencies: World Bank/ESMAP, the International Energy Agency (IEA), the International Renewable Energy Agency (IRENA), the United Nations Statistical Division (UNSD), and the World Health Organization (WHO). The report features 220 countries' advancement in reaching the SDG 7 targets on access to electricity, clean cooking, renewables, and efficiency. As the custodian agency for SDG 7.1.1, the World Bank/ESMAP is responsible for the report's electrification data and the chapter on access to electricity.

The eighth edition of the report, launched in June 2022, reveals that at today's rate of progress, the world is still not on track to achieve the SDG 7 targets. Globally, 733 million people have no access to electricity, and 2.4 billion people continue to cook using fuels detrimental to their health and the environment. The COVID-19 pandemic has been a key factor in slowing progress toward universal energy access. The pace of progress on the SDG 7 targets is expected to further slow because of the energy crisis provoked by the Russian invasion of Ukraine.

**Figure 2.1. Tracking SDG 7 2022 – Key Data**

INDICATOR	2010	LATEST YEAR
 Proportion of population with access to electricity	1.2 billion people without access to electricity	733 million people without access to electricity (2020)
 Proportion of population with primary reliance on clean fuels and technology for cooking	3 billion people without access to clean cooking	2.4 billion people without access to clean cooking (2020)
 Renewable energy share in total final energy consumption	16.1 % share of total final energy consumption from renewables	17.7 % share of total final energy consumption from renewables (2020)
 Energy intensity measured as a ratio of primary	5.6 MJ/USD primary energy intensity	4.7 MJ/USD primary energy intensity (2019)
 International financial flows to developing countries in support of clean energy research and development and renewable energy	11.2 USD billion intenational financial flows to developing countries in support of clean energy	10.9 USD billion intenational financial flows to developing countries in support of clean energy (2019)

**Multi-Tier Framework for Energy Access.** The Multi-Tier Framework (MTF) uses country data to identify and analyze the main factors preventing or limiting households' use of electricity. It then presents a set of recommendations for removing the identified constraints, providing additional data on the actual services that the households have received.

This tool redefines energy access, from the traditional binary count to a multidimensional definition: "the ability

to avail energy that is adequate, available when needed, reliable, of good quality, convenient, affordable, legal, healthy, and safe for all required energy services."

In FY2022, the MTF team conducted surveys in Bangladesh, Pakistan, Papua New Guinea, Rwanda, South Sudan, and Sudan. The team used the surveys to assess the effectiveness of the Bangladesh Electricity Distribution Modernization Program and to establish the baseline of energy access in

Papua New Guinea and Pakistan. In Pakistan, the MTF survey results brought to light the issue of informal connections and revealed that the affordability of electricity service could be the reason for such prevalent informal connections. In Papua New Guinea, the government requested help from the MTF team to develop its capacity to assess and monitor the country's energy access status. The MTF team conducted a phone survey of 2,635 households in Papua New Guinea, completed the data analysis, and presented the results to the government and development partners. The report and dataset will be published in FY2023.

In Rwanda, the MTF has been used to track the energy access progress since 2016, and, for the first time, to assess the energy access status in refugee camps. In South Sudan and Sudan, the surveys also increased understanding of the off-grid energy market as well as developments in energy efficiency.

And in South Sudan, where the government and development partners had little information on the penetration of off-grid solar solutions and their potential role in the electrification of the country, the MTF survey showed that the penetration of off-grid solar solutions in South Sudan was significant. As a result, the World Bank energy team decided to include technical assistance in off-grid solar solutions in the newly proposed energy access program.

During FY2022, the MTF survey instrument was reviewed and improved, in collaboration with ESMAP partners. In Rwanda, the MTF team collaborated with the World Bank's Mind, Behavior, and Development Unit (eMBeD) to reflect the behavioral aspect of clean cooking solutions in the survey questionnaire. The scope of the MTF was also expanded to include energy efficiency, refugee issues, and general behavioral aspects.

**The Regulatory Indicators for Sustainable Energy.** This is the first policy scorecard introduced at the global level to assess the investment climate for energy access, energy efficiency, and renewable energy at the country and global levels. The *Regulatory Indicators for Sustainable Energy* (RISE), which is published biannually, gives users free access to online data that enable them to customize the information they need on each country's power sector and regulatory and policy framework. RISE indicators are included in the outputs of several well-established global initiatives, including the

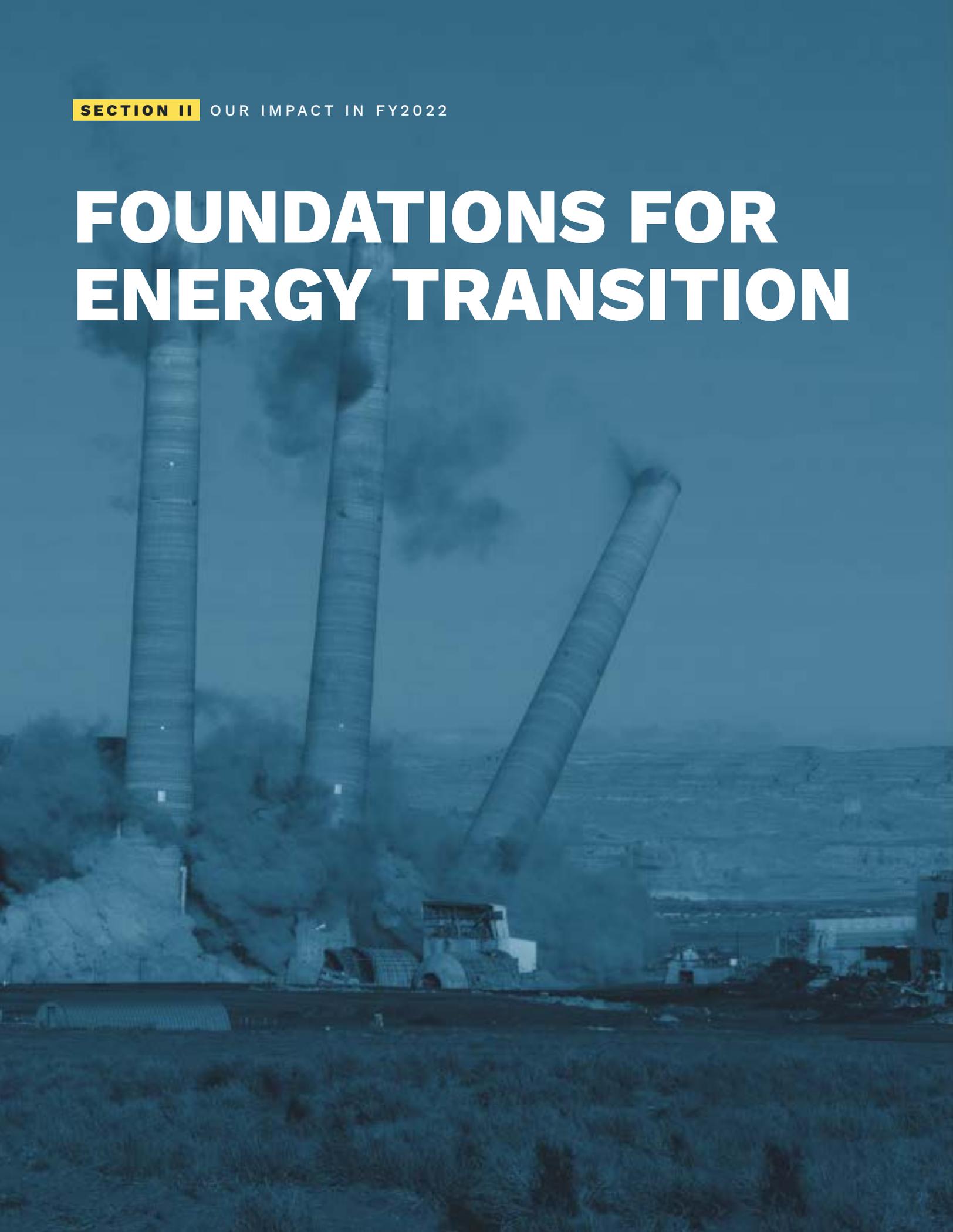
Renewables Global Status Report (REN21), the Clean Cooking Alliance Communication Corps, the SDG 7 policy briefs compiled by the multi-stakeholder SDG 7 Technical Advisory Group, and they are used to inform policy and regulatory design at the country level. In FY2022, the RISE team completed data collection for and published the December 2022 edition of the scorecard. This new edition includes information on the due diligence activities of multinational law firms with a significant presence in the energy industry.

The *Global Electricity Regulatory Index* (GERI) is a companion piece to the RISE scorecard and was developed in collaboration with the African Development Bank (AfDB). GERI was first published in 2020 and featured a select group of 56 countries. It now collects data from more than 100 developing countries to enable them to identify gaps in their regulatory frameworks and benchmark their performance against their global peers. In FY2022, the team began working with the AfDB to expand GERI to all developing countries that are covered by RISE. While RISE provides a snapshot of countries' policies and regulations in the energy sector, GERI measures adoption of regulatory best practices and captures different aspects of the regulatory systems in the electricity sector.

**The Electricity Demand Estimation Program.** The program, newly created as part of the Business Plan FY2021–24, is supporting multiple countries in assessing the energy demand from residential and commercial activities, particularly in the agricultural sector. In Nigeria, for example, the team assessed the electricity demand from agro-processing activities to provide market intelligence and evaluate the cross-sectoral synergies between the World Bank projects on livelihood improvement and productivity enhancement and the activities of the [Nigeria Electrification Program](#) (NEP). This effort enabled a better understanding of the dynamics of electricity demand in the agribusiness industry and assess the potential of mini grids to respond to that demand. As a result of the project, it is expected that the farmers' cooperative doesn't need to rely on expensive and polluting diesel generators to run their milling machine and improve the productivity and profitability of their business. The program also helped to assess the potential electricity consumption of rural communities to size the generation and feasibility of mini grid operations. In Pakistan, the program helped the government to assess the electricity demand of tube wells as part of its scheme to reduce electricity subsidies.

**SECTION II** OUR IMPACT IN FY2022

# FOUNDATIONS FOR ENERGY TRANSITION



The three-prong crisis the world is currently experiencing—the Covid-19 pandemic, the war in Ukraine, and climate change impacts—has created, in the short term, new obstacles to countries' clean energy transition. These same developments, however, have highlighted the importance of not only staying the course toward a decarbonized energy sector, but significantly hastening the pace of transition by taking advantage of several new factors to accelerate the process: (1) the decreasing cost of renewable sources of energy; (2) technological advances in demand management, storage, and digitalization; and (3) new decentralized business models for service delivery.

FY2022's unfortunate developments also triggered a rethinking of the business-as-usual and the deployment of new, innovative regulations and policies. Regarding energy subsidies, for example, while several governments put in place support packages to shield households from record high energy bills, many have come to the realization that short-term measures, well-targeted to meet the needs of the poorest and most vulnerable, are more effective and often lower in cost than broad-based price subsidies. Similarly, the spikes in electricity market prices caused by underlying fossil fuel costs revealed the challenges of both short-term affordability for the vulnerable consumers and the stability of supply. They triggered a long-pending discussion on the need to adjust the market design to facilitate faster integration of renewable energy by increasing the role of capacity-balancing instruments, long-term trading contracts, short-term ancillary services, and regional markets and interconnections. Utilities, which are the backbone of power delivery, are also facing new challenges. The COVID-19 pandemic brought many utilities with already weak financials to the brink of bankruptcy. But tools now exist for utilities to integrate renewable energy, automate their activities, and expand their services to the last mile.

Staying the course is what brought years of efforts to enable the transition from fossil fuels to cleaner technologies to fruition in several countries. One example is Uzbekistan, where ESMAP worked for several years with the government to lay the foundation for scaling up renewables and utility-scale solar plants, to enable the country to meet with clean energy the demand served by fossil fuels.

ESMAP continues to offer support to governments as they build toward their transition to clean energy. Through its overarching [Foundations for Energy Transition program](#), ESMAP provides a comprehensive policy framework for the energy transition through innovative solutions in five interlinked areas:

1. **Designing new business and regulatory models for utilities** of the future, able to maintain financial viability and service standards and able to absorb emerging innovations in a timely manner—Utilities for the Energy Transition Program.
2. **Developing competitive markets, connecting regions, and deploying power trade mechanisms** that provide the price signals and incentives needed to induce investment in the right technologies and behaviors—Markets, Connectivity, and Trade Program.
3. **Helping countries to stop subsidizing fossil fuels** and remove subsidies and other distortions—Energy Subsidy Reform Facility.
4. **Supporting transitioning from coal and least-cost planning**—Supporting Coal Regions in Transition.
5. **Promoting gender equality** in the energy sector—Closing Gender Gaps in Energy.

In 2022, fuel and electricity prices reached record high levels. As governments try to shield households and firms from the harshest impact of the substantial increases in energy prices, energy subsidies are proliferating. The latest figures indicate that the total global spending on fossil fuel subsidies worldwide almost doubled from 2020 to 2021, from \$362.4 billion to \$697.2 billion.

**\$697.2**  
billion

## UTILITIES FOR ENERGY TRANSITION

Decarbonization goals and technological advancements are driving the energy sector's transformation. The increasing availability of cost-effective digital technologies is also opening new opportunities for enhanced data-driven decision making, automation, and new business models that can help improve the

flexibility and reliability of power grids. However, for utilities in developing countries, inadequate contractual obligations, inefficient energy pricing and subsidy design, as well as the lack of knowledge and financial resources can be challenging. Yet, emerging innovative solutions also present an excellent opportunity to deliver on the urgent goals of universal access and full decarbonization.

BOX 2.1

NIGERIA

### ASSESSING THE SOLAR ROOFTOP POTENTIAL IN NIGERIA

The [Utilities for the Energy Transition](#) program worked in Nigeria to conduct an assessment of the potential for solar rooftop and prepare an action plan designed to scale up clean, reliable access to electricity for urban centers. The first phase of the project is being conducted in Lagos State using distributed photovoltaics (DPV) to support bill reduction for consumers. The project also aims to alleviate utilities' struggle with low collections, high losses, and lack of cost recovery. The market assessment estimated that 10-15 TWh of solar DPV potential with large residential and commercial segments in Lagos State is suitable for DPV intervention. The assessment also evaluated the impact on utilities and the possible role for distribution utilities in DPV implementation. Based on the study and consultations, the Lagos State government has set the policy target of 15 percent of the state energy mix from DPV by 2030.

The program also supported a South-South Knowledge Exchange visit to India to learn from its experience in rooftop solar implementation. The visit included sessions on the impact of the integration on distribution utilities. The next phase of activity will support implementation in Lagos State and explore options for introducing a similar approach in other regions of the country.

ESMAP's [Utilities for the Energy Transition Program](#) supports utilities, regulators, and sector decision makers in developing countries contending with this changing landscape. The program provides technical assistance and pilot programs to guide investments in digital and decentralized technologies, such as advanced metering infrastructure and grid-connected distributed energy resources. It also introduces innovative business models and processes to improve utility performance and enable the integration of renewable energy onto the grid.

Since it was introduced, in FY2021, the program has committed \$3.2 million, including \$1.8 million in FY2022 for grants in countries in the Africa and Latin America and the Caribbean (LCR) regions.

In Costa Rica, the program supported the development of the National Smart Grid Strategy, which details a matrix of actions for smart grid implementation. This strategy and action plan will provide the framework for distribution companies to invest in digital technologies and enable the investments in the smart grid systems to be passed to end-users through electricity tariffs.

In Kenya, the program collaborated with the distribution utility, Kenya Light and Power (KPLC), to design a pilot appliance financing program. KPLC customer data and billing systems were used to identify customer groups more likely to demand appliances with a reduction in credit market barriers.

## **ELECTRICITY MARKETS, GRID CONNECTIVITY, AND REGIONAL TRADE**

Clean energy increasingly is becoming the most affordable option for electricity grids around the world. Therefore, experts have explored the prospect of a market design that would provide the reliable and cost-effective integration of clean resources to decarbonize the power system. The [Electricity Markets, Grid Connectivity, and Regional Trade \(MARCOT\) Program](#) provides governments in developing

countries, and World Bank operational teams, with advice on electricity markets. MARCOT serves as a consolidated center of expertise on power market design and operation tailored to the unique needs of developing countries.

In FY2022, the program relied on the RISE platform to create a comprehensive, regularly updated database of power markets globally. The database, to be released at the beginning of 2023, will hold information about the electricity sector's market characteristics and development over time, presenting a new and unique tool to benchmark the performance of emerging markets. Based on the knowledge produced, the program has launched a series of trainings on the Fundamentals of Energy Markets.

The MARCOT Program also allocated technical assistance grants to 16 activities in various regions to increase the number of countries with established or improved markets for energy services and interconnected grids. The activities include Advancing Regional Energy Projects in Southern and Eastern Africa to improve the enabling environment for power trade in these regions.

During F20Y22, the program continued to work with the West African Power Pool (WAPP), a specialized agency of the Economic Community of West African States (ECOWAS), which was created to respond effectively to the inadequacy of the electricity supply in the region. Some key activities include working on the Côte d'Ivoire, Liberia, Sierra Leone, and Guinea (CLSG) project to construct a transmission line to improve electricity flow and finance the construction of the 875 km high voltage line interconnecting Benin, Burkina Faso, Niger, and Nigeria. MARCOT continues to support an increase in regional trade and financing from public and private sources and contributed to the efforts of the Organisation pour la mise en Valeur du fleuve Gambie (OMVG) Interconnection Project to facilitate electricity trade between the Gambia, Guinea, Guinea Bissau, and Senegal.

## ENERGY SUBSIDY REFORM FACILITY

ESMAP's [Energy Subsidy Reform Facility](#) (ESRF) has been supporting governments in designing and implementing energy subsidy reform programs since 2013. The facility supports analytic work on various aspects of complex energy subsidy reform agendas, including poverty impact, social protection, fiscal management, macroeconomics, political economy communication, and climate change mitigation.

