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ESMAP

Energy Sector Management
Assistance Program

ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAM

ANNUAL REPORT 2023

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ABOUT ESMAP

The Energy Sector Management Assistance Program (ESMAP) is a partnership between the World Bank and over 20 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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ENERGY SECTOR MANAGEMENT
ASSISTANCE PROGRAM

ANNUAL REPORT 2023

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ABBREVIATIONS

AfDB	African Development Bank
AI	artificial intelligence
AREP	Accelerating Regional Energy Projects (a multi-donor trust fund)
ASCENT	Accelerated Sustainable & Clean Energy Transformation
BESS	battery energy storage system
CCF	Clean Cooking Fund (ESMAP initiative)
CCS	Carbon Capture and Storage (ESMAP trust fund)
CCUS	carbon capture, utilization, and storage
CIF	Climate Investment Funds
CO₂	carbon dioxide
COP	United Nations Climate Change Conference
DARES	Distributed Access through Renewable Energy Scale-Up
DRE	distributed renewable energy
EAQIP	Energy Access Quality Improvement Project
EnDev	Energising Development
ESP	Energy Storage Partnership (ESMAP initiative)
ESRF	Energy Subsidy Reform Facility (ESMAP initiative)
FAO	Food and Agriculture Organization (United Nations initiative)
FIEA	Financial Innovation for Energy Access (ESMAP initiative)
FY	fiscal year
GCF	Green Climate Fund
GDP	gross domestic product
GEP	Global Electrification Platform
GERI	Global Electricity Regulatory Benchmarking Index
GFMG	Global Facility on Mini Grids (ESMAP initiative)
GHG	greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GOGLA	Global Off-Grid Lighting Association
GW / GWh	gigawatt / gigawatt hour
H4D	Hydrogen for Development Partnership (ESMAP initiative)
HFC	hydrofluorocarbon
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association
IEA	International Energy Agency
IESP	Integrated Electrification Strategies and Planning (ESMAP initiative)
IFC	International Finance Corporation

ILHC	Improving Livelihoods and Human Capital (ESMAP initiative)
IRENA	International Renewable Energy Agency
LNBH	Leave No One Behind (ESMAP initiative)
MARCOT	Energy Markets, Connectivity, and Regional Trade (ESMAP initiative)
MDTF	multi-donor trust fund
MRV	measurement, reporting, and verification
MJ	megajoules
MTF	Multi-Tier Framework for Energy Access
MW	megawatt
NEP	Nigeria Electrification Project
PUE	productive use of electricity
PV	photovoltaic (solar technology)
RBF	results-based financing
REA	Rural Electrification Agency
RENEW	Regional Network in Energy for Women
RESPITE	Regional Emergency Solar Power Intervention Project
RISE	Regulatory Indicators for Sustainable Energy
SDG	Sustainable Development Goal (United Nations initiative)
SEforALL	Sustainable Energy for All
SIDS	small island developing state
SRMI	Sustainable Renewables Risk Mitigation Initiative (ESMAP initiative)
STEM	science, technology, engineering, and mathematics
TTL	task team leader
UNDESA	United Nations Department of Economic and Social Affairs
WB/WBG	World Bank / World Bank Group
WHO	World Health Organization

WORLD BANK REGIONS

AFR	Africa
EAP	East Asia and Pacific
ECA	Europe and Central Asia
LAC	Latin America and the Caribbean
MNA	Middle East and North Africa
SAR	South Asia

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

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FOREWORD

ESMAP AT 40 | LOOKING BACK WHILE MOVING FORWARD



In 1973, the Organization of Arab Petroleum Exporting Countries imposed a worldwide oil embargo. Resulting fuel shortages and sky-high prices had major repercussions throughout much of the decade. In the United States, leaders called for measures to conserve energy, asking gas stations to close on Sundays and homeowners to refrain from putting up holiday lights. Countries such as Germany, Switzerland, and others, limited driving, boating, and flying, while the British prime minister urged citizens to heat only one room during winter.