In 2022, fuel and electricity prices reached record high levels, with the demand for energy growing strongly with economic recovery, while supply remained constrained and further exacerbated by the war in Ukraine. As governments try to shield households and firms from the harshest impact of the substantial increases in energy prices, energy subsidies are proliferating and are delivered in various forms—retail or wholesale price caps, rate freezes, tax breaks, transfers to households or firms, or support to energy utilities. The latest figures, from a joint analysis by the Organisation for Economic Co-operation and Development (OECD) and the International Energy Agency (IEA), indicate that the total global spending on fossil fuel subsidies worldwide almost doubled from 2020 to 2021, from \$362.4 billion to \$697.2 billion, respectively. While formal consolidated estimates for 2022 are not available, aggregate global energy consumption and production subsidy figures are likely to be much higher than 2021 levels. In Europe alone, it is estimated that since the start of the energy crisis in September 2021, more than \$700 billion had been allocated to energy subsidies by national governments. When subsidies introduced or expanded in other regions of the world are considered, the 2022 figures are likely to reach record levels, signaling a significant fiscal burden that will need to be borne by governments and citizens in the coming years.

The expanded or new subsidy programs create fiscal risks by burdening governments amid tightening fiscal space and putting spending pressure on other priorities. International experience strongly suggests that any subsidy measure to keep fuels, electricity, or gas affordable in response to a crisis should be time-bound, transparent, and fully budgeted.

ESRF continues to see strong and growing demand from World Bank teams supporting client countries in their efforts with energy subsidy reform with the growing recognition of the need to reform fossil fuel subsidies in view of their climate impact, significant fiscal cost, and the economic distortions they create. ESRF allocated \$25.6 million in technical assistance to energy subsidy reform efforts in 65 countries since FY2014, when the first grants were made to date. ESRF-funded technical assistance helped the preparation of 57 World Bank lending operations, totaling \$21.8 billion in volume.

During FY2022, ESRF provided about \$1 million in technical assistance grants for in-country activities that support energy subsidy reform, launching the implementation of 32 active grants. Further, ESRF-funded grants contributed to the development of energy subsidy reform policies and regulations in eight client countries and the preparation of five World Bank lending operations approved in FY2022, corresponding to a total of \$1.3 billion in volume.

In addition, ESRF supports the expansion of the global knowledge base in energy subsidy reform by developing knowledge products that provide an analytical basis for real-world action. The facility also engages in global outreach to diverse stakeholders and communicates on key agenda items.

An ESRF-funded global study, "Fiscal Costs and Risks from Infrastructure in an Era of High Debt Vulnerabilities," was completed in FY2022. A collaboration of the Energy and Transport global practices, the study assessed the fiscal costs and risks from energy and transport infrastructure in developing countries, focusing on hidden liabilities of state-owned enterprises and public-private partnership, and presented ways in which fiscal risks can be better identified, monitored, and managed. Rising debt levels and tightening fiscal and monetary conditions put further pressure on the financing available for infrastructure. The study provides a deeper understanding of these risks in order to help to target policy reforms where they would have the greatest impact.

## WESTERN BALKANS

## ANALYZING THE ENERGY CRISIS IN THE WESTERN BALKANS

Together with other ESMAP windows, ESRF financed the analytical work that contributed to a special chapter, “Managing the Energy Crisis in the Western Balkans,” in the [Western Balkans Regular Economic Report No. 21, Spring 2022: Steering Through Crises](#). The chapter analyzed Western Balkan countries’ vulnerability to the price shocks of natural gas, electricity imports, and crude oil and oil products. It recommended that in the short term, governments should prioritize expanding targeted social protection for vulnerable populations, as this has proven to be more cost effective and has avoided distortionary impacts. In the medium to long term, the chapter proposes, governments could adopt measures aimed at building resilience against future energy price shocks.

## DOMINICAN REPUBLIC

## ENHANCING THE SOCIAL PROTECTION SYSTEM IN THE DOMINICAN REPUBLIC

In the Dominican Republic, an assessment of the poverty and social impacts of tariff increases on consumer groups, including the most vulnerable households, was prepared as part of ESRF-funded technical assistance. The assessment supported the government in strengthening the design of the Bonoluz Program in order to efficiently integrate it into Superate, the national social assistance program. The assessment also supported the preparation of the World Bank’s Dominican Republic Electricity Reform for Sustainable Growth Development Policy Loan, a \$400 million operation approved in FY2022 to support the improvement of the financial self-sufficiency and operational performance of the electricity sector.

## SUPPORTING COAL REGIONS IN TRANSITION

Despite the health, environmental, and financial risks associated with coal extraction and power generation, coal remains the lowest cost source of baseload electricity in many countries. While the COVID-19 pandemic caused a 4 percent drop in coal demand, the Russian invasion of Ukraine has led to an increase in coal consumption. Fortunately, increasing availability and affordability of cleaner sources of energy complemented by strong government commitments to clean energy are resulting in a transition away from coal.

ESMAP's [Supporting Coal Regions in Transition Program](#) is assisting governments in their transition from coal to more sustainable energy options. The program helps governments in developing countries to begin their transition through coal mine closure and coal plant repurposing. Specific support includes exchanging knowledge, assisting in developing roadmaps for transition, designing paths to preserve and grow human capital by developing comprehensive social protection packages for families impacted by the transition, creating reskilling and job transition programs, and presenting potential paths for economic transition. The key priority of the program is to support governments and ensure that communities are protected during the phaseout of coal as the country transitions toward cleaner energy sources.

In FY2022, the program established the Coal Regions in Transition Learning Academy, and the first courses became available online in December 2021. The Western Balkans and Ukraine, with about 14 regions transitioning away from coal production and consumption, were selected for the pilot design and implementation of the Learning Academy.

In addition, with ESMAP's support, the World Bank's Energy and Extractives Global Practice designed a knowledge exchange program between Ukrainian and Polish coal regions. Delegations from five Ukrainian coal regions will visit Poland to study preparatory and planning activities in order to chart their transition strategies. This is a complex undertaking involving two governments and as many as eight coal regions and including many development initiatives and funding sources, such as ESMAP and NFOiGW of the Polish government.

In Colombia, the World Bank is providing the government with technical assistance to develop diversification strategies for the Cesar and La Guajira regions. This is happening in close cooperation with the mining and energy industries.

In India, ESMAP supported a prefeasibility study for the decommissioning of two coal plants in the West Bengal region. The plants are being prepared for replacement with solar, battery storage, and synchronous condensers.

In Indonesia, ESMAP has provided funding for baseline analytics, which will map the coal mining ecosystem and support policy reforms to phase out coal use.

In South Africa, ESMAP is supporting the government as it prepares to decommission and repurpose four coal plants as part of the [Just Energy Transition Project](#) (see SPECIAL SECTION: Transitioning from Coal to Renewable Energy Regeneration in South Africa).



# TRANSITION FROM COAL TO RENEWABLE ENERGY IN SOUTH AFRICA: ESMAP'S FOUNDATIONAL ROLE IN THE KOMATI PROJECT

In January 2019, a team of ESMAP experts published a blog titled, [A Renewable Rebirth for Coal?](#). The article described an emerging practice in countries like Germany, India, and the United States of converting old and unprofitable coal power plants into sites for renewable energy and battery storage. The blog explained that the phaseout of coal was inevitable and was going to be a fast-paced process. It posited that, although nascent, there were some technical knowledge and best practices to be extracted from those existing conversion projects. It also advocated for the design of a technical assistance program to help governments in developing countries articulate a system-wide strategy and identify good projects for repurposing. The blog stated, “The inevitability of coal plant retirement will provide an opportunity for increased renewables uptake, energy storage, and old plant component repurposing for grid stability applications. This patch image is worth looking at to create some awareness of these possibilities, given the transformative potential it holds. A more thorough mapping of the investment, policy, and regulatory means to bolster this pathway is now required.”



As the idea made its way throughout the World Bank and in conversations with client governments, ESMAP, as part of its FY2021–24 business plan, created a new program, [Supporting Coal Regions in Transition](#). The program aims to support governments in developing countries begin their transition away from coal through coal mine closure and coal plant repurposing. It facilitates knowledge exchange, assists

in developing roadmaps for transition, and designs pathways to preserve and grow human capital by structuring comprehensive social protection packages to protect families impacted by the transition. It also develops training and job transition initiatives. The program's priority is to support governments and protect communities during the phaseout of coal in transitioning to cleaner energy sources.

One of the first countries to benefit from ESMAP's technical assistance on coal plant decommissioning is South Africa. Eighty-five percent of South Africa's electricity is produced by coal power plants. The country experiences frequent power outages due to the aging and insufficient maintenance of its coal power fleet. In response, the South African utility Eskom adopted a just energy transition plan, and the government has committed in principle to net zero CO<sub>2</sub> by 2050. The World Bank Africa region, with ESMAP's help, developed a \$2.5 million advisory project to lay the foundations for the transition. The project, approved in December 2019, aims to support South Africa in gradually changing the carbon-intensive generation mix and integrate lower cost renewables while mitigating

social and economic impacts, and reform and restructure its power sector to ensure its long-term financial viability and improve its overall efficiency. ESMAP is the biggest contributor to the project, with \$1,250,000 out of a total budget of \$2,553,551. The ongoing preparatory project has already developed an impressive number of activities (Box 2.2), needed ahead of an investment project.

The advisory support is helping Eskom with the retirement of four coal power plants: Camden, Grootvlei, Hendrina, and Komati. The project activities include technical, economic, and environmental assessments; a socioeconomic baseline for the plants and all surroundings; and the design of reskilling programs for Eskom staff and other workers.

BOX 2.5

## SOUTH AFRICA

## PROGRAMMATIC ADVISORY SERVICES AND ANALYTICS FOR ENERGY SECTOR IN SOUTH AFRICA, ACTIVITIES

1. Political Economy Analysis of Energy Sector
2. Development of Coal Decommissioning and Re-Purposing Strategy
3. Energy Efficiency Financing Strategy for RSA
4. Battery Storage Development Strategy
5. Energy Skills Development Strategy
6. Supporting National Determined Contribution (NDC) Implementation in the Energy Sector
7. Diagnostic of Electricity Businesses in South Africa's Metros
8. Municipality and Power Procurement
9. Energy Service Company (ESCO) Market Development in South Africa

Figure 2.2. From Coal to Renewables



In parallel with its project support, the ESMAP team continued in FY2022 its knowledge work on coal plant decommissioning, and in August 2021, it released the report [Coal Plant Repurposing for Ageing Coal Fleets in Developing Countries](#). This report presents a detailed cost-benefit framework for examining the value proposition of repurposing coal plants for solar energy generation and battery energy storage. Coal Plant Repurposing concludes that the direct benefits for repurposing coal plants outweigh the direct costs associated with decommissioning. These direct benefits include a reduction in carbon emissions as well as the reuse of land and equipment. The report provides evidence for the hypothesis formulated in the aforementioned blog, namely that repurposing coal plants can serve as a viable renewable energy-based option.

**The preparatory work supported by ESMAP culminated in November 2022 with the World Bank Group Board approving a \$497 million investment to decommission and repurpose the Komati coal-fired power plant. The ESMAP team played an integral role in developing the climate finance and investment package required to operationalize the project.**

The Komati Just Energy Transition Project is financed jointly by a \$439.5 million World Bank loan, a \$47.5 million concessional loan from the Canadian Clean Energy and Forest Climate Facility, and a \$10 million grant from ESMAP, made possible by the United Kingdom

Department for Business, Energy, and Industrial Strategy (\$3 million), and the Global Energy Alliance for People and Planet (\$7 million). ESMAP also supported the preparation of the Climate Investment Fund Accelerating Coal Transition (ACT) program, providing knowledge and staff time to support the government of South Africa in drafting the plan.

The Komati coal powerplant will be repurposed into an installation with 220 MW renewable energy solutions (including 150 MW solar photovoltaic (PV) and 70 MW wind) and 150 MWh batteries. Under the Komati project, the workers will be supported through a comprehensive transition plan, elaborated jointly with inputs from staff and unions. A portion of project financing will be devoted to creating economic opportunities for local communities, which is expected to benefit approximately 15,000 people.

The decommissioning and repurposing of the Komati coal-fired plant is a demonstration project that can serve as a reference on how to transition fossil-fuel assets for future projects in South Africa and around the world. As part of the project and for dissemination, coal plant decommissioning and repurposing guidelines will be developed together with socioeconomic guidelines to mitigate impact on workers and communities.

**SECTION II** OUR IMPACT IN FY2022

# ACCELERATING DECARBONIZATION



COP27 emphasized the urgent need for immediate, deep, and sustained reductions in global greenhouse gas (GHG) emissions. It also recognized that the unprecedented global energy crisis underscores the urgency to rapidly transform energy systems to be more secure, reliable, and resilient, including by accelerating clean and just transitions to renewable energy. Decisive decarbonization steps are critical when expanding world population and economic growth (resulting in rising average income), industrialization, and accelerating urbanization are pushing GHG emissions upward—while millions remain without access to electricity. Simultaneously meeting sustainable development goals and international climate change objectives requires an integrated approach to decarbonization that avoids inefficient, high-emitting, and expensive development trajectories.

The [Accelerating Decarbonization](#) pillar is the main component of ESMAP's support to end-use decarbonization. Recognizing that supply side interventions to scale up clean energy generation are essential but not sufficient to reach net zero goals by mid-century, and that a large share of emissions (about 75 percent) come from outside the power sector, ESMAP's Accelerating Decarbonization complements other ESMAP pillars and builds on the foundation and experience developed in ESMAP's previous business plan (FY2017–20).

Further, the pillar seeks to support strategies and actions that accelerate: (1) the adoption and testing of innovative technologies, including the shift to electrification in industries; (2) increased access to different forms of clean energy, particularly for heating; (3) systematic integration of advanced energy efficiency improvements across multiple end uses; and (4) the generation of benefits for communities and the economy, including addressing gender inequality. While barriers to countries' decarbonization (e.g., the absence of carbon price regimes in developing countries, high

development and transaction costs, the lack of awareness and information, split incentives, behavioral inertia, and the like) may be common, there is no single path for all. Accelerating decarbonization supports countries in critical areas, with three sector-focused yet complementary programs to cater to each country's needs. The programs include: (1) the zero-carbon public sector program; (2) the efficient and clean cooling program; and (3) the industrial decarbonization program, along with two technology-focused programs: (1) the geothermal direct use program; and (2) the green hydrogen program.

## EFFICIENT AND CLEAN COOLING

By 2030, over half of the world's population will live in climates with high temperatures, leading to increased exposure to potentially dangerous heat conditions. This includes more than a billion people in developing countries already considered at risk because of the lack of access to cooling. Access to sustainable cooling is no longer a luxury in a world with rising temperatures. It has become an issue of equity, resilience, and sustainable development that impacts various sectors, including agriculture and health.

Extreme heat and lack of access to cooling threaten people's safety, productivity, wellbeing, and health. These conditions also impact the quality and safety of food and medicine that require a cool environment. Today's cooling technologies consume massive amounts of energy, putting pressure on many already inadequate or strained energy systems and increasing GHG emissions.

ESMAP's [Efficient and Clean Cooling Program](#) seeks to accelerate the adoption and deployment of sustainable,

# 6x

Low-carbon hydrogen offers a solution to decarbonize heavy industries that produce more than 25% of global CO<sub>2</sub> emissions, for which there is presently no viable alternative to fossil fuels. Estimates suggest that hydrogen use would need to grow sixfold to support the global energy transition, eventually accounting for 10% of total energy consumption by 2050.

climate-friendly, and reliable cooling solutions by integrating efficient and clean cooling into relevant World Bank policy dialogues and lending operations (IBRD and IDA). The program incorporates active and passive energy efficiency solutions, adopts renewable energy solutions, and supports the transition to more climate-friendly refrigerants (aligned with the Kigali Amendment to the Montreal Protocol). It works across multiple end-use sectors, such as health, agriculture, urban development, and transportation, to support the transition to renewable energy.

Efficient and Clean Cooling contributed financial and technical support as part of the World Bank's COVID-19 pandemic response efforts and the rollout of vaccines. It supported the deployment of reliable and climate-friendly vaccine cold chains in collaboration with partners such as WHO, UNICEF, and Gavi, the

Vaccine Alliance. The program also allocated more than \$9 million in grants to over 15 countries, including fragility, conflict, and violence (FCV) countries, to help strengthen health systems.

Specific technical support includes providing advisory services (including in-kind technical support) and participating in workshops with government officials and implementing agencies. The program also delivers detailed guidance and technical knowledge on the needs of the countries. Further, a tool has been developed to support planning for cold chains for health sector strengthening and is being piloted in Ethiopia, Nigeria, and Somalia. The tool will enhance these countries' understanding of the cost, energy, and climate change implications of upgrading cold chains to respond to the pandemic.

BOX 2.6

COVID-19

## EXAMPLES OF COVID-19 RESPONSE ACTIVITIES

With a \$2 million ESMAP grant, 62 solar direct drive refrigerators (climate-friendly cold chain equipment) have been procured, deployed, and installed in South Sudan and are currently operational in field locations in the Upper Nile and Jonglei States. The investment will support services delivered to approximately 1.26 million people; it is a testimony to the World Bank's strong commitment to fragile and conflict-affected settings and providing climate-friendly energy solutions in the health sector.

In Mongolia, a project financed by a World Bank COVID-19 Emergency Response Project received from the ESMAP team in-kind technical expertise on the design and construction of a new, reliable, energy-efficient, solar-ready, state-of-the-art central vaccine storage facility, with four times the original capacity based on the facility's technical specifications. This enabled the country to fully vaccinate more than 65 percent of the population and have reliable storage for life-saving vaccines while limiting GHG emissions and lowering operating costs.



BOX 2.5

## RWANDA

## IMPROVING AGRICULTURAL OUTCOMES IN RWANDA

Agriculture continues to be the dominant source of livelihood in Rwanda, but it has not reached its full potential. This is due to post-harvest losses caused by the country's limited access to storage options, including cold storage. The [Efficient and Clean Cooling Program](#) is supporting Rwanda's [Sustainable Agricultural Intensification and Food Security Project \(SAIP\)](#) to enhance understanding of the landscape of cold chains along the country's horticulture value chains. ESMAP's work with SAIP will suggest a roadmap, including policy and investment recommendations and business models, and adapt applicable lessons from international experiences in energy-efficient cold chains along the horticulture and livestock value chains. This is significant because the agrifood sector is one of the main drivers of Rwanda's economic growth and an important industry to help achieve its targets for poverty reduction, food security, and human capital improvement. Moreover, the insights from Rwanda will be shared more broadly to inform and advance sustainable cold chain solutions in the agriculture sector of other countries.

The Clean and Effective Cooling Program secured \$157 million from the Green Climate Fund in October 2021. The Cooling Facility is one of the world's first cooling-focused facilities with the aim to accelerating the uptake of investments in innovative and climate-friendly cooling technologies and systems across nine countries, namely Bangladesh, El Salvador, Kenya, Malawi, North Macedonia, Panama, São Tomé & Príncipe, Somalia, and Sri Lanka, and three sectors--agriculture, health, and buildings. Since the effectiveness of the Cooling Facility on July 29, 2022, processing of the funding has been initiated for the projects in Somalia, through an additional financing to the Improving Healthcare Services in Somalia project ("Damal Caafimaad"); and in São Tomé & Príncipe through additional financing to the COVID-19 Emergency Response project. It is expected that both projects will reach World Bank's approval in the first quarter of FY2024.

## INDUSTRIAL DECARBONIZATION

Seventy percent of direct global emissions come from three major industries: iron and steel, non-metallic minerals (cement, glass, and lime), and chemical industries. In addition, 74 percent of the energy consumed in the industrial sector is for heat production, which is hard to decarbonize, especially in the production of cement, steel, and petrochemicals. Decarbonization of heavy industries requires innovative clean technologies to be deployed widely and in an efficient manner. Today, the majority of low-emissions production pathways have a lower technical maturity and increased cost compared to conventional pathways.

This is a particularly pressing issue for developing countries, as rapid industrialization and improving the competitiveness of industries make creating a low-carbon future more difficult. Yet, decarbonizing the industrial sector is a crucial step in limiting the global temperature increase and fighting climate change.

The [Industrial Decarbonization Program](#) (IDP) supports governments in developing countries to decarbonize their industrial sectors. The program works to help them adopt innovative solutions and advance beyond old technologies that could lock them into carbon emissions for decades.

The program structures its activities around three strategies: reducing the demand for carbon-intensive products,

improving energy efficiency, and deploying decarbonization technologies. The IDP works to produce knowledge pieces and guidance material. It also develops strategies, roadmaps, and recommendations on enabling policies, regulations, and legal frameworks for decarbonization.

During FY2022, seven grants were approved to support the work related to the decarbonization of the industrial sector in India, Morocco, Pakistan, and Vietnam. These country projects will support the manufacturing and agribusiness sectors to adopt innovative solutions to reduce carbon emissions.

In Kazakhstan, an ESMAP grant is supporting the country to proceed with implementing the industrial decarbonization and adoption of the relevant regulatory framework to contribute to reducing the GHG emissions from the industrial sector. The regulatory studies focus on capacity building for innovative decarbonization technology and creation of legislative frameworks for research and development promotion. Industries in the country are adopting decarbonization technologies and conducting technical and financial analyses to apply industrial symbioses. Overall, working with in-country partners has been essential to implement the program and to align with government priorities, just as working upstream on legal and regulatory frameworks for the promotion and adoption of innovative technologies. Similarly, engagement with companies' management structure to get buy-in for low-carbon technologies has been critical. However, promoting early technologies without long-term proven results or higher price points than conventional technologies remains challenging.

## GEOTHERMAL DIRECT USE

The heat from geothermal resources can displace fossil fuels in various applications. Eighty-eight countries worldwide use geothermal energy, producing 283,580 GWh annually. This displaces about 600 million barrels of oil and more than 250 million tons of carbon dioxide every year.

Yet, despite its great potential, geothermal energy is a relatively unknown energy alternative and is underused, especially in low- and middle-income countries. Some of the barriers to the commercial use of geothermal



#### GEOTHERMAL DIRECT USE

## GEOTHERMAL DIRECT USE CONTRIBUTIONS TO ACHIEVING THE TARGETS OF THE SUSTAINABLE DEVELOPMENT GOALS

Sustainable Development Goal	Geothermal Direct Use Contribution
<b>SDG 2:</b> End hunger, achieve food security, and improve nutrition and promote sustainable agriculture.	Adopts agricultural greenhouse techniques, food drying, aquaculture, and soil warming.
<b>SDG 5:</b> Achieve gender equality and empower all women and girls.	Expands employment, training, and entrepreneurial opportunities.
<b>SDG 7:</b> Ensure access to affordable, reliable, sustainable, and modern energy for all.	Provides clean and renewable sources for heat and electricity.
<b>SDG 8:</b> Promote inclusive and sustainable economic growth, employment, and decent work for all.	Serves as an underlying resource for many local business activities.
<b>SDG 9:</b> Build resilient infrastructure, promote sustainable industrialization, and foster innovation.	Creates, improves, or expands varied local enterprises.
<b>SDG 13:</b> Take urgent action to combat climate change and its impacts.	Replaces fossil fuels with geothermal heat.



## TÜRKIYE

## HARNESSING THE USE OF GEOTHERMAL RESOURCES IN TÜRKIYE

Officials in Türkiye identified 239 geothermal fields representing an estimated potential of 60,000 MWs of thermal energy. Although these fields are spread across the country, most of them are concentrated in the Western Anatolia region. The fields are suitable for agriculture, district heating, thermal tourism, and several industrial processes. About 40,000 MWs of thermal energy have temperatures high enough to be suitable to generate for the region up to 4,000 MWs of clean electricity, which can support the cogeneration of about 2,000 MWs of thermal energy. The remaining 20,000 MWs of thermal energy is more suitable for geothermal direct use. The [Geothermal Direct Use Program](#) team assessed the technical and economic viability of different options for the use of geothermal resources in the country.

resources are the high upfront costs and limited understanding of its potential.

ESMAP's [Geothermal Direct Use Program](#) helps countries to overcome these barriers. It works to scale up the use of geothermal resources by raising awareness of geothermal energy's value in creating and decarbonizing economic activity. The program generates knowledge, conducts regional or country-specific studies, and strengthens the capacity of sector experts, government officials, and other stakeholders.

In FY2022, the program expanded activities begun in the Europe and Central Asia (ECA) region the previous year to support Kazakhstan and Türkiye in harnessing the potential for the use of their geothermal resources. These activities were centered around phasing out coal, promoting renewable energy, and enhancing energy efficiency and sustainable heating.

In Kazakhstan, the team worked with Iceland's Ministry of Foreign Affairs to carry out two studies exploring the potential for using geothermal resources to provide district heating. A new project in Türkiye will support horticultural production using modern geothermal-operated and technology-based greenhouses.

New programs were introduced in the LAC region, where funding facilitated investments in geothermal direct use in El Salvador and Costa Rica. Technical support was also provided in the Dominican Republic for a geothermal risk mitigation project. A renewable energy project that was launched in St. Lucia includes components to evaluate the feasibility of using geothermal resources.

In September 2021, ESMAP collaborated with the International Geothermal Association to host a [virtual event](#) to highlight the importance of geothermal resources. The event was attended by a mix of private and public sector participants from 78 countries. It will be followed by a study tour to Iceland to further engage and generate interest.

Work is underway to complete a study on the sediment management in reservoirs and run-of-the-rivers which will be published in FY2023.

## GREEN HYDROGEN SUPPORT PROGRAM

The world is not on track to limit the increase in average global temperature to 1.5° C, and deeper actions for decarbonization across all economic sectors are required, particularly in hard-to-abate sectors. Green hydrogen—produced with renewable electricity through electrolysis—can help address GHG emissions from hard-to-abate sectors, such as cement and steel production, shipping, and heavy road transport, and provide a low-cost, flexible option for energy storage.

ESMAP's [Green Hydrogen Support Program](#) was established to raise awareness of the potential for green hydrogen to create economic opportunities in developing countries and decarbonize energy-intensive activities. The program assists governments in low- and middle-income countries to identify short- and long-term green hydrogen opportunities. It also addresses the challenges associated with the deployment of green hydrogen projects, such as technology risks, capacity building, regulatory requirements, and technoeconomic analyses.

In FY2022, the program provided a grant to fund the Green Hydrogen Opportunities and Roadmap for India, which is connected to a project to support the energy transition of the country's power sector. The grant will support the government in promoting green hydrogen in the country and serve as a benchmark for leading countries and identifying early entry points through demonstration and pilot projects. In Namibia, the Green Hydrogen Support Program supported activities to deepen the understanding of the sectors that could benefit from a green hydrogen economy. The country's government intends to leverage a public-private partnership to develop a world-class, renewable energy-powered mega-project. In Costa Rica, the team worked with the country's Ministry of Environment and Energy on a feasibility study to replace the existing thermal power plants. An additional analysis was conducted to evaluate the viability of producing green hydrogen-derived e-fuels. In Morocco, the team is providing technical assistance to study the country's potential for generating green hydrogen. An in-depth study will focus on identifying the preconditions for large-scale green hydrogen development.



## GREEN HYDROGEN

# THE HYDROGEN FOR DEVELOPMENT PARTNERSHIP

In November 2022, during COP27, the World Bank Group launched a new global initiative to boost the deployment of low-carbon hydrogen in developing countries: the Hydrogen for Development Partnership (H4D). This initiative, hosted by ESMAP, will build a platform for knowledge sharing, capacity building, and financing by fostering the international cooperation needed to afford tailor-made solutions for low- and middle-income client countries.

H4D will support client countries in accelerating the deployment of low-emissions hydrogen solutions. The knowledge and capacities developed by the partnership will support the implementation of the enabling environment that will accelerate investments in low-carbon projects. H4D's goal is to ensure that emerging markets and developing countries can participate in the growing hydrogen economy across the value chain to support their climate and energy objectives.

H4D will also help to catalyze significant financing for hydrogen investments in the next few years, both from public and private sources. The partnership of hydrogen stakeholders is expected to foster capacity building and regulatory solutions, business models, and technologies for the rollout of low-carbon hydrogen in developing countries. During the launch event, 14 partners committed to advancing low-carbon hydrogen worldwide.

H4D will work closely with partners, including research institutions, technical laboratories, industry associations, policymakers, regulators, and development entities. The work done by H4D will support the decarbonization of hard-to-abate sectors, help developing countries to meet their NDC, and enhance their energy security by unleashing domestic low-carbon hydrogen production.



## ZERO CARBON PUBLIC SECTOR

By being an effective early adopter of innovative approaches, the public sector has the potential to provide leadership for a net zero carbon future: its institutions and their extensions, such as public buildings, public utilities, and transportation facilities, typically consume up to 20 percent of an average country's energy resources, and the sector can contribute to innovation and market creation through planning, policy, and procurement. Unfortunately, according to the 2022 [ESMAP Regulatory Indicators for Sustainable Energy \(RISE\)](#), energy efficiency policies are not receiving adequate attention, despite unprecedented energy price hikes. The report shows that 49 countries made little or no advances on energy efficiency policy frameworks.

ESMAP recognizes the importance of the public sector in the transition to net zero emissions and so created the Zero Carbon Public Sector initiative to promote the adoption of energy-efficient and low-carbon solutions by public entities in developing countries. The initiative, aligned with the World Bank Group's new Climate Change Action Plan, works by providing technical assistance to

governments in developing countries to prioritize zero carbon pathways and low carbon activities for the public sector. It also helps them develop and implement activities to decarbonize the public sector within public buildings, public transport, street lighting, water, waste disposal, and district energy.

During FY2022, the [Zero Carbon Public Sector](#) initiative supported 27 activities across World Bank regions covering the decarbonization of buildings, transport, and utilities. In Uzbekistan, the initiative provided technical assistance to analyze clean energy options for heating and cooling public buildings, including schools and hospitals. Activities to promote buildings' energy efficiency and green building certification were carried out to support India's energy transition and climate change agenda.

In Mexico, the initiative helped to address the significant challenges in ensuring sustainable housing among low-income and vulnerable population groups. Design manuals were produced to introduce energy efficiency solutions in the country's housing market.

# CLEAN COOKING



The share of the global population with access to clean cooking fuels and technologies rose to 69 percent in 2020, an increase of 3 percentage points over the previous year. However, population growth outpaced much of the gains in access, particularly in the Sub-Saharan Africa (SSA) region. As a result, the total number of people lacking access to clean cooking has remained relatively stagnant for decades. A coordinated multisector effort is needed to achieve the SDG 7 target of universal access to clean cooking by 2030. It is critical that the global community learns from the successes of and challenges faced by countries that have attempted to design and implement clean household energy policies.

In some countries, like Kenya, significant progress has been made. The government announced a strategy to address rising cases of respiratory illnesses and mitigate the global climate crisis by increasing the use of modern clean cooking solutions. The National Clean Cooking Strategy aims to ensure Kenya is on track to achieve its target of universal access to clean energy by 2028. Through this strategy, the country will increase access to improved transitional and clean cooking solutions. The solutions include climate-friendly, efficient biomass stoves, as well as switch fuels from solid biomass and kerosene to cleaner and environmentally friendly options such as biogas, bioethanol, LPG, solar photovoltaic (PV), and electric cooking.

Notwithstanding needing to catch up with growing populations, the clean cooking sector is gaining momentum and is at a turning point. There is more recognition and integration of clean cooking into national

climate and energy plans than ever before. Nearly 70 countries have included clean cooking as part of their National Determined Contribution (NDC). Countries are increasingly adding demand for electric cooking to their utility plans or integrated energy plans.

Through ESMAP, the World Bank is tackling the multisector development challenge of clean cooking access by catalyzing action through political prioritization, financing, knowledge creation, and partnerships. The World Bank is mainstreaming clean cooking into energy access projects at the country and regional levels. The World Bank's Energy Compact, presented to the United Nations High-Level Dialogue on Energy, commits support to providing up to 100 million people with access to clean cooking by 2025. Aligned with this commitment, one of the World Bank's corporate priorities is to track annual progress in helping people gain access to clean cooking during the International Development Association 20 (IDA20) cycle, between July 2022 and June 2025. Fourteen countries have targets to support SDG 7.1.2, on access to clean cooking and technologies through the UN Energy Compacts.

The World Bank engages with external partners on knowledge sharing, policy coordination, and hosting joint events, and webinars at the global and country levels. Globally, the World Bank co-convened the [Health and Energy Platform of Action](#) together with WHO and the United Nations Development Programme (UNDP) and is part of the [High-Level Coalition on Health and Energy](#) to strengthen the health and energy sectors' cooperation, increase political momentum, spur investments, mobilize public support, and drive practical solutions.

# 2.4

## billion

The total number of people lacking access to clean cooking has remained relatively stagnant for decades. Between 2000 and 2010, this number was close to 3 billion people, or one-third of the global population. It dropped to around 2.4 billion in 2020.

## CLEAN COOKING FUND

The [Clean Cooking Fund](#) (CCF) was created in September 2019 and has been working to improve the cooking sector ecosystem through knowledge, investment, and partnerships. The CCF has supported the preparation of five approved investment projects, which are now under implementation in Chad, Mozambique, Niger, Rwanda, and Uganda. With \$36 million of CCF co-financing, it has leveraged \$42 million in IDA financing, \$10.8 million in carbon financing and \$65 million in private financing to help more than nine million people and 750 schools to gain access to clean cooking. This is expected to lead to 12 million tCO<sub>2</sub>eq in emission reductions. The CCF is also administering the disbursement of 19 country and regional grants and providing just-in-time technical support to the country/regional teams, which have contributed to market assessment, technical design, and development of national strategies to improve the ecosystem for the clean cooking sector.

For example, CCF grants have supported Ghana's upcoming National Clean Cooking Strategy, and the Rwanda Vision 2020 Umurenge Program's communication strategy. During FY2022, the program made progress across two pillars: the first pillar oversees the Country and Regional Investment Program, which provides dedicated grant resources to leverage public and private investments; and the second pillar oversees knowledge, innovation, and policy coordination.

Under the first pillar, in Niger, the CCF co-financed the clean and efficient cooking subcomponent of \$15 million (\$7.5 million IDA and \$7.5 million CCF grant) as a part of the [Niger Accelerating Electricity Access](#) project (Haske). The project will seek to transition a total of 550,000 households from tiers 0 and 1 of the cooking multitier framework (MTF) toward tiers 2- to 5-equivalent solutions depending on their relative market segments. This is expected to result in an estimated net emission reduction of 1.4 million tCO<sub>2</sub>eq and reduced consumption of woody biomass by 2.3 million tons of wood and would save each household \$10 to \$65 annually depending on the tiers involved. Activities and incentives for the private sector will be tailored to ensure that at least 20 percent of beneficiaries (110,000 households and 605,000 people) are forcibly displaced persons or from their host communities.

In Mozambique, the CCF provided co-financing and preparation support to the Sustainable Energy and Broadband [Access in Rural Mozambique Project](#) (approved in December

2021 with a \$5 million CCF grant). The project aims to provide 200,000 households, 30 percent of which are female beneficiaries, with access to improved and clean cooking solutions, reducing emissions by 0.79 million tCO<sub>2</sub>eq (see Box 2.12 for an in-depth overview of the Mozambique project).

The CCF also supported the preparation and approval of additional financing for the [Rwanda Energy Access and Quality Improvement Project](#) (EAQIP), which leveraged \$10.8 million carbon finance from the [Carbon Initiative for Development Fund](#) to purchase carbon credits generated through clean cooking and off-grid operations. The carbon revenue will flow back to the [CCF-co-financed results-based financing fund](#) to make it a revolving fund. Through ESMAP co-financing of \$3.15 million, the project has also expanded support to institutional cooking by helping 150 schools to access clean cooking solutions.

Under the second pillar, during FY2022, the CCF has made two key contributions to sector development. The [Clean Cooking Planning Tool](#) (CCPT) provides clean cooking data to countries and allows stakeholders and users to understand the status of the sector in 2020 and estimate the transitioned population; investments needed by the public, private, and household sectors; and benefits to health, climate, and gender equality by 2030 (see box for additional information).