Oil-importing developing countries were particularly hard hit. Rising prices put pressure on national budgets, leaving little room for other development priorities. In response, the World Bank and donors established the Energy Sector Management Assistance Program—better known as ESMAP—40 years ago, in 1983. Initially, the trust fund was designed to turn recommendations produced by the Bank’s Energy Sector Assessment Reports into concrete measures for implementation by oil-importing developing countries. The program’s mandate was to provide hands-on advice to governments facing energy challenges. Over time, ESMAP’s work has changed and expanded significantly, but that basic mandate is still at the heart of our work today.

Forty years on from the energy crises of the 1970s and early 1980s, the world has faced many more energy challenges. Most recently, the COVID-19 pandemic highlighted the desperate need for energy to power vaccine cold chains. Russia’s invasion of Ukraine inflated energy prices. Energy-related greenhouse gas emissions are at the center of the climate crisis. But 40 years have also enabled energy technologies to modernize at an unprecedented speed. In fact, today the world has many of the technological capabilities in place to make the switch from fossil fuels to zero-carbon energy sources while connecting the world’s population to electricity.

One of the key challenges that remains is to implement those energy solutions at scale in developing countries. Enabling universal access to energy and accelerating the transition from polluting and carbon-intensive to cleaner energy sources make large-scale and often complex financing mechanisms necessary. And that requires mobilization of both the

public and private sectors. As World Bank President Ajay Banga points out time and again: the private sector needs to contribute to development as governments and multilateral development banks alone cannot provide the vast funds necessary to secure a world free of poverty on a livable planet.

In FY2023, ESMAP put a laser focus on devising and supporting such financial solutions that help make projects viable for commercial players. For instance, combining solar and wind energy generation with battery storage is an obvious solution, as the sun shines and wind blows only intermittently. In FY2023, the ESMAP-convened [Energy Storage Partnership](#) began work on a framework for planning and implementing utility-scale solar-plus-storage projects while leveraging private investments to overcome high upfront costs.

Similarly, the use of renewable hydrogen to decarbonize heavy industries, such as steel production, holds significant promise but also faces considerable financing challenges. ESMAP's global [Hydrogen for Development Partnership](#) (H4D), launched in 2022 during COP27 in Egypt, is designed to facilitate capital-intensive hydrogen investments along with knowledge sharing and capacity improvements.

Sustainable Development Goal 7 sets out the world's ambition to connect everyone to reliable and sustainable electricity by 2030. As that deadline looms large, time is of the essence, making a redoubling of our efforts necessary. While the world has made significant progress to date, with the global electrification rate reaching 91 percent in 2021, the current degree and pace of progress is insufficient. In Sub-Saharan Africa, no more than half of the population has access to electricity, and the world is off track to ensure that changes by the end of this decade.

Here again, World Bank and ESMAP support in making projects commercially attractive when they otherwise might be seen as too challenging is critical to crossing the finishing line: the world's remaining 675 million people without electricity often live in remote, difficult-to-reach regions, and are among the poorest. In response, the World Bank—informed by ESMAP's research and expertise and supported by its grant money—launched the [Distributed Access through Renewable Energy Scale-Up \(DARES\)](#) Platform at COP27 in November 2022. DARES is a World Bank, MIGA, and IFC umbrella for numerous initiatives. Under it, the World Bank launched [Nigeria DARES](#) to connect some 18 million Nigerians with quality access to electricity through distributed renewable energy. The second program under DARES, [Accelerating Sustainable and Clean Energy Access Transformation \(ASCENT\)](#), was also prepared with ESMAP support and aims to bring quality electricity to 100 million people in up to 20 countries across Eastern and Southern Africa over the next 7 years.

Since its inception 40 years ago, ESMAP has provided unmatched prowess and knowledge in energy access, decarbonization, and renewable energy in emerging and developing economies. Not only have we supported innovative technologies, such as off-grid solar, mini grids, and battery storage, but we have also tackled issues that had received less attention than they deserved, such as the energy field's gender dimension.