The CCF has contributed to four of the World Bank's recently launched core diagnostic documents, the Country Climate and Development Reports (CCDRs) in G5 Sahel Region (Burkina Faso, Chad, Mali, Mauritania, and Niger), Malawi, Mozambique, and Rwanda. The CCDRs help countries prioritize the most impactful actions to reduce GHG emissions and boost adaptation while delivering on broader development goals. Access to clean cooking as a development issue and closely linked to mitigation and adaptation is an integral part of these countries' energy sector focus. The CCF provided data-driven, in-depth background analysis on the status of clean cooking, policy analysis, planning, and the investment needs to achieve the country's targets by 2030. For the Malawi CCDR, the CCF provided a detailed analysis on the sector in the Malawi Clean Cooking Sector Background Note. The underlying data in the CCDR relies on the CCPT modeling and analysis to help estimate outcomes, investment needs, and benefits of the policies and programs in a particular country or region.



## CLEAN COOKING FUND

# THE CLEAN COOKING PLANNING TOOL

Driving progress on SDG 7 requires mobilizing financial and analytical resources to improve the overall cooking ecosystem, as well as innovative technologies and partnerships. One of the identified priority actions is to formalize cooking energy demand in national energy planning and develop strategies for achieving universal access.

The [Clean Cooking Fund](#) created a scenario-based, integrated [Clean Cooking Planning Tool](#) (CCPT) to help decision makers and planners explore and identify transition paths for achieving universal access to clean cooking solutions.

The tool is designed primarily for helping national-level energy planners, decision makers, program developers, and researchers to explore the estimated sector costs and public co-benefits of transitioning their urban and rural populations to modern cooking energy services by 2030. This information will help them to be better prepared to begin the national-level dialogue among key stakeholders and development partners and mobilize the required public and private investments.

The CCF team has promoted the CCPT through multiple channels, including webinars, conferences, and integrated sector analysis in the CCDRs. The country and regional level analysis generated for the reports has been published for Malawi (including a Clean Cooking Sector Background Note), Mozambique (forthcoming), and the G5 Sahel.



## MOZAMBIQUE

## SUSTAINABLE ENERGY AND BROADBAND ACCESS IN RURAL MOZAMBIQUE

In FY2022, the World Bank approved a new project, [Sustainable Energy and Broadband Access in Rural Mozambique](#), which will bring investments of \$10 million to support the government of Mozambique to expand access to clean cooking solutions for 880,000 people (200,000 households) across the country. This project leverages grant support from [ESMAP's Clean Cooking Fund](#) (CCF) with \$10 million, \$5 million from IDA and \$5 million cofinancing from CCF. Technical assistance will support developing a national strategy, raising awareness among consumers, and providing assistance to market players. The project will help shift households using traditional stoves to improve biomass solutions and those using charcoal to switch to modern fuels and stoves. Using a market-based approach, such as a results-based financing mechanism, the project aims to attract and expand the local private sector to deliver solutions based on the needs of Mozambicans. In doing so, the impacts of the project can extend to net emission reductions of 0.86 million tCO<sub>2</sub>eq, equivalent to a reduction of 1.2 million tons of wood per year, and save each household \$1 to \$20 annually depending on the tier of its stove.



# MITIGATING FOOD INSECURITY THROUGH THE PRODUCTIVE USE OF ELECTRICITY

A little-known fact: 30 percent of the world's energy—mainly fossil fuels—is consumed within the agricultural value chain. When, in 2022, Russia invaded Ukraine, global food markets were hit twofold: (1) the global supply of wheat and barley took a plunge, since Russia and Ukraine together provide about 30 percent of the global supply of these crops; and (2) as the war led to a huge increase in energy prices, this in turn impacted food prices and food production.

Unfortunately, this is particularly problematic in developing countries, especially those in the Africa and Asia regions where food insecurity was already prevalent. Mitigating food insecurity has become a development emergency that requires, among other actions, addressing energy poverty challenges that exist along food supply chains. More affordable and predictable energy access can prevent food losses, improve yields, and enable farmers to add value to their agricultural products.

ESMAP, together with its partners, has taken on this challenge, led by its [Improving Livelihoods and Human Capital](#) (ILHC) Initiative, together with its [Efficient Clean Cooling Program](#) (ECCP) and the [Off-Grid Solar](#) and [Mini Grids](#) programs. The work aims to help countries improve their ability to address food security challenges from an energy point of view and to enhance the economic and social opportunities that come from a connection to electricity in the field of agriculture.



This is known as “productive use,” and in agriculture, it encompasses irrigation of crops powered by solar energy; food processing machines like millers and grinders using renewable energy; the whole cooling chain for agricultural products, from cold storages in farms, to refrigerated trucks and refrigerators in markets and other retail places, and finally to home refrigerators, all powered by hybrid solar mini grids or independent solar panels.

Together with World Bank regional teams, ESMAP is working to build the foundation necessary to include productive use of energy in World Bank agriculture

investment projects. What does this look like? In the Democratic Republic of Congo, Ethiopia, Kenya, Nigeria, and Rwanda, courtesy of a \$1.4 million grant from the Rockefeller Foundation, ESMAP is supporting preparatory studies on the productive use of electricity and demand stimulation, with a view to encouraging the deployment of renewable energy. The grant is also used to assess the viability of the colocation of agricultural value chains with solar-powered mini grids. Further, it supports engagement with key project stakeholders, including mini grid developers, appliance suppliers, microfinance institutions, and commercial banks.

## IN NIGERIA,

for example, the grant supported a study that found a high potential for co-locating solar-powered mini grids as the least-cost means to provide electricity to farmers in communities cultivating rice and cassava. In January 2022, a workshop was held to share the findings of the study with key stakeholders to raise awareness of the agriculture-energy nexus and identify investment opportunities.

## IN ETHIOPIA,

the World Bank approved the \$500 million access to [Distributed Electricity and Lighting in Ethiopia \(ADELE\) Project](#) in 2021. The project aims to deliver adequate, reliable, and affordable electricity services to households, small-scale farmers, social institutions, and commercial and industrial institutions in urban, peri-urban, rural, and rural areas. ESMAP supported analytics to fill the knowledge gaps in potential productive uses of energy focusing on appliances especially in the agriculture value chain, powered by off-grid solar and mini grid technologies. The analysis helped to identify the energy needs of these markets and critical barriers to their development. Based on this analysis, a new \$10 million facility is being created to support the sale of about 15,000 solar water pumps in rural areas of Ethiopia.

ESMAP works on productive use of energy for agricultural production and along the agricultural delivery chain. For example, thanks to a \$1 million from the Kigali Cooling Efficiency Program (now the Clean Cooling Collaborative), ESMAP is helping to develop and

integrate in World Bank lending operations efficient and clean cooling solutions in Bangladesh, Kenya, Malawi, and Rwanda. In Malawi, ESMAP is funding a diagnostic of the current situation of cooling facilities in small and medium enterprises.

## IN KENYA,

the team is providing advice to colleagues in the agriculture global practice and the government of Kenya on the integration of sustainable cold chains within the new [National Agriculture Value Chain Development](#) World Bank project. The country's first cold chain stakeholders working group has been convened and ongoing consultations are identifying bottlenecks in sustainable solutions and proposing suitable interventions.

## IN BANGLADESH,

an ESMAP grant-funded technical assistance is advising and informing the [Bangladesh Livestock and Dairy Development Project](#). With \$500 million, it is the World Bank's largest operation in the livestock and dairy sectors. ESMAP support is enabling cold chain infrastructure market needs assessments, the design of business models, consumer awareness campaigns, as well as policy advice for the government of Bangladesh.

## IN RWANDA,

the World Bank and Government of Rwanda have developed the [Sustainable Agricultural Intensification and Food Security Project](#) to increase agricultural productivity, market access, and food security in targeted project areas. A critical component of this program is increasing farmers' capacity to undertake sustainable agricultural practices and improving post-harvest infrastructure, with the construction of 10 solar-powered cold rooms to support this. An ESMAP grant enabled the analysis of why these cold rooms have been underused, and it developed recommendations for how to rectify this.

As the World Bank introduces electrification programs in increasingly challenging markets and contexts, ESMAP will continue to provide in-kind and financial support to deploy productive use of energy solutions. It will also continue to provide policymakers and practitioners with the knowledge and tools they need. A new toolkit is in the

works and will take practitioners through the five building blocks of productive use of energy: (1) planning and data analytics; (2) policies and regulations; (3) technology and innovation; (4) access to finance; and (5) business development support.

# ELECTRICITY ACCESS



Universal access to affordable, reliable, and modern energy services by 2030 is a prerequisite for improving the living and working conditions of the currently energy deprived populations. However, the world is still not on track to achieve the SDG 7 goal of ensuring access to affordable, reliable, sustainable and modern energy by 2030. Globally, 733 million people still have no access to electricity.

The COVID-19 pandemic has been a key factor in slowing progress toward universal energy access. The pace of progress on the SDG 7 targets is expected to further slow because of the energy crisis provoked by the Russian invasion of Ukraine. At the current rate of progress, 670 million people will remain without electricity by 2030—10 million more than projected last year.

With only eight years left to achieve SDG target 7.1—to ensure universal access to affordable, reliable, and modern energy services by 2030—governments and the international community face the challenge of drastically increasing the pace of progress in a context of high uncertainty and transition to net zero energy systems. The pace of electrification is highly uneven, with some countries well on track to reach SDG 7 targets, while others would require an additional 100 years at their current pace. High levels of electricity access deficits are seen particularly in sparsely populated countries afflicted with fragility, conflict, and violence (FCV). To achieve universal access, energy access should be an integral part of the just energy transition and embedded in countries' socioeconomic development and climate commitments. For energy access to reach the most remote and

poorest communities, including forcibly displaced populations, it should be at the center of governments' electrification strategies and feature least-cost options such as off-grid solar and mini grids—proven to serve rural communities effectively. Delivering the socioeconomic benefits of energy access also requires developing productive uses and electrifying healthcare, education, and other public institutions. This will improve livelihoods and boost human capital. The overall financing for electrification projects should increase significantly and should include schemes to reinvigorate bankrupt national utilities and encourage private sector investments, in addition to critical support for distributed renewable energy solutions.

The ESMAP Electricity Access Program operates six workstreams: (1) Integrated Electrification Strategies and Planning; (2) Global Facility on Mini Grids; (3) Off-Grid Solar Scale-Up (Lighting Global); (4) Leave No One Behind; (5) Improving Livelihoods and Human Capital; and (6) Financial Innovation for Electricity Access. Through these workstreams, the program emphasizes scaling up access to affordable, reliable, and modern energy services. In FY2022, four goals drove the program's work, to (1) respond decisively to the COVID-19 crisis, with a focus on electrifying health facilities and maintaining energy access gains; (2) use the workstreams to engage across sectors to set up ambitious, strategic interventions to impact electrification progress; (3) advance the objectives of Leave No One Behind and other pro-poor initiatives; and (4) increase focus on low-income countries affected by FCV.

# 733 million

At today's rate of progress, the world is still not on track to achieve the SDG 7 goals of ensuring access to affordable, reliable, sustainable, and modern energy by 2030. Globally, 733 million people still have no access to electricity.

## INTEGRATED ELECTRIFICATION STRATEGIES AND PLANNING

ESMAP's [Integrated Electrification Strategies and Planning](#) (IESP) program provides technical assistance and operational support to governments for geospatial electrification planning, pipeline development and implementation, and preparation of geospatial mini grid investment portfolios. The program aims to have at least 12 countries officially adopt integrated electrification strategies/least-cost plans with universal access targets, implementation schedules, modalities, and financing plans.

During FY2022, the program launched a new and improved Global Electrification Platform that incorporates health facilities and educational institutions. It includes a proxy for electricity demand for commercial activity in the demand estimation. The model was updated to include hybrid mini grid systems, and the quality of input data and modeling assumptions were improved by including updates to the grid generating cost of electricity and the bottom-up demand estimates.

In addition, the electrification investment estimates were completed for the Global Assessment of Electricity in Healthcare Facilities report, to be jointly released by WHO, SEforALL, IRENA, and the World Bank in January 2023. The updated Global Electrification Platform, along with facility-level survey data, was used to carry out this investment needs assessment, which covers the deployment of both greenfield solutions for off-grid health facilities and backup power provisioning for facilities with unreliable electricity service.

During FY2022, the program carried out a geospatial characterization of mini grid potential in Ethiopia with a focus on modeling agricultural loads and their impact on mini grid viability. It also conducted an agribusiness and mini grid co-location study that assessed the impact of electricity demand from agribusinesses supported by a World Bank agro-processing project in Nigeria on the dimensioning, costing, and commercial viability of greenfield mini grids in the same communities. An articulation of the catchment areas served by selected primary healthcare centers in Nigeria was carried out along with an assessment of mini grid viability in settlements

hosting priority primary healthcare centers. In addition, a national least-cost electrification analysis, geospatial mini grid portfolio planning, and energy access surveys in Pakistan were implemented simultaneously to reduce the lead time for the preparation of significant energy access operations.

Two capacity building and knowledge exchange events were also conducted during FY2022. The Sixth Annual Joint Summer School on Modelling Tools for Sustainable Development was administered in May–June 2022 with a consortium of partners from the energy modeling community. A four-week webinar series, “Open-source Geospatial Solutions in Energy Access,” was held in April 2022 with the World Resources Institute (WRI) and the EnAccess Foundation.

## GLOBAL FACILITY ON MINI GRIDS

Geospatial analysis indicates that solar mini grids could be the most affordable way to provide affordable and reliable electricity to nearly half a billion people worldwide under the right conditions. This innovative source of electrical supply already contributes to the productive use of electricity for almost 50 million people engaging in agricultural, commercial, and industrial activities in more than 20,000 communities, towns, and cities around the world.

The [Global Facility for Mini Grids](#) (GFMG) provides technical guidance to governments in developing countries to help them integrate and scale up mini grid deployment as part of each country's electrification program. To ensure that the mini grids facilitate rapid, sustainable expansion of electricity services, the GFMG has developed a policy framework for growing the mini grid sector in order to give large numbers of people access to quality, affordable electricity.

The GFMG's technical guidance also provides hands-on technical support to the World Bank teams and their national counterparts working on the ground in the various countries of the institution's mini grid portfolio. It comprises 40 operations in 31 developing countries and represents a \$1.5 billion commitment to mini grids.

## MINI GRIDS

## TEN BUILDING BLOCKS FOR THE DEPLOYMENT OF MINI GRIDS

Ten building blocks can be used as a comprehensive roadmap for policymakers and practitioners to realize the full potential of mini grids:

1. Reducing costs and optimizing design and innovation for solar mini grids.
2. Planning national strategies and developer portfolios with geospatial analysis and digital platforms.
3. Transforming productive livelihoods and improving business viability.
4. Engaging communities as valued customers.
5. Delivering services through local and international companies and utilities.
6. Financing solar mini grid portfolios and end user appliances.
7. Attracting exceptional talent and scaling skills development.
8. Supporting institutions, delivery models, and champions that create opportunities.
9. Enacting regulations and policies that empower mini grid companies and customers.
10. Cutting red tape for a dynamic business environment.

Of the 60 World Bank projects that are active, in the pipeline, or recently closed within the past couple of years, that feature a mini grid component, the ESMAP GFMG has had a hand in supporting the design, preparation, and/or implementation of about 40 of them.

GFMG support to World Bank projects includes activities targeting project preparation and project implementation, such as: grant-supported consultancies to work alongside World Bank operations teams to provide in-depth studies that support project preparation or implementation; targeted technical assistance such as reviewing and advising on regulations, grant agreements, and contracts; and, experts and GFMG staff embedded within project teams to provide day-to-day support from project preparation through to project implementation.

Two of the largest World Bank investment commitments in mini grids in the portfolio of currently active projects are in Nigeria and Ethiopia. ESMAP support to these projects has included geospatial portfolio planning to identify, characterize, and prioritize potential sites/communities for mini grid electrification, development of technical and service standards, cost benchmarking and financial modeling to assess viability gaps and assist in tariff review, transaction advisory support, analysis of regulations and enabling environment, mapping of public institutions and their catchment areas, matchmaking of productive use equipment suppliers and financiers with mini grid developers, and the adoption of data platforms for project design, e-tendering, and remote monitoring.

## MINI GRIDS

## MINI GRIDS FOR HALF A BILLION PEOPLE

With a set of data and statistics completely updated since the 2019 Executive Summary, as well as in-depth how-to guides in 10 key mini grid areas, ESMAP's new handbook on mini grids, [\*Mini Grids for Half a Billion People: Market Outlook and Handbook for Decision Makers\*](#) is the World Bank's most comprehensive and authoritative publication on mini grids to date.

The handbook presents an overview of the global mini grid market, highlighting that currently, more than 48 million people worldwide are receiving electricity from more than 21,000 mini grids. It also describes how mini grids are the least-cost solution to connect nearly 490 million people globally by 2030 provided that the necessary enabling conditions are in place. The handbook then lays out a detailed, actionable roadmap for decision makers on how to create these enabling conditions by instituting the 10 building blocks listed in the box above.

Over the past three years, the mini grid sector has made significant progress toward becoming a mainstream path to providing modern energy services to people who need it the most, particularly in Sub-Saharan Africa, alongside grid extension and standalone solar systems. The following data highlight both the progress and potential of modern mini grids:

- The pace of deployment has tripled, accelerating from less than 50 per country per year in 2018 to 150 per country per year in 2021.
- The unsubsidized levelized cost of energy has fallen by a third, from \$0.55 per kWh in 2018 to \$0.38 per kWh in 2021, which is on pace to be less than \$0.20 per kWh by 2030.
- The cumulative required investment cost to connect 490 million people to mini grids by 2030 is approximately \$98 billion, down from an estimate of \$190 billion in 2018, because of faster-than-expected cost declines.
- As a result of technology disruption since 2018, when 79 percent of planned mini grids were expected to be powered by solar PV technology, more than 99 percent of mini grids being planned today will be powered by solar PV.
- Significant market potential for system standardization is based on geospatial analysis:
  - 21,000 mini grids with a capacity of less than 20 kW
  - 58,000 mini grids with a capacity of 20–80 kW
  - 46,000 mini grids with a capacity of 80–200 kW
  - 35,000 mini grids with a capacity of 200–500 kW
  - 17,000 mini grids with a capacity of 500–1,000 kW
  - 24,000 mini grids with a capacity of more than 1 MW

Connecting half a billion people to mini grids by 2030 would achieve SDG 7. It is a monumental task that requires unprecedented levels of investment, innovation, and commitment from development partners, governments, and the mini grid industry.

The facility focuses on delivering just-in-time in-depth advisory assistance to projects in fragile countries, such as the Democratic Republic of Congo, Haiti, and Niger. In particular, the team helped design and is helping to implement three of the largest mini grid programs in Sub-Saharan Africa: the [Access to Distributed Electricity and Lighting in Ethiopia \(ADELE\) Project](#), with 600 mini grids; the [Nigeria Electrification Project](#), with 850 mini grids; and the [Kenya Off-Grid Solar Access Project \(KOSAP\)](#) with more than 130 mini grids.

As mini grid deployment becomes integrated into a growing number of countries' strategies for accelerated electrification, the GFMG team has received an increasing number of requests for technical assistance from the World Bank teams working on operations, as in the case of the Yemen World Bank project in electricity. Looking forward, the GFMG is planning to further upgrade its just-in-time support to meet the increased demand for on-the-ground technical support.

Finally, a key role of the GFMG is generating and sharing knowledge on the design and implementation of mini grids. In September 2022, the GFMG published the groundbreaking handbook on mini grids, *Mini Grids for Half a Billion People: Market Outlook and Handbook for Decision Makers*. This 300-page publication is a reference guide for government, private sector, and development partner leaders who are designing, implementing, and investing in mini grid projects and programs in any country with an electricity access deficit. The handbook is currently being translated, and the French version is expected in early 2023.

## OFF-GRID SOLAR

For millions of people worldwide who do not have access to safe, affordable, and reliable energy, there is often no alternative to expensive traditional solutions such as kerosene lamps, which not only provide poor lighting but can also be harmful to people's health. ESMAP's [Off-Grid Solar Program](#), also known as Lighting Global, is designed to increase access to clean, reliable, and sustainable electricity provided by modern off-grid solar solutions.

Lighting Global supports the development of sustainable markets that deliver quality off-grid energy solutions where they are needed most. The program creates global knowledge products and informs World Bank lending projects by assigning off-grid solar experts to World Bank operational teams. The teams advise governments on how to scale up off-grid solar markets by developing country-specific guidance, drawing on the program's toolkit of interventions. This includes conducting market research, promoting consumer education, advancing consumer protection and product quality assurance frameworks, sharing best practices, helping to unlock financing bottlenecks for both consumers and companies, and building national capacity.

During FY2022, the program carried out several key activities. These include publishing [Designing Public Funding Mechanisms in the Off-Grid Solar Sector](#). This report provides in-depth technical advice and guidance on different ways in which public funding can be deployed to support the uptake of off-grid solar. Based on case studies and key informant interviews with development professionals and public officials, it identifies the advantages, disadvantages, risks, and opportunities involved in each approach. The report also identifies the conditions under which each approach is most likely to be effective, critical success factors, and best practices for the design, implementation, and adaptation of programs over time.

The Off-Grid Solar Program contributed a catalytic \$2.2million grant toward the Energy Access Relief Fund (EARF) in FY2022. The grant supplemented \$66 million of existing relief funds from a dozen investors, foundations, and development partners. The EARF is funded by a coalition of sponsors convened by Acumen, including the World Bank/ESMAP, IFC, the CDC Group, FMO, the Green Climate Fund (GCF), the IKEA Foundation, Power Africa, the Shell Foundation, the Swedish International Development Cooperation Agency (SIDA), the Swiss Agency for Development and Cooperation (SDC), the Rockefeller Foundation, USAID, the US International Development Finance Corporation, and UK Aid. The fund is designed to provide emergency capital to energy access companies that are serving millions

of rural and low-income households. It also aims to stabilize the renewable, off-grid energy sector by providing these companies with vital liquidity as they work to continue operations, retain staff, and recover from the economic crisis caused by the pandemic so that they can continue to deliver on their potential to provide energy to millions. As of end-2021, the fund's investments had made a tremendous impact: 1.4 million people served with improved energy access and 2,000 employees retained.

Following the launch of the End User Subsidy Lab in FY2021, in FY2022, the program delivered various webinars and case studies highlighting early lessons from end-user subsidy projects in the off-grid solar sector. In addition, the program entered a partnership with Energising Development (EnDev) under which end-user subsidies will be piloted in four African countries with the objective of scaling up successful pilots through World Bank funding.

BOX 2.15

YEMEN

## THE YEMEN EMERGENCY ELECTRICITY ACCESS PROJECT

The [Yemen Emergency Electricity Access Project](#) (YEEAP), funded by the World Bank and implemented by the United Nations Office for Project Services (UNOPS), has used an innovative approach to build a market for quality off-grid solar products in a challenging, fragile context. Initially, participating microfinance institutions (MFIs) were reluctant to sell off-grid solar products in rural areas, given the high costs and risks involved. The project used an in-kind grant mechanism, whereby products were procured, imported, and made available to MFIs to sell, before they made a partial repayment to UNOPS. In this way, MFIs were able to build off-grid solar business models without incurring significant costs or risks. Three years later, when MFIs were more comfortable with investing in off-grid solar and taking risk, the project transitioned to a results-based financing approach whereby MFIs procure and import quality off-grid solar products, and sell them, before receiving payment from UNOPS. The project has supported the distribution of 117,600 SHS so far, enabling 787,920 people to gain access to electricity. In the future, results-based financing amounts can be gradually reduced to facilitate a transition to a sustainable, commercial market. YEEAP is now being scaled up and is expanding scope to include pay-as-you-go solar home systems as well as productive uses of electricity. Lighting Global has supported the project team from the outset in the design and implementation of this unique approach to building a sustainable off-grid solar market in a humanitarian setting.

## LEAVE NO ONE BEHIND

The number of displaced people around the world continues to increase and is further exacerbated by the economic consequences of the COVID-19 pandemic and the Russian invasion of Ukraine. Developing countries are disproportionately affected by the recent displacement patterns, as they host over 85 percent of the world's displaced population. Due to their underdeveloped energy infrastructure, these host communities are often unable to handle the ever-increasing demand for electricity access. This poses a hindrance to efforts to reach universal electricity access by 2030.

ESMAP's [Leave No One Behind Program](#) (LNBH) works to provide safe, reliable, and affordable electricity for host communities and displaced persons. In this context, increased electrification does not only help progress toward achieving SDG 7, but also means a reduction in gender-based violence and an improvement in the quality of life and economic opportunities for vulnerable populations.

The LNBH program supports governments in developing countries in collecting data to assess the local population's electricity access needs and challenges. It also works with local utilities and mini-grid and off-grid private sector stakeholders to develop approaches and business models for the electrification of displaced people and host communities. The program promotes inclusion by ensuring that governments include displaced persons, particularly women and children, in their electrification strategies and plans. It compiles and disseminates knowledge products to give insight on and share lessons learned with key energy sector stakeholders.

In FY2022, the LNBH team worked with the Multi-Tier Framework team to create a survey targeting communities in displacement settings, MTF 2.0, which is now being piloted in Rwanda. In addition, the team developed the HOMER Enhanced to Electrify Displacement Settings tool, a free web app that creates the initial design and outlines the cost of electrifying displacement settings via solar-powered mini-grid systems. The tool helps practitioners in humanitarian settings—even those with limited experience with solar

PV technology—to increase the sustainability of electric power systems and address the challenges posed by diesel fuel consumption.

The report *Leaving No One Behind—Rethinking Energy Access in Displacement Settings* was launched in December 2022 to raise awareness of the different support systems available to provide electricity for displaced populations. The report, which will serve as a resource for energy experts, the humanitarian sector, host governments, and local decisionmakers, also highlights specific challenges and emphasizes the complexities of energy access operations in these settings.

In FY2022, the LNBH Program also completed twin regional studies in the Lake Chad Basin and in the Sahel that address the severe lack of electrification for the displaced and their host communities. The studies encompass socioeconomic and market assessments and identifies innovative delivery solutions and business models for creating sustainable markets for energy solutions in displacement settings. The studies, which cover seven countries and are expected to inform several World Bank energy access operations, will be disseminated in a series of webinars for government officials, nongovernmental organizations, civil society organizations, and other relevant stakeholders in the regions. Additional information on the LNBH program activities is highlighted in SPECIAL SECTION: Improving Access to Electricity for the Most Vulnerable, on page 55.

## IMPROVING LIVELIHOODS AND HUMAN CAPITAL

Many households and businesses around the world do not take full advantage of the socioeconomic benefits of electrification, and the [Improving Livelihoods and Human Capital](#) (ILHC) Initiative is working to change that. ILHC promotes the productive uses of electricity and helps to provide clean and reliable electricity to health facilities, which has an important impact on vaccine cold storage. The initiative also strengthens communication and education by providing essential services, including water, sanitation, and transportation. These activities focus on

the development impact of energy access and post-pandemic recovery operations, laying the groundwork for restoring livelihoods, creating jobs, and generating income for all population groups, including women.

The ILHC team routinely collaborates with teams from other ESMAP initiatives, such as Off-Grid Solar/Lighting Global and the Global Facility on Mini Grids. Project activities are centered on providing technical guidance on productive uses of energy and conducting assessments of the value chain market, the electrification of public institutions, estimated demand, and sustainable business models. In FY2022, the ILHC team provided technical advice to address complex issues, such as climate-smart agriculture, food and water security, and sustainable electrification models for public institutions. The lessons learned from the design and implementation of project activities are documented in flagship reports and knowledge products developed in collaboration with internal and external partners.

Examples of these include the *Global Assessment of Electricity in Healthcare Facilities*, which was developed in partnership with WHO, SEforALL, and IRENA. The report, which was launched in October 2022, promotes global awareness and advocacy efforts around the efforts to improve electrification in healthcare facilities. Another knowledge product, the *Sustainable Electrification Models for Electrification of Public Institutions*, evaluates the approaches adopted by the World Bank and other development partners and proposes recommendations for more sustainable private and public business models.

In May 2022, the ILHC co-organized a panel on “Powering Healthcare During and Beyond a Pandemic” at the SEforALL forum in Kigali. In addition, the ILHC team supported the ADELE Project by providing advice and embedding experts in operational activities. It also contributed to the design of the mini grid component and electrification of public facilities under the Sierra Leone Electrification Project. The team supported projects aligned with the pandemic response with vaccine purchase, emergency response, and health system preparedness in Afghanistan,

the Comoros, and South Sudan. In addition, project activities supported the design of productive use appliance interventions across both mini grid and off-grid components. Specific interventions include the development of a performance-based incentives mechanism and analytical work to identify productive loads (horticulture, dairy, poultry, and industrial parks) suitable to serve as anchor customers for the mini grids constructed under ADELE.

## FINANCIAL INNOVATION FOR ENERGY ACCESS

Innovative financing solutions are needed to improve electricity access for the millions of disadvantaged and vulnerable people living off the electricity grid. Existing market incentives without adequately targeted interventions are insufficient for the private sector to extend solutions to portions of the population that are not considered a top priority due to location. ESMAP’s [Financial Innovation for Energy Access](#) (FIEA) Program addresses the energy access deficit by providing support to develop and test financing instruments and implementation models designed to accelerate inclusion. FIEA does so by providing additional financing rather than excluding or competing with private markets. The program also seeks to address challenges related to the application of existing innovative structuring options and financing instruments to increase electricity access. It has used results-based financing to encourage governments to pay the public utilities and incentivize private companies to expand electricity access.

FIEA supports the creative structuring of available financing tools and the piloting of new ones to reach low-income households. This includes the introduction of digital payment options for electricity services. The program also contributes to the body of knowledge on applying innovative financing instruments for electricity access and compiles lessons learned from the World Bank, IFC, private funds, and external agencies.

## ENERGY ACCESS

## INNOVATIVE FINANCING SOLUTIONS FOR ENERGY ACCESS

**Multi-product funds.** Establishing funds to support off-grid solar products is inherently challenging. Multi-product funds simultaneously support the deployment of off-grid solar products, clean cooking initiatives and appliances that promote the productive use of electricity.

**Local currency financing.** Offering local currency financing is an effective way to encourage private solar companies to extend pay-as-you-go services to their consumers in countries with higher foreign currency exchange risk. Governments have used World Bank proceeds and absorbed the foreign currency risk to allow local banks extend financing to solar companies in mid-term financing in local currency. This has protected the end consumers, solar companies and local banks from foreign currency exchange fluctuation risk.

**Guarantee fund.** Given the innovative and evolving solar technology, the risk perception of financial institutions on the off-grid solar business model is high. This prevents solar companies from raising the funds they need. Offering guarantees for technology and market-related risks to the financial intermediaries has allowed them to reduce the risk premium and/or collateral requirements and has allowed them to offer acceptable lending terms to solar companies.

In FY2022, the FIEA window awarded grants for projects in Kenya and Niger to prepare a pilot design to explore how electricity demand can be increased among grid-connected customer segments with low consumption rates. The FIEA team explored the digitalization of utilities by focusing on

models to implement a digital payment solution for utility customers. This is expected to create efficiencies for both utilities and their customers by allowing them to save time and money and removing the barriers to scale.

# IMPROVING ACCESS TO ELECTRICITY FOR THE MOST VULNERABLE

According to the United Nations High Commissioner for Refugees (UNHCR), the consequences of conflict and violence have led to the forcible displacement of 89.3 million people worldwide. More than 80 percent of displaced people settle in developing countries that rarely have the means to provide the required assistance. Despite their extreme vulnerability, the displaced often are a low priority for governments. The large and often unexpected influx of people can overburden existing services and infrastructure, deepening the level of poverty in host communities and sometimes even leading to additional conflict. However, humanitarian organizations are becoming increasingly aware of the role that development institutions can play in mitigating the challenges presented by forced displacement.

One of the factors that plays a key role in improving the living conditions of the displaced and their host communities is improving access to energy. Most often, the displaced have minimal access to energy and are forced to resort to sources of energy that are costly, inefficient, unsafe, and harmful to the environment, such as poorly maintained diesel generators. As part of its work on energy access, ESMAP's [Leave No One Behind Program](#) (LNBH) promotes electricity access for the displaced and their host communities in synergy with other key ESMAP initiatives, such as the [Efficient and Clean Cooling Program](#), the [Off-Grid Solar/Lighting Global Program](#), the [Global Facility on Mini Grids](#), and the [Improving Livelihoods and Human Capital Initiative](#). LNBH also collaborates with external partners, such as the UNHCR, as part of its objective to improve access to electricity by informing lending operations and identifying the best strategies to address their energy poverty.

## FOLLOWING ARE EXAMPLES OF BEST PRACTICES IN ACTIVITIES THAT LNBH HAS COLLABORATED ON:

BOX 2.17



### PROMOTING ACCESS TO ELECTRICITY FOR THE DISPLACED AND HOST COMMUNITIES IN CHAD

In Chad, tensions along border areas and threats from nonstate armed actors are a source of strong humanitarian and security challenges. As of December 2021, the country was hosting more than 560,000 refugees and asylum seekers settled in 20 camps and in N'Djamena, the country's capital, located in the western part of the country along the border with Cameroon. Poverty is widespread among refugees and their host communities, with food insecurity, together with vulnerability to natural disasters and climate change, posing the biggest threat. Further, refugees and host communities in Chad lack access to electricity and clean cooking. Energy access-related issues are especially acute in Chad's northeast region, host to more than two-thirds of the country's refugees and where limited natural resources and harsh climate conditions cause a chronic lack of access even to primary energy resources. This negatively impacts refugee safety, health, nutrition, and livelihoods.

The Leave No One Behind Program helped address the severe challenges for Chad's displaced people and their host communities through a regional study to identify strategies for delivering energy solutions to these communities and their surroundings. LNBH's technical assistance informed the [Chad Energy Access Scale-Up Project \(CEASP\)](#), approved by the World Bank Group Board in March 2022 with a budget of \$395 million. This lending operation aims to provide electricity to about six million, including 400,000 refugees and 740,000 people from host communities located within 25 kilometers from refugee camps. CEASP also plans to provide electricity access for 150 medical centers and 200 schools in displacement areas and will promote productive uses of electricity to increase and diversify sources of livelihood for the project beneficiaries. This initiative aims to significantly improve the quality of life of refugees through a broad range of benefits that include better lighting, protection, food security, water, sanitation, health, and education.



## IMPROVING LIVING CONDITIONS FOR THE REFUGEES IN NIGER THROUGH A MULTIPHASE PROGRAMMATIC APPROACH

The spillover of the crisis in Mali and the Boko Haram regional crisis is causing a significant displacement of people toward and within Niger, which in 2022 was home to more than 556,078 displaced people. The government of Niger has demonstrated a strong commitment to the protection of refugees and their host communities, especially by providing housing and promoting integration with the local populations. Since end-2019, the country has been closing displacement camps not only to tackle security issues, but to promote such integration. However, these interventions do not include access to electricity, thus hindering economic opportunities and quality of life for the displaced.

To address this energy poverty in both urban and rural settings in the region, ESMAP has conducted a regional Assessment of Electricity Access for Host Communities and Forcibly Displaced People in the Sahel, including in Niger. The study clarified which strategies to adopt in displacement settings across the region and ultimately informed the design of the [Niger Accelerating Electricity Access Project](#) (Haské) Multiphase Programmatic Approach, a lending operation approved in 2022 with a budget of \$842 million. Through this initiative, at least 74,500 refugee and host households will receive electricity connections on their premises. Further, 170,000 refugees and 380,000 people from host communities will directly benefit from electricity services through the electrification of the localities and community infrastructures, including health and education facilities, street lighting, and water pumping.