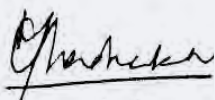
During the 1990s, ESMAP focused on increasing the availability of energy services for poverty alleviation and social development. We integrated our work on market development with that on energy access to ensure an increase in energy services and their sustainability. The concept of sustainability started to take hold following the Rio Earth Summit in 1992, but it would be another 10 years before world leaders listened to the amplified voices of scientists and researchers, emphasizing that the world was ignoring the dangers of climate change at its peril.

During the first decade of this century, ESMAP extended its engagement with client countries to include the nexus between energy security, energy access, and climate change, mirroring the changing landscape of energy challenges. The global community realized that energy vulnerability not only meant a potential lack of power sources but also exposure to the effects of climate change. Consequently, ESMAP proactively assisted client countries in reducing their energy sectors' susceptibility to climate variability while transitioning to a low carbon development path in support of poverty reduction and economic growth.

While we at ESMAP are proud of what we have accomplished over the past four decades, we are determined to push the boundaries to help secure universal energy access over the next seven years and beyond while ensuring more energy supply does not equate to more carbon emissions. The United Nations Climate Change Conference (COP28) pledged in December 2023 a tripling of renewable energy capacity and a doubling energy efficiency improvements by 2030. Similarly, the World Bank's energy lending is set to triple to \$30 billion by 2030. Also, among the six Global Challenge Programs of the World Bank's new Evolution Roadmap, one is focused on energy with an emphasis on energy transition and universal access to modern, reliable, and affordable electricity. The program will emphasize projects' replicability and scalability, with more profound innovations and transformative approaches rolled out based on lessons learned.

These developments present ESMAP with a significant opportunity as we will be at the center of this global work. Accordingly, expectations for our ability to deliver results have risen considerably and we will only be able to meet these expectations if we have sufficient grant resources to support the critical capacity building and knowledge needed to build a pipeline of ambitious projects and consistently achieve impacts on the ground. ESMAP's evolving FY2025-30 business plan will reflect this new level of ambition.