## ADDRESSING THE ROHINGYA DISPLACEMENT CRISIS IN COX'S BAZAAR, BANGLADESH

Since 2017, extreme violence in Rakhine State, Myanmar, has driven an estimated 800,000 people from the Rohingya community across the border into the Cox's Bazar district of Bangladesh. Almost all the displaced are hosted in some of the world's most congested areas, including in the Kutupalong mega-camp, the largest displaced population camp in the world. The displaced account for about one-third of the total population in Cox's Bazar, a district that was already facing severe development challenges, and they are housed in makeshift shelters with minimal access to basic infrastructure and services. Such areas are also prone to natural disasters, especially cyclones and floods. In addition, the displaced are not permitted to work and their movement is restricted.

ESMAP has supported the preparation and implementation of energy sector interventions as part of the World Bank's [Emergency Multi-Sector Rohingya Crisis Response Project](#) (EMRCRP) and its additional financing. The goal of EMRCRP is to improve access to basic services and build the disaster and social resilience of people in Cox's Bazar across multiple areas, including health and nutrition; education; and water, sanitation, and hygiene. ESMAP devised a roadmap for meeting the energy needs of the refugees and their host communities, highlighting the role of energy as a key enabling factor for a multisector response. The roadmap focuses on ways to: (1) support the distributed renewable energy system using solar PV to increase access to clean and sustainable electricity for energy-poor households and shared facilities, such as health centers and learning centers; and (2) reduce energy consumption, including through solar power and greater energy efficiency in lighting, appliances, and equipment. The project ultimately aims to increase access to better public infrastructure to more than half a million displaced Rohingya people.

# GENDER AND ENERGY



Focusing on gender equality is at the core of development. It is also smart economics. There is clear evidence from the World Bank Group and other cross-disciplinary organizations that no country, community, or economy can achieve its potential or meet the challenges of the 21st century without the full and equal participation of women and men. Recent estimates for the energy sector indicate that women account for only 22 percent of employees in the oil and gas sector and about 33 percent in the renewable energy sector.

Through its global [Gender and Energy Program](#), ESMAP has built considerable momentum toward closing gender gaps in the energy sector by supporting World Bank interventions that aim to foster the participation of women in the sector, both as workers and leaders; improve women's productivity and livelihoods; and increase women's access to clean and modern energy. The window includes six gender programs for each of the World Bank regions:

- Africa Gender and Energy Program
- East Asia and Pacific Gender and Energy Facility
- Energy, Gender, and Social Inclusion in the Europe and Central Asia region
- Latin America and the Caribbean Energy and Gender Program
- Middle East and North Africa Energy and Gender Program
- South Asia Gender and Energy Facility

These programs, aligned with the World Bank Group Gender Strategy, have helped strengthen women's roles as consumers, employees, and entrepreneurs in the energy sector. In addition, the team has developed, implemented, and completed several products as a part of its knowledge and analytical work agenda.

During FY2022, the Gender and Energy Program collaborated with other ESMAP windows to finalize several technical notes, guidelines, and discussion papers. The program continues to address the knowledge limitations that World Bank project leads face when designing interventions to address gender inequalities in lending operations. The program has developed analytical work to provide practical knowledge on various gender topics, such as women's employment and energy access, which will guide new operations and open opportunities for agenda setting and policy dialogue.

One of these knowledge products was a report, [Opening Opportunities, Closing Gaps: Advancing Gender-Equal Benefits in Clean Cooking Operations](#), which was prepared in collaboration with ESMAP's [Clean Cooking Fund](#). The report introduces the World Bank task teams and other practitioners to key arguments, opportunities, and practical steps for integrating gender considerations into clean cooking programs.

The program team also worked with the Small Island Developing States DOCK Support Program on the Geospatial Assessment of Women Employment and Business Opportunities in the Energy Sector. This project is supported by the Canada Clean Energy and the Forests Climate Facility. It uses geospatial analysis to identify hot spots for places that offer jobs for women, safe routes for transit and other specific places where energy sector women can do business and work.

# 22%

Recent estimates for the energy sector indicate that women account for only 22% of employees in the oil and gas sector and about 33% in the renewable energy sector.

The Africa region's Gender and Energy Program coordinated technical support for the design and execution of energy lending and technical assistance to foster the economic participation of women in the sector to increase their access to energy services. Ninety-two percent of energy lending operations (10 out of 11 approved projects) have the meaningful inclusion of a gender assessment, activities that aim to close the identified gaps, and indicators that show narrowing of the gender inequalities (gender-tagged for World Bank operations). Gender experts on the team provided technical guidance to both task teams and country clients.

In the MNA region, despite the global and regional context and its impact on the region's energy pipeline, the Gender and Energy Program provided support

to two IDA lending operations. In addition, the team increased the focus on gender issues by replicating in the MNA region the South Asia region's Women in the Power Sector Network (WePOWER) initiative's best practices. It collaborated with the Regional Center for Renewable Energy and Energy Efficiency (RCEEE) to strengthen the Regional Network in Energy for Women (RENEW) MNA and launched a report on increasing women's participation and leadership role in the energy sector. This MNA network is expected to enhance opportunities for entrepreneurship; facilitate science, technology, engineering, and mathematics (STEM) education-to-work transitions; and promote recruitment, retention, and advancement strategies in energy companies, utilities, and power sector agencies. Activities will improve financial inclusion, with a focus on renewables and digital technologies.

BOX 2.20

CONGO

## IMPROVING FEMALE PARTICIPATION IN THE WATER AND ELECTRICITY SECTORS IN THE DEMOCRATIC REPUBLIC OF CONGO

The Electricity & Water Access and Governance Project in the Democratic Republic of Congo is designed to target female-headed households to increase female participation in the water and electricity sectors. Throughout the Africa Gender and Energy Program, ESMAP has supported the development of activities to reduce gender gaps. The activities have focused on interventions that support the creation of technical knowledge through training for the water and electricity utilities to attract, retain, and promote women in technical jobs.

During its implementation, the project will work with La Maison de la Femme to ensure that gender-based violence is addressed. The project further aims to make certain that women beneficiaries are included in decision making and are also satisfied with the provided services.



# RENEWABLE ENERGY



Substantially scaling up renewable energy is not the only essential factor in tackling climate change. For most countries, in the current context of economy recovery from the COVID-19 pandemic, rising energy prices due to the war in Ukraine, and growing climate impact, investing in renewables is a multiplier solution that simultaneously addresses affordability, energy security, and resilience from climate shocks.

While some countries are reacting to the energy crisis with short-term measures, such as reopening old coal power plants, many governments are now taking longer-term steps to decrease their dependence on imported fossil fuels and accelerate the structural changes necessary to transition to clean energy sources. The IEA's *World Energy Outlook 2022* indicates that the total electricity generation from renewables increased by more than 500 TWh from its 2020 level to reach a record high of over 8,000 TWh in 2021. The report also predicts that, under a Stated Policies Scenario (STEPS), renewables will continue to scale up rapidly, with their share of electricity generation rising to 43 percent by 2030 and 65 percent by 2050.

Scaling up renewable energy investment makes economic, social, and environmental sense. Sri Lanka, for example, is a small island state that recently has had to declare bankruptcy, because its fuel prices skyrocketed. Yet, the country has strong wind and solar potential and investing in renewables makes sense. At COP27, the Sri Lankan government announced a plan to increase the country's renewable energy generation from 35 percent to 70 percent by 2030.

Similarly, in Chad, Liberia, Sierra Leone, and West Africa are facing significantly higher electricity purchase costs because of the rising petroleum prices and the high share of liquid fuel generation in their power mixes. The increased fuel purchase cost amounts to 0.5 to 1 percent of each of these countries' GDP. Instead of supporting them with buy-down expensive fuel costs, the World Bank is taking a different approach through the proposed Regional Emergency Solar Power Intervention (RESPITE). The project will not only enable the World Bank to support the public procurement of emergency renewable energy generation, but also help to set a benchmark for a future increase in the private sector deployment of renewables and less dependency on expensive fossil-fuel alternatives.

The trends in the adoption of renewable energy are mostly positive but not sufficient: achieving net zero emissions by 2050 requires the global share of renewables in electricity generation to double from 30 percent today to about 60 percent in 2030. ESMAP is using a three-prong approach to help accelerate investments in renewable energy technologies in developing countries. This involves: (1) helping countries improve their enabling environments for renewable energy in order to unlock large-scale investment in mature technologies, such as ground mounted solar, onshore wind, and geothermal, and aid the integration of variable renewables in power systems; (2) broadening the range of renewable energy technologies deployed in developing countries to include new innovations such as battery storage, rooftop and floating solar, and offshore wind; and (3) building a pipeline of sustainable hydropower projects in recognition of their role in power grids for system balancing, flood control, and irrigation.

# 43%

Forecasts indicate that renewable energies will continue to scale up rapidly, with their share of electricity generation potentially rising to 43% by 2030 and 65% by 2050.

## SUSTAINABLE RENEWABLES RISK MITIGATION INITIATIVE

The [Sustainable Renewables Risk Mitigation Initiative](#) (SRMI), formerly known as Energizing Renewables, was launched four years ago at COP24 under the leadership of the World Bank and ESMAP in partnership with the Agence Française de Développement (AFD), IRENA, and the International Solar Alliance (ISA), later joined by SEforALL.

The initiative's objective is to support countries in developing and implementing sustainable and resilient renewable energy programs that can attract private investors while maximizing socioeconomic benefits. SRMI supports countries across the spectrum of renewable energy development, including technical assistance to create an enabling environment for deployment, integration planning, support for robust procurement processes, and subsequently project implementation through risk mitigation instruments and public financing for grid infrastructure. SRMI has made a tremendous impact on the renewable energy ecosystem, enabling 4 GWs of new renewable energy deployment in more than 19 countries, leveraging over \$5.5 billion in private capital, securing \$4 billion in

public infrastructure and guarantees, and mobilizing \$1.2 billion in climate finance.

In FY2022, the World Bank Board approved two new projects within the Green Climate Fund (GCF) "SRMI-1" facility in the Democratic Republic of Congo and Central African Republic. The two projects combined with the Uzbekistan project approved in FY2021 represent \$111 million of GCF funding blended with \$1.06 billion of World Bank financing to support the deployment of 1.6 GW of solar generation and 115 MWh of battery storage and the mobilization of \$1.67 billion of private investments, to connect around 6.6 million people to the grid. Initiatives such as the Sustainable Renewables Risk Mitigation Initiative (SRMI) and the Clean, Cooling Facility have mobilized concessional and climate financing, unlocking \$688.6 million in FY2022. The World Bank Board further approved three SRMI investment projects with Clean Technology Fund (CTF) funding for scaling up electricity access in Uganda, modernizing electricity distribution in Bangladesh, and supporting geothermal energy development in St. Lucia. Together, these three investments are supporting the deployment of 218 MWp of solar and geothermal generation, 40 MWh of battery storage, and leveraging \$295 million of private investments.

BOX 2.21

CONGO

### DEMOCRATIC REPUBLIC OF CONGO: ACCESS GOVERNANCE & REFORM FOR THE ELECTRICITY AND WATER SECTORS PROJECT

This project was approved by the World Bank Board in March 2022 to support the implementation of a national mini grid program. SRMI provided technical and financial support to the development of a first-of-its-kind risk mitigation instrument, covering the demand risk of solar and battery storage mini grids using the SRMI-1 \$30 million of GCF reimbursable grant, along with \$4 million GCF grant on technical assistance. A note on this innovative instrument will be developed once the tender is launched in the next fiscal year.



CENTRAL AFRICAN REPUBLIC

## CENTRAL AFRICAN REPUBLIC: ELECTRICITY SECTOR STRENGTHENING AND ACCESS PROJECT

This project was approved by the World Bank Board in June 2022 as part of the GCF SRMI-1 facility. It has received GCF co-financing of \$30 million to support the construction and operationalization of five solar mini grids totaling 10MW in selected provincial cities, as well as solar generation, transmission, and distribution reinforcement and extension. SRMI has also provided technical support for the development of a socioeconomic assessment, which is expected to be delivered in the next fiscal year. The socioeconomic targets will be included in the independent power project framework.

In FY2022, SRMI provided technical support to 55 countries, more than double FY2021, including support to teams preparing the World Bank's new CCDRs. On the outreach and engagement side, the initiative convened several high-level events in FY2022, including at COP26, and prepared new knowledge products, including the report *Maximizing Socioeconomic Benefits Triggered by Renewables: A Sure Path to Sustainable Renewable Energy*, to lay the groundwork for the initiative's socioeconomic assessment workstream in FY2023.

In FY2023, the SRMI team expects GCF Board approval of the second GCF-SRMI Facility, "SRMI-2," in March 2023. SRMI is continuing to structure new and innovative risk instruments and prepare knowledge products, including updated Renewable Energy Guidelines, Guidelines on the Socio-economic Contributions of the Geothermal Sector, the Hybrid Solar Battery Storage Power Purchase Agreement (PPA) report, and lessons learned from the Noor Ouarzazate complex in Morocco. A new workstream also will be initiated to adapt the SRMI guidelines to the specific needs of small island developing states (SIDS).

## ENERGY STORAGE PROGRAM

Energy storage is one of the key enablers of renewable energy deployment. As more countries transition from fossil fuels, energy experts and government officials need to find ways to secure reliable renewable energy supply to power systems. Many developing countries have limited options to increase their power system flexibility. Renewable energy with storage offers an alternative to fossil-based generation and offers an additional avenue to bridge the electricity access gap. In addition, energy storage provides a solution to achieve flexibility, and enhance grid reliability and power quality to accommodate the scale-up of renewable energy.

To enable the rapid uptake of variable renewable energy (VRE) in developing countries, the World Bank convened the [Energy Storage Partnership](#) (ESP), a global initiative involving national laboratories, research

institutions, development agencies, and philanthropies. The ESP fosters technological cooperation and training to develop and adapt to new energy storage solutions tailored to the needs and conditions of developing countries. This supports the expansion of the global market for energy storage, leading to improved technologies and accelerating cost reductions over time. The Energy Storage program is also committed to closing gender gaps in the energy storage sector by fostering the professionalization and leadership of women through the [Women in Energy Storage](#) (WES) mentoring program.

In FY2022, the program supported three grid-connected projects in Bangladesh, Cabo Verde, and India. It also supported four mini grid projects in the Central African Republic, Chad, the Democratic Republic of Congo, and Niger.

In Bangladesh, ESMAP supported the mobilization of concessional financing for Battery Energy Storage Systems (BESS) to overcome barriers on the limited uptake of solar PV in the distribution network. This investment comes at a crucial time to catalyze the distributed solar PV market to enable the power distribution system's progressive transition to solar energy.

In Cabo Verde, ESMAP is working to help the country transition to a low-carbon economy by increasing the uptake of renewable energy sources to 30 percent by 2025. The grant activities have financed a study to identify the pilot investments in BESS to support the small-scale solar PV plants to be constructed on the five islands through the World Bank-financed investment project.

In the Central African Republic, ESMAP grant activities have facilitated the continuation of activities to increase electricity access through the use of solar resources. The grant has been used to procure a grid-connected solar plant and BESS, which is currently under construction. In addition, mini grid pre-feasibility studies are being conducted for 32 previously identified sites.

## SOUTHERN AFRICA

## BOTSWANA AND NAMIBIA: ACCELERATING UTILITY-SCALE SOLAR DEVELOPMENT IN SOUTHERN AFRICA

ESMAP is supporting the implementation of the national and regional power system planning in Botswana and Namibia. This will enhance understanding of the opportunity for near-term investments in renewable energy and longer-term targets for renewable energy development. The modeling identified first investments of 200 MW of dispatchable solar, 100 MW of wind, and battery storage in Botswana. In Namibia the modeling identified 200 MW of dispatchable solar and 200 MW of wind, with battery storage.

Both countries are incorporating large-scale renewable energy into their plans informed by the modeling under this grant. In Botswana, the future target for the number of MW has increased from 100 MW of PV to 800 MW of PV, 200 MW of CSP, 50 MW of wind, and 140 MW of battery storage. While the figures for Namibia have not yet been finalized, they are also expected to increase.

The results and outcome of the ESMAP grant are expected to influence the design of two new World Bank lending operations. The enabling environment assessment and the power system planning results funded through this grant informed the development of an SRMI Facility proposal of \$44 million and \$33 million in Green Climate Fund financing.

### INNOVATIVE SOLAR

Many countries have created solar parks to harness their solar energy potential. These parks, with large-scale, ground-mounted, and grid-connected solar PVs, provide a much-needed solution in some settings. However, in places where the land is insufficient or difficult to acquire, or where the distribution grid is unable to serve properly all the demand, alternatives to large ground-mounted, grid-connected PV parks can still be implemented to harvest and use solar energy. These solutions include distributed photovoltaic (DPV), such as solar PV systems installed on rooftops or floating on water surfaces. [The Innovative Solar Program](#) aims to promote access to these innovative solutions. It supports client countries in the awareness, adoption, and deployment of innovative grid-tied solar concepts and business models.

The program supports distributed solar, which provides solar energy by placing energy technologies (such as rooftop PV) in proximity to the end users, who can use their own premises to produce the electricity that they consume, thus becoming “prosumers,” and re-inject their production in excess into the distribution grid to serve other nearby customers. It also supports the deployment of floating solar panels in places where land acquisition poses a challenge to solar development. Another key program activity is the hybridization of solar PV with different forms of storage like thermal energy storage and hydropower plants reservoirs, the latter providing a win-win combination that delivers multiple co-benefits, including space for deploying solar panels, flexibility for energy and water storage management, and the use of the existing connection to the transmission grid.

In FY2022, the program supported the deployment of solar rooftops in Bangladesh, Columbia, Nigeria, Peru, Saint Vincent and Grenada, Serbia, Türkiye, and Uzbekistan. It also provided financial grants to support the deployment of floating PV in Bangladesh, the Maldives, and Tajikistan. In the Maldives, Innovative Solar has informed a 10MW tender preparation for future near-shore marine floating solar projects.