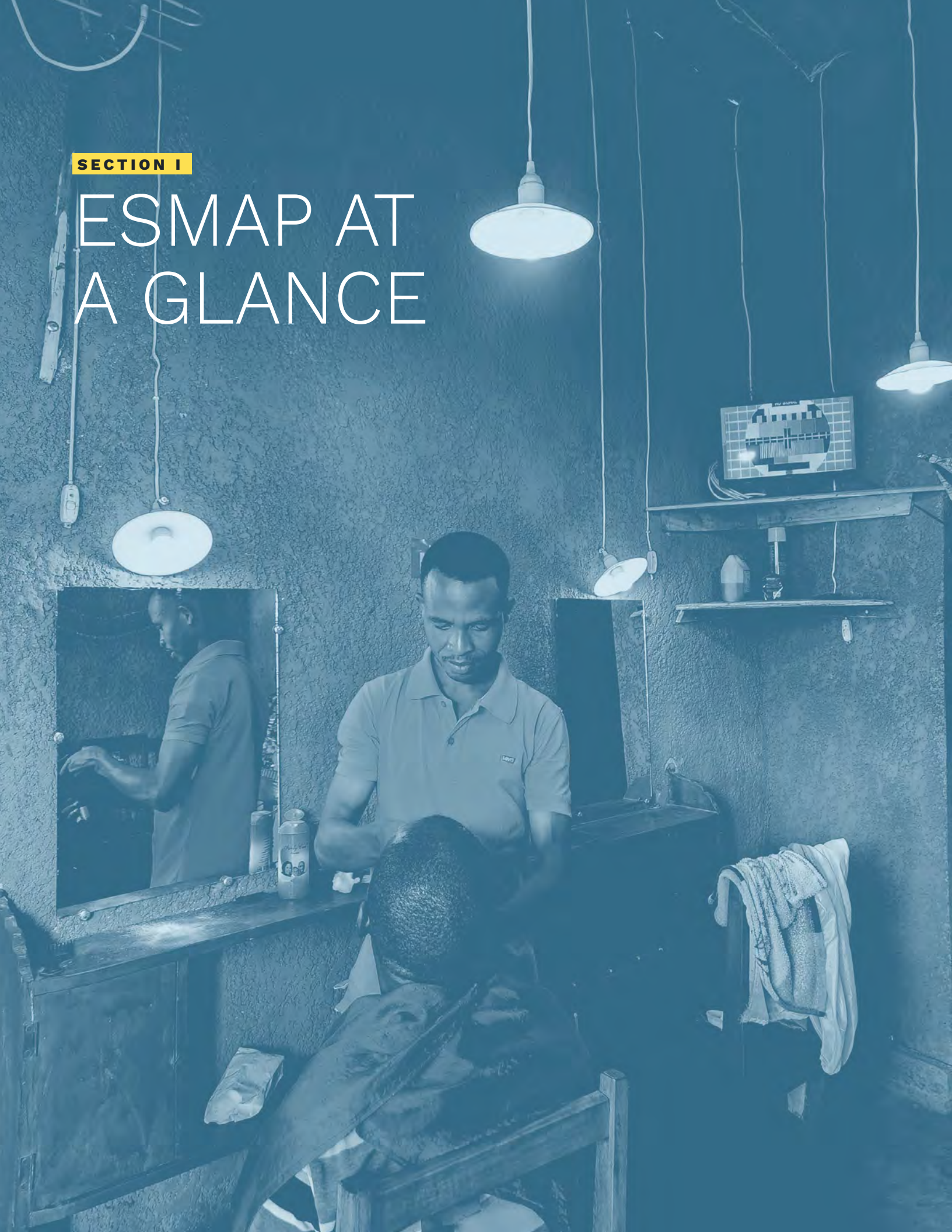
To our donor partners, we look forward to working with you on implementing our new business plan and thank you for the support you have given us over the past 40 years!



Chandrasekar Govindarajalu
ESMAP Practice Manager

SECTION I

ESMAP AT A GLANCE



ABOUT ESMAP

ESMAP is a partnership between the [World Bank](#) and [over 20 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 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 \$254.1 million (as of June 30, 2023), with FY2022–23 average annual commitments of about \$90.3 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 to inform World Bank 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 agriculture, environment, gender, health, transport, urban, and water
- Help mobilize \$6.8 billion in external financing, including \$3.6 billion from private sector,

\$2.9 billion from public financing, and \$283 million from multilateral development banks and external trust funds in FY2023 to support the World Bank's energy sector lending portfolio

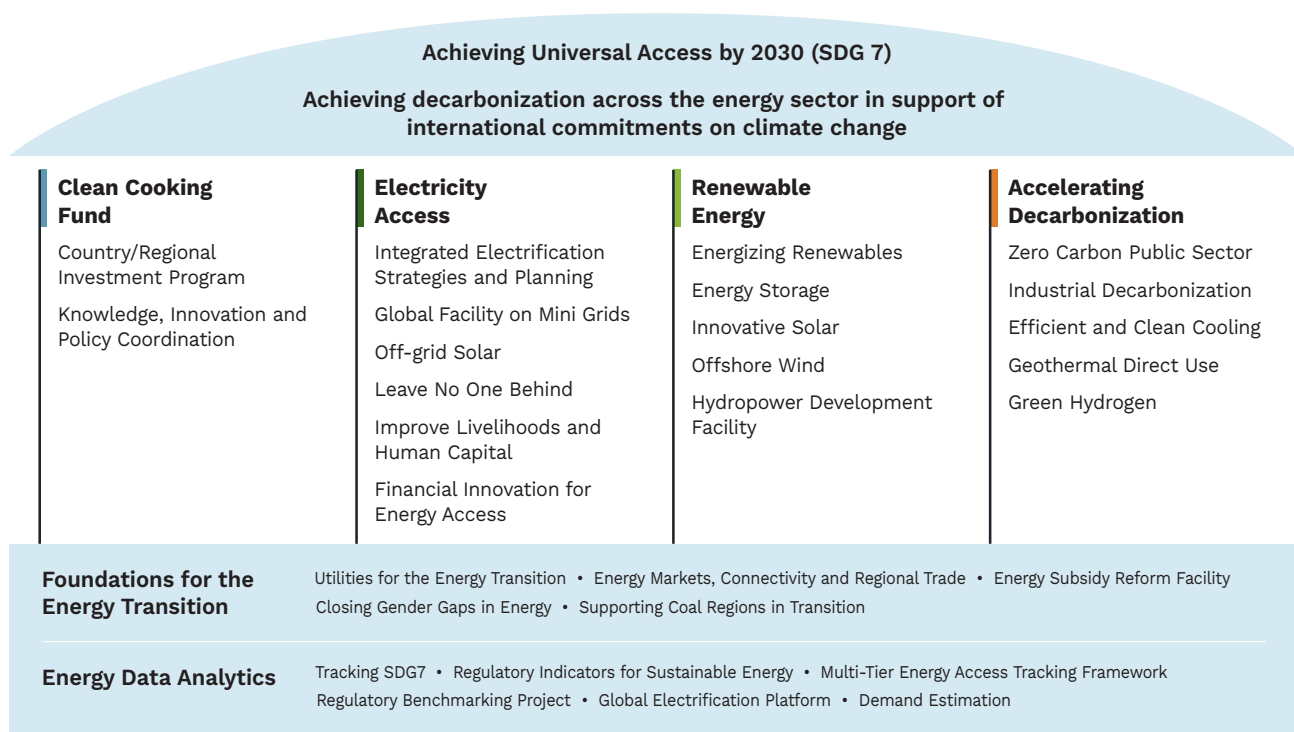
ESMAP FY 2021-24 BUSINESS PLAN STRUCTURE

ESMAP is implementing a four-year [business plan \(FY2021–24\)](#) structured around four thematic pillars and two cross-cutting thematic blocks. Within these, ESMAP operates 29 technical windows (or programs). All this work is directed at 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.

ESMAP's four overarching and interlinked pillars focus on Clean Cooking, Electricity Access, Renewable Energy, and Decarbonization. The two cross-cutting thematic blocks are Foundations for 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



In Section I, this annual report articulates how ESMAP worked toward implementing its business plan in FY2023 (July 1, 2022 to June 30, 2023) during global challenges of great significance, including the ongoing Russian invasion of Ukraine, rising interest rates, 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 FY2023

Fiscal Year 2023 (July 2022 to June 2023) marked the third year in the implementation of ESMAP's four-year business plan.

As of the end of June 2023, ESMAP's cumulative active portfolio reached \$254.1 million, encompassing 320 activities implemented in more than 77 countries.¹ Concrete program results are illustrated throughout the report.

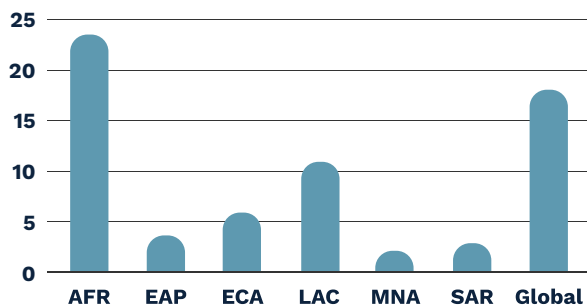
In FY2023, ESMAP approved a total of \$108.5 million² to support global knowledge work and provide additional financing to existing activities and financing for new activities, including co-financing for World Bank projects as recipient-executed grants.