In addition, in India, the program supported innovative solar water pumping for agriculture. In Tunisia, it supported the hybridization of PV with Concentrated Solar Power with Thermal Energy Storage (CSP-TES), with the development of a hybrid CSP-TES-PV-battery design model, the first of its kind.

The team also prepared several knowledge products, including a three-report series dedicated to distributed solar, *From Sun to Roof to Grid*, to help policymakers, regulators, and utility operators to resolve challenges associated with the deployment of distributed solar and realize its benefits. The [From Sun to Roof to Grid: Distributed PV and Energy Sector Strategies](#) report, published in December 2021, overviews DPV in different countries to help integrate it into high-level national energy strategies. *Grid Operations and Planning with DPV* addresses the technical challenges of integrating high shares of PV into the grid. The *DPV Economics and Policy* report completes the series, covering cost-benefit analysis, regulatory issues, and business models. The last two reports are expected in early 2023.

BOX 2.24

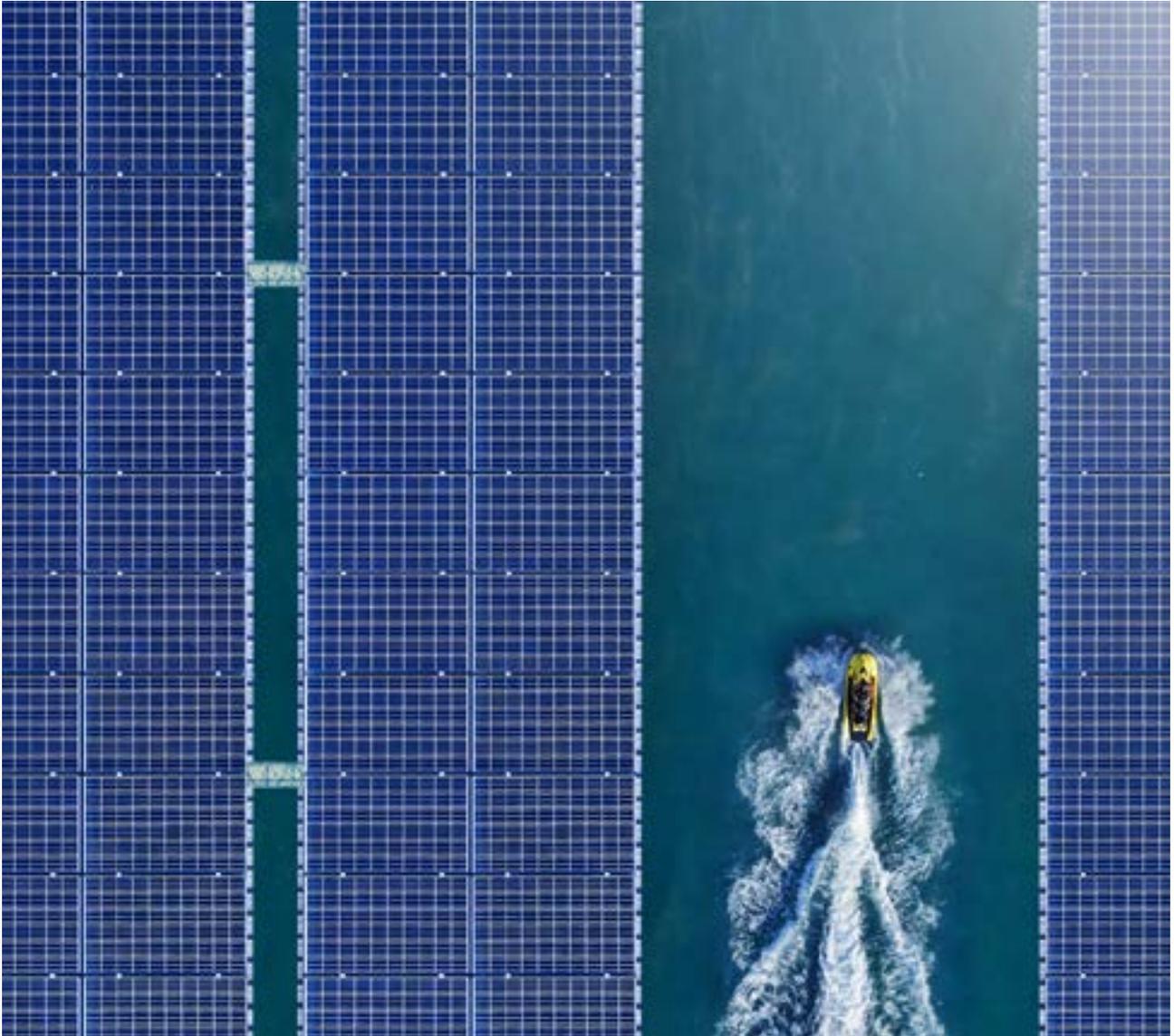


COLOMBIA

## PV-POWERED E-CARGO BIKE DOCKING STATIONS IN COLOMBIA

An ESMAP grant has supported studies to inform Colombia's local and national e-mobility policy and strategy for the use of solar PV generation to energize docking stations for e-cargo bikes as a green solution for last-mile freight delivery services in urban centers.

Under BiciCarga, an initiative of the city of Bogotá supported by IFC to mobilize private sector resources to implement innovative and green solutions for the movement of goods in urban centers, the grant has supported the elaboration of a roadmap that assessed the potential implementation and financing options to roll out solar-powered solutions. Two companies are currently operating on a collaborative cross-docking platform pilot for cargo e-bikes. The grant supported an assessment of the pilot and provided policy options for the scaling up of the solar-powered collaborative cross-docking platform for cargo e-bikes in Bogotá.



THE MALDIVES

## MARITIME FLOATING SOLAR IN THE MALDIVES

In the Maldives, a small island country with no ground available for renewable energy installations, an ESMAP grant has supported the assessment of maritime sites and suitable floating technologies for deploying near-shore floating PV. It has informed a 10MW tender in Addu, one of the first in the world for maritime floating solar PV, under the World Bank-funded [Accelerating Renewable Energy and Integration of Sustainable Energy \(ARISE\)](#) Project.

## OFFSHORE WIND

More countries are turning to offshore wind power as a cost-competitive and clean energy source. Offshore wind can be a key solution to transition from fossil fuels, increase energy security, and create new industrial opportunities and local jobs.

The number of offshore wind farms has grown rapidly over the past three decades, with over 58 GW of capacity installed globally by 2022. However, more turbines in the waters of more countries will need to be installed even more rapidly over the next three decades to help the world achieve net zero.

Developing countries have over 16,000 GW of offshore wind technical potential, which offers a new opportunity for domestic renewable energy generation. Harnessing this potential, however, requires proactive government support to establish dedicated policy and regulatory frameworks to enable investment and development, and to help reduce the cost of electricity.

The joint ESMAP-IFC [Offshore Wind Development Program](#) works with governments and industry to accelerate the deployment of offshore wind in emerging markets. Since its establishment, in 2019, the program has provided support to more than 20 countries, from large, growing economies such as India and Vietnam to SIDS such as Fiji and St. Lucia.

As offshore wind is a new technology for all client countries, the program's team has initially provided its support to governments across a broad range of technical assistance topics in order to share knowledge and inform the inclusion of offshore wind in energy policies. It is continuing to provide clients with assistance to establish the proper regulatory and market conditions for each country, and ultimately to build a pipeline of bankable projects. To help accomplish this, the program cooperates with the Global Wind Energy Council (GWEC), which provides strong links with the international offshore wind industry and market insights in our client countries.

Offshore Wind has provided initial grants to seven countries, and in FY2022, Azerbaijan, Colombia, and India received additional grants, totaling \$550,000, for follow-on studies. These grants are funding the development of a strategic offshore wind roadmap for each country, and the subsequent technical assistance informed by each roadmap's recommendations.

In FY2022, the program published offshore wind roadmaps for Azerbaijan, Colombia, and the Philippines, which join the roadmap for Vietnam, which was published in FY2021. Additional roadmaps are being drafted for India, Sri Lanka, and Türkiye, with roadmaps for Brazil and South Africa expected to commence in FY2023.

In September 2021, the program published its flagship knowledge report, [Key Factors for the Successful Development of Offshore Wind in Emerging Markets](#).

The report is designed to help government officials understand the foundational best practices for successfully developing offshore wind. It uses evidence and case studies to outline the key success factors across the broad topics of strategy, policy, frameworks, and delivery. Positive feedback from clients, country teams, and the offshore wind industry suggests that the report is considered an indispensable resource to inform decision making and capacity building.

The program's support has already directly led to major outcomes in Brazil and Colombia, which both published government decrees for offshore wind during FY2022. These regulations were developed with substantial support from the Offshore Wind team through a series of technical workshops and notes. Similar technical assistance is underway in Vietnam, focusing on the development of a strategy for competitive frameworks for seabed leasing and power procurement.

Through the best practice documents, roadmaps, and follow-on technical assistance, the program has helped client counterparts make more informed decisions and begin to establish regulations to unlock investment in offshore wind project development.

## EMERGING MARKETS

# ESTABLISHING BEST PRACTICES TO ACCELERATE OFFSHORE WIND DEPLOYMENT IN EMERGING MARKETS

The International Renewable Energy Agency (IRENA) estimates that 2,000 GW of offshore wind capacity will be required globally by 2050 for the world to achieve net zero—a substantial increase over the 58 GW installed today. This means that countries need to significantly accelerate offshore wind deployment over the next three decades to avoid the worst impacts of climate change. Since the first turbine was installed offshore in 1991, there have been many important lessons learned on what works and, most important, what does not work to successfully deploy offshore wind with lower risks and costs, and greater volumes and economic opportunities.

To scale up offshore wind in emerging markets, there is no need to reinvent the wheel, and to help accelerate deployment, these countries can learn from the successes and mistakes of established offshore wind markets.

In September 2021, the Offshore Wind Development Program published its flagship knowledge output, [Key Factors for Successful Development of Offshore Wind in Emerging Markets](#). This unique report is intended to help government officials in emerging markets to answer the question: “What do we need to do to successfully develop offshore wind?”

It uses evidence and case studies to outline the key success factors for an emerging market across the areas of strategy, policy, frameworks, and delivery. Through the experiences of established offshore wind markets, the report presents lessons learned and the resulting industry best practices to support emerging markets on their offshore wind journey.

The report is currently being used as essential reference material for client governments, country teams, and industry alike to effectively guide decision making and technical assistance by applying best practices locally.

In FY2023, the program will also publish these key success factors as a series of e-learning modules hosted on the World Bank Group’s Open Learning Campus to further build capacity on offshore wind in emerging markets.



## PHILIPPINES

## THE REALITY OF OFFSHORE WIND IN THE PHILIPPINES

The Philippines has a rapidly growing demand for power, high coal dependence, and limited land space. The country also has significant offshore wind potential, which could help improve energy independence, reduce greenhouse gas emissions, and increase the domestic clean energy supply.

The [Offshore Wind Development Program](#) has been working closely with the Philippines's Department of Energy (DOE) since 2020, to help the country explore its offshore wind resources. In April 2022, the DOE and the World Bank Group published the Offshore Wind Roadmap for the Philippines, which provides strategic analysis of the country's vast offshore wind opportunity.

Through analysis of environmental and social considerations, infrastructure, supply chain, financing, energy demand, and costs, the roadmap demonstrates that, under a high-growth scenario, the Philippines has the potential to install 21 GW of offshore wind power by 2040. The roadmap also provides recommended actions for the government to realize this scenario, including setting a long-term vision for offshore wind, infrastructure development, investment, and policies.

Since the roadmap's publication, offshore wind has quickly become a priority for the government. The country's recently elected President referenced offshore wind and its important role in the Philippines during his opening state of the nation speech.

Additionally, the roadmap has catalyzed huge interest from the international offshore wind industry. This has resulted in the government's awarding private developers with 42 project sites, representing around 31 GW of potential capacity. A high-priority recommendation from the roadmap was to eradicate foreign ownership restrictions for offshore wind projects, and in late 2022, the government announced that it would be lifting these restrictions, an important move to catalyze investment in the country's new sector and attract international investors. Discussions are ongoing with the client counterparts on the priority next steps for technical assistance, based on the roadmap's series of recommended actions. This assistance is likely to include support on wind resource assessment, transmission grid planning, policy development, and environmental and social best practices.

As part of the program's knowledge sharing initiatives, the program works closely with donor countries with mature offshore wind sectors and the industry to organize study tours for client countries. These study tours foster crucial information exchanges between both mature and emerging offshore wind markets, as well as providing client countries first-hand experience of the potential scale and socioeconomic opportunities from offshore wind. The program previously organized study tours in the United Kingdom (2019), virtually (2020), and planned a tour across the Netherlands, Germany, and Denmark for September 2022 (more about this study tour in the 2023 Annual Report).

## HYDROPOWER DEVELOPMENT FACILITY

When properly developed in a sustainable manner, hydropower can be an important renewable resource that can deliver energy at affordable and competitive prices while helping countries to meet climate change targets.

Hydropower solutions are a long-term investment because of their low cost, reliability, efficiency, and flexibility. They are also able to provide essential grid services and water management solutions and enable renewable energy integration into the national grids.

According to the International Hydropower Association, about half of the global hydropower potential worldwide remains untapped. ESMAP's [Hydropower Development Facility](#) (HDF) helps countries identify and build a pipeline of sustainable hydropower projects. It supports clients in developing and managing rehabilitation of existing hydropower plants and greenfield projects. The facility works to accelerate the deployment of technology that is critical to integrating variable renewable energy into the grid.

In FY2022, a \$1.8 million ESMAP grant supported work in the global hydropower industry with an additional \$5 million allocated to support World Bank hydropower operations in several countries. ESMAP provided a \$2 million grant to support the [Upper Arun Hydroelectricity Project](#) (UAHEP) in Nepal. The project will enable the country to develop adequate, reliable, and secure power, doubling the installed capacity and increasing current government revenues. The project will also contribute to a surplus of power generation that will be marketed for export to Bangladesh and India, offering greater resilience and a cleaner energy supply.

In Burundi, Rwanda, and Tanzania, ESMAP provided a \$200,000 grant to support the construction of the Rusumo Falls Hydropower Plant with a tunneling and blasting expert to strengthen the supervision and safeguarding of the project. This ensures that the blasting is performed within permissible limits and adherence to international environmental, health, and safety standards. All tasks have been completed.

In Tajikistan, ESMAP is working with the country to perform due diligence on technical, environmental and social, and a commercial framework to prepare the Rogun Hydropower Plant for private sector financing.

The HDF is also finalizing research findings to enhance the sustainability of hydropower projects and maximize socioeconomic benefits such as short- and long-term job creation, access to electricity, increased gender equality, economic growth, and increased safety and security.

**SECTION II** OUR IMPACT IN FY2022

# ASSOCIATED TRUST FUNDS



## ADVANCING REGIONAL ENERGY TRANSFORMATIONAL PROJECTS MULTI-DONOR TRUST FUND

The Advancing Regional Energy Transformational Projects (AREP) multi-donor trust fund (MDTF) was established to advance regional energy projects and improve the enabling environment for regional power trade originally in the Southern and Eastern Africa subregions.

In 2020, AREP MDTF became an Associated Trust Fund with ESMAP that was designated as the main umbrella trust fund of the World Bank for the energy sector. It provided an opportunity for showcasing the successes of AREP globally, facilitating easier knowledge exchange between the original AREP MDTF countries and other regions of the Bank, systematizing markets and regional trade indicators globally, and bringing greater flexibility in the mobilization and utilization of resources, including from donors beyond the original AREP MDTF, through a common governance, results and reporting framework. It has further expanded to cover the whole Sub-Saharan Africa region and supports developments also in West and Central Africa.

The program complements the World Bank's activities and funding for promoting regional power markets, trade, and connectivity in these subregions by leveraging and informing IDA financing. The program has supported regional teams and complemented the World Bank and other development partners' efforts to increase regional integration in energy.

From the hard infrastructure angle, several large generation sources and high voltage transmission interconnectors have either been commissioned, or their preparation has been launched, or their financing has been approved. These include the ongoing construction of: (1) the Mozambique – Malawi line in South African Power Pool (SAPP); (2) the Ethiopia-Djibouti line in the East African Power Pool (EAPP); (3) the Cameroon – Chad line in Central Africa Power Pool (CAPP); and (4) the Côte d'Ivoire – Liberia – Sierra Leone – Guinea (CLSG) interconnection project; (5) OMVG Loop Interconnection

Project (Gambia – Guinea – Guinea Bissau – Senegal), (6) OMVS Interconnection linking Mali, Mauritania, and Senegal; (7) North Core/Dorsale Nord Interconnector linking Nigeria, Niger, Benin; and (8) Burkina Faso and Guinea-Mali Interconnection in the West African Power Pool (WAPP). Innovative solutions are being explored to utilize the benefits of regional integration including battery storage options to allow electricity to flow smoothly across national borders under the [Battery Energy Systems and Synchronization Project](#) (BEST Project) in WAPP. Also, the program of solar development in Sub-Saharan Africa is providing technical assistance to the WAPP members to prepare five large-scale, privately financed solar park projects, to be connected to the regional power market and serve demand across multiple countries. New regional financing solutions are being explored through the concept of a [Regional Transmission Infrastructure Financing Facility](#) (RTIFF) in SAPP.

From the soft infrastructure angle, numerous regulatory decisions have been supported and taken at both the regional and continental levels. These include development of regional market designs to enable the formation of a competitive markets, series of market trainings and capacity building activities for regional institutions, regulators, and utilities, operational readiness studies and guidelines to ensure that the regional transmission grids operate in a safe, reliable, secure and efficient manner, regional system planning studies, and creating an enabling environment through the development and adoption of grid management studies and practices such as transmission pricing, cost allocation and third-party access.

The [MARCOT](#) program (through AREP) supports World Bank country teams and client countries and regions to design and implement energy sector reforms, strongly focusing on meeting the conditions to establish well-functioning competitive and transparent national and regional electricity trading markets. The program generates and customizes global knowledge and its deployment to specific countries and regions. It also supports clients through capacity building, advocacy, and dissemination for both internal and external audiences.