Of the approved \$108.5 million, \$64.6 million were committed against new FY2023 grants³ and are under implementation with:

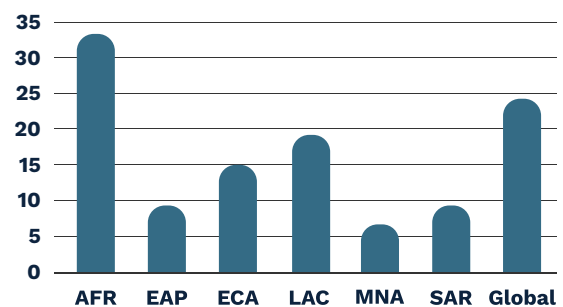
- 68 activities in 44 countries (excluding regional activities)
- 23 activities with a regional focus
- 23 activities with a global focus

Regional Profile of New ESMAP Activities Approved, FY2023

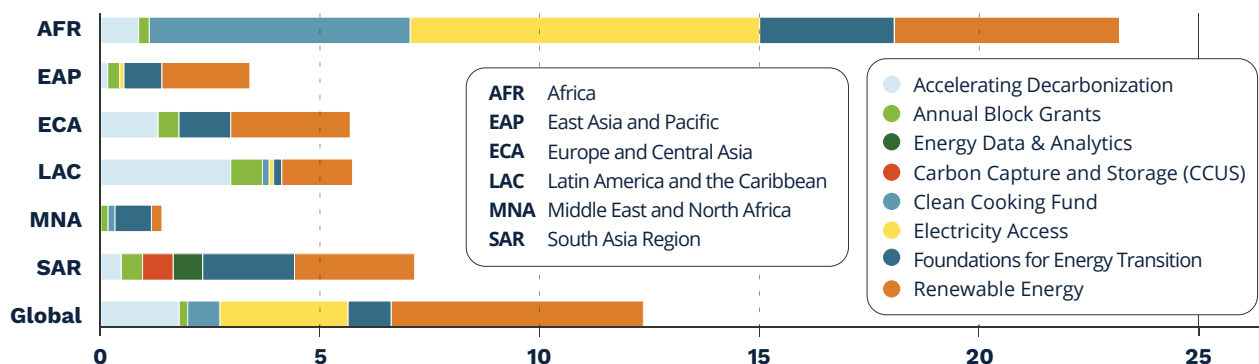
ESMAP Grant Amount by Region (US\$ million)



Number of Activities by Region



ESMAP Grant Amounts by Thematic/Cross-Cutting Areas for New Activities, FY2023 (US\$ million)



1 The active portfolio excludes allocations to cover Program Management & Administration, Monitoring & Evaluation, Communications, and Knowledge Management, totaling \$3.3 million.

2 Includes additional financing against existing grants, FY2023 new activities, and outstanding grants pending activation in the ESMAP system.

3 Commitments represent the financial liability created against grants that become active/effective (Bank-executed and recipient-executed) in the World Bank's system.

SECTION II

OUR IMPACT IN FY2023



\$12.3 BILLION

in FY2023 World Bank development financing informed by ESMAP's expertise and funds (an increase of \$2 billion compared to FY2022)

\$6.8 BILLION

external financing mobilized, including \$3.6 billion from private sector, \$2.9 billion from public financing, and \$283 million from multilateral development banks and external Trust Funds⁴

\$8.4 BILLION

in climate finance informed by ESMAP⁵

37.6 MILLION

people expected to gain access to electricity through FY2023 World Bank financing informed by ESMAP, of which 34.7 million people will gain access to renewable energy

8 MILLION

people gained access to electricity in FY2023 through ongoing projects and lending operations informed by ESMAP

43,833

people provided with new or improved access to clean cooking solutions through projects supported by the Clean Cooking Fund

1,632 MW

of renewable energy constructed in FY2023 through ongoing World Bank projects and lending operations informed by ESMAP

8.5 GW

of renewable energy expected to be installed through FY2023 World Bank financing informed by ESMAP

370 MILLION

MT of CO₂ emissions expected to be reduced across 22 projects and six regions through FY2023 World Bank financing informed by ESMAP

285 MILLION

MWh projected lifetime energy and fuel savings to be achieved through FY2023 World Bank financing informed by ESMAP