## CARBON CAPTURE USE AND STORAGE

The World Bank CO<sub>2</sub> Capture and Storage (CCS) Trust Fund is an associated trust fund under the ESMAP umbrella that has been operating since 2009. The program is designed to assist client governments to assess their potential for CO<sub>2</sub> capture and storage to meet national and international climate change mitigation goals. It has allocated more than \$55 million to support the development of carbon capture use and storage in several countries and regions worldwide.

IEA frames the need for carbon capture, utilization, and storage (CCUS) in industry as a way to address process emissions (especially for cement), extending the life of existing facilities, and residual emissions that remain even after decarbonization measures.

During FY2022, there was increased recognition of the need for CCUS, and the technology has been featured in several World Bank decarbonization studies, which are also highlighted in draft Country Climate and Development Reports (CCDRs). The CCDR for Türkiye, which was published in June 2022, recognized the need for CCUS in power generation, especially in hard-to-abate industries. In industry, CCUS could be used to address process emissions for cement production. The CCDR also noted the potential needs for CCUS in iron and steel production. While decarbonization of the power sector is led by renewables, the Resilient and Net Zero Pathway described in the CCDR recognizes the potential contribution from gas power with CCUS by 2040. Commercial CCS projects are now operating across several sectors, including natural gas processing, power generation, and hydrogen production and in the hard-to-abate chemical, fertilizer production, and steel sectors.

In Nigeria, the CCS program began operations during FY2022 and involved a range of activities to enhance understanding of the potential for CCUS in the country. A project in collaboration with IFC is focusing on conducting assessments of CO<sub>2</sub> sources and storage potential. It will also identify and rank potential industrial CCUS pilot project sites and provide information to support the World Bank Group's knowledge sharing activities.

In Timor Leste, the CCS project team is working with colleagues in IFC to investigate the potential development of a storage hub in the country to assist with climate-friendly industrialization and development and support decarbonization efforts.

A high-level assessment of CCUS potential is being carried out in India to provide the World Bank with a current and accurate understanding of CCUS costs and technical potential in the country. This will include a focus on hard-to-abate industrial sectors and identify key steps to establish CCUS. The India case study will build on previous CCUS project-specific activities undertaken in India with support of the Asia Development Bank (ADB). The CCS TF team has been engaged with the ADB to ensure this previous work can be leveraged to the maximum degree. Analysis of CCUS in India to date has been somewhat limited, with the work that has been undertaken differing in scope, methodology and assumptions, or at a project-specific level as was the case with the ADB supported activities.

A study on decarbonizing natural gas using CCUS technology was undertaken to improve the knowledge of the need for CCUS for natural gas production to meet global climate mitigation goals, including the Paris Agreement and the global net zero emissions targets. The report findings also include high-level country studies focusing on the status and potential for CCUS on natural gas in Brazil, China, Egypt, Indonesia, Kazakhstan, Mexico, Mozambique, Saudi Arabia, Ukraine, and Vietnam.

Despite increasing developing and emerging country interest in CCUS, awareness and understanding of CCUS is still significantly lower than other mitigation technologies, such as renewables and energy efficiency, and capacity to advance CCUS in developing countries is extremely limited, in particular, when transitioning from studies and analytics to pilot project development. The trust fund has been very successful in increasing understanding and awareness of CCUS with recipient governments, as well as supporting governments to fully consider the role of CCUS in meeting climate mitigation targets. Of the countries engaged by the trust fund to date, six have included CCUS in their NDCs: China, Egypt, Mexico, Montenegro, Saudi Arabia, and South Africa. In addition, Mexico and South Africa have also listed CCUS as part of their long-term low-greenhouse gas emission development strategies (LEDS).



## SMALL ISLAND DEVELOPING STATES (SIDS) DOCK

Small island developing states (SIDS) are some of the most vulnerable locations in the world, increasingly threatened by climate change and often extremely dependent on imported petroleum products to meet their energy needs. This reliance on fossil fuels has a significant fiscal impact on these island nations, making them vulnerable to fluctuations in oil prices. Therefore, many SIDS are exploring more sustainable energy sources with energy efficiency and renewable energy options, such as solar, wind, geothermal, and biomass.

The SIDS DOCK Support program is designed to assist the member countries of the Alliance of Small Island States (AOSIS) to transform their energy sectors and address the adaptation to climate change. The \$22.1 million program is designed to help transform the energy sector in SIDS client countries by focusing on creating an enabling operational, legal, and institutional environment to implement renewable energy and energy efficiency policy reforms. It also supports the implementation of renewable energy and energy efficiency initiatives with the potential for scale-up through climate finance and other sources of finance.

Since 2011, the program has supported four global activities and 23 country/regional activities. It has helped to mobilize and inform investments for a total of \$309 million in countries such as Comoros, Dominica, the Maldives, the Marshall Islands, São Tomé and Príncipe, St. Lucia, and Tuvalu.

During FY2022, the SIDS DOCK Support Program supported a \$1 million grant in Comoros to support the supply and installation of advanced metering infrastructure (AMI) as part of the country's solar energy access project. The AMI will include an integrated system of smart meters, communication networks, and data management systems, which will enable communication between the control centers and targeted customers for better demand-side management and operational efficiency.

The program has been instrumental in advancing the solar PV agenda in the Maldives, with particular focus on the battery energy storage system (BESS). A purchasing power agreement was implemented as part of a project to accelerate sustainable private investment in renewable energy in the island nation. The 11 MW solar PV installation will be the single largest in the Maldives, with plans to expand energy access across remote islands.

SECTION III

# FINANCIAL REVIEW



This chapter summarizes the FY2022 financial information of the ESMAP Umbrella Trust Fund Program, anchor and its associated trustee accounts.<sup>4</sup>

## CONTRIBUTIONS

In FY2022, ESMAP received \$98.3 million from 11 donors. A new trust fund associated with ESMAP was established

to co-finance the Energy Access and Quality Improvement Project (EAQIP) in Rwanda (P172594). Table 3.1 presents actual receipts in FY2022 from individual donors for ESMAP and cumulative receipts during FY2017-22. Table 3.2 indicates cumulative pledges and receipts of associated trust funds to ESMAP.

**Table 3.1. Donor Contributions to ESMAP, FY2017-22 (\$ thousands)**

Country	FY2022 Contribution Paid-In & Receivables		ESMAP FY2017-22	
	ESMAP	Cumulative Pledges	Cumulative Receipts	Cum. Receipts over Cum. Pledges
Austria		4,154	4,154	100.0%
Canada		2,298	2,298	100.0%
ClimateWorks	850	3,100	3,100	100.0%
Denmark	20,792	44,479	43,278	97.0%
EU		14,023	7,298	52.0%
Finland		144	144	100.0%
France		1,222	1,222	100.0%
Germany				
- BMU	11,269	19,734	19,734	100.0%
- BMZ	1,125	6,192	5,141	83.0%
Iceland	800	4,517	3,717	82.0%
Italy				
- Ministry of Ecological Transition	4,528	10,833	4,528	42%
- Ministry of Foreign Affairs and International Cooperation		6,054	6,054	100%
Japan				
Luxembourg		1,124	1,124	100.0%
Netherlands	10,000	75,878	55,878	74.0%

> Continued

4 As set out in the Administration Agreement with ESMAP donors, the current financial information relating to multi-donor and associated trust funds under ESMAP management can be accessed via the Bank's Trust Funds Donor Center. The Bank's Financial Statements, as well as the Single Audit Report on Trust Funds, can be accessed on the Bank's public website on World Bank Group Finances. Consistent with the Bank's Trust Fund Reform, the ESMAP has an Umbrella "Anchor" MDTF TF073553 and the older TF071389 and TF072490. ESMAP's Umbrella structure includes four trust funds associated to ESMAP: (1) TF071728: Support for Small Island Developing States (SIDS DOCK); (2) TF071379: Carbon Capture, Utilization and Storage (CCUS); (3) TF072636: Advancing Regional Energy Projects (AREP) in Africa; and (4) TF073420: Support to Regional Off-Grid Electrification Project (ROGEP). Totals provided in this financial section may not add up due to rounding.

&gt; Continuation of Table 3.1

Country	FY2022 Contribution Paid-In & Receivables		ESMAP FY2017-22	
	ESMAP	Cumulative Pledges	Cumulative Receipts	Cum. Receipts over Cum. Pledges
Norway				
- MFA		4,773	4,773	100.0%
- Norad	11,360	83,421	54,508	65.0%
Rockefeller Foundation		1,650	1,650	100.0%
Spain		7,088	7,088	100.0%
Sweden	2,749	57,109	39,760	70.0%
Switzerland				
- SDC		3,374	3,374	100.0%
- SECO	13,699	27,749	27,749	100.0%
United Kingdom				
- BEIS		73,589	59,214	80.0%
- FCDO	21,130	73,863	55,662	75.0%
World Bank				
<b>Grand Total</b>	<b>98,302</b>	<b>526,368</b>	<b>411,448</b>	

Note: U.K. Department for Business, Energy & Industrial Strategy (BEIS) provides its contribution in promissory notes. Receipts denote the encashed amount.

**Table 3.2. Donor Contributions to Associated Trust Funds to ESMAP (\$ thousands)**

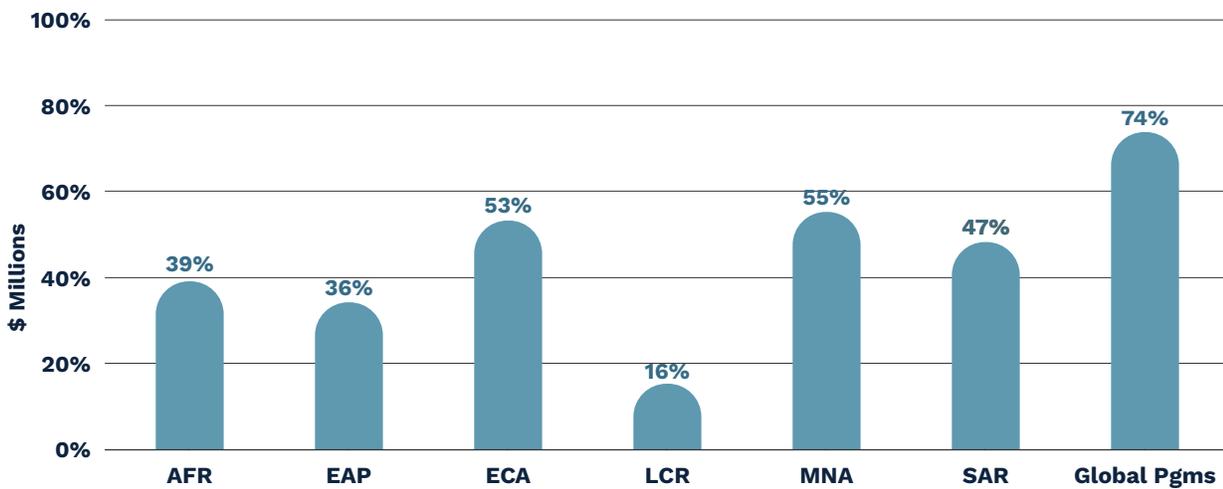
Associated Trust Fund	Donor Country	Cumulative Pledges	Cumulative Receipts	Cum. Receipts over Cum. Pledges
Advancing Regional Energy Projects (AREP) in Africa	Sweden	17,446	17,446	100%
Carbon Capture, Utilization & Storage (CCUS)	Norway	18,313	18,313	100%
	United Kingdom	40,759	40,759	100%
	Global Carbon Capture and Storage Institute, Ltd.	2,173	2,173	100%
Small Island Developing States (SIDS DOCK)	Denmark	22,093	22,093	100%
	Japan			
Support to Regional Off-Grid Electrification Project (ROGEP)	Netherlands	44,000	16,000	36%
Support to Energy Access and Quality Improvement Project (EAQIP) in Rwanda	Denmark	3,796	3,796	100%

## DISBURSEMENTS

ESMAP disbursed about \$53.2 million in FY2022, representing an increase of about 37 percent compared to the amount disbursed in FY2021. The total disbursements for the associated trust funds, SIDS DOCK, AREP, and CCUS, ROGEP, and EAQIP

amounted to about \$9.4 million. Total cumulative disbursement totaled \$109.4 million at the end of FY2022. The following figures and tables present the breakdown of disbursements for FY2022.

**Figure 3.1. ESMAP Disbursements and Percentage, by Region, FY2022 (\$ millions)**



Note:

1. Percentages refer to cumulative disbursement as a percentage of cumulative grant commitments for the Region/Global
2. Global includes disbursements for country grants, including India: Developing a Coal Mine Closure Framework, Achieving a Just Transition for All (\$1.0M), and two global RETFs—COVID-19 Energy Access Relief Fund (\$2.2M) and Quality Assurance Capacity Building for the Off-Grid Solar Sector (\$0.6M)

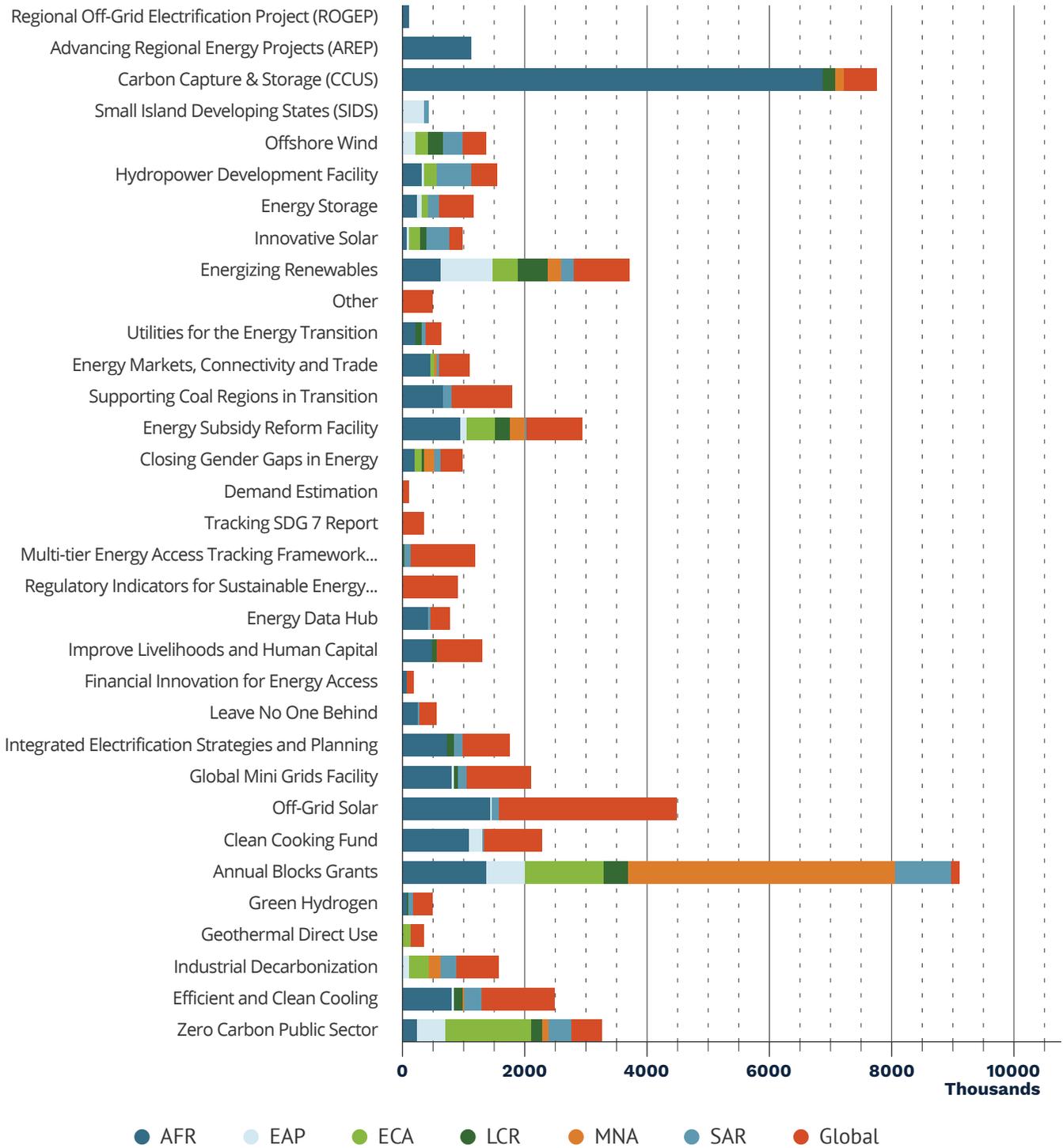
Table 3.3. ESMAP Disbursements, by Region and Program Management, FY2022 (\$ thousands)

REGION	\$ Thousands
AFR	12,004
EAP	2,800
ECA	4,908
LCR	2,267
MNA	5,323
SAR	4,592
Global Programs	18,495
<b>Total</b>	<b>50,389</b>
ADMINISTRATIVE UNIT	\$ Thousands
Program Management & Administration	1,317
Monitoring & Evaluation	533
Communications	760
Knowledge Management	228
<b>Total</b>	<b>2,838</b>
<b>Grand Total</b>	<b>53,227</b>

Table 3.4. ESMAP and Associated Trust Funds Disbursements, by Region, FY2022 (\$ thousands)

REGION	ESMAP	AREP	CCUS	ROGEP	SIDS	EAQIP	TOTAL
AFR	12,004	1,129	6,885	122			20,141
EAP	2,800				373		3,173
ECA	4,908						4,908
LCR	2,267		182				2,449
MNA	5,323		168				5,490
SAR	4,592				51		4,643
Global Pgms	21,333		491				21,824
<b>Total</b>	<b>53,227</b>	<b>1,129</b>	<b>7,726</b>	<b>122</b>	<b>425</b>		<b>62,629</b>

**Figure 3.2. ESMAP and Associated Trust Funds Disbursements, by Program Area, FY2022 (\$ thousands)**



\* Includes data on clean cooking and displaced communities.

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