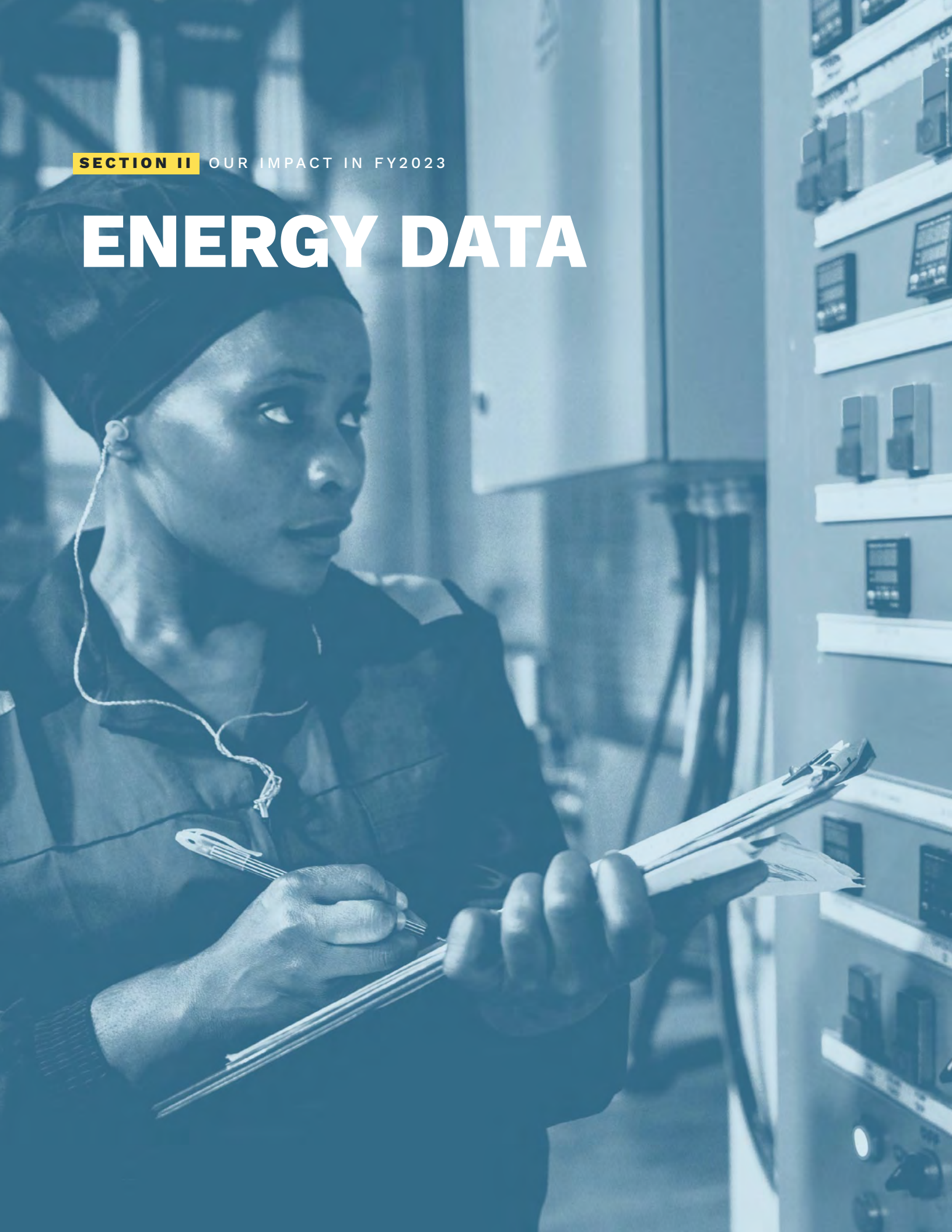
Impact indicators illustrate ESMAP's contributions to the development objectives by informing WBG lending operations. ESMAP will source the data for impact indicators from the project appraisal or other official documents of the lending operations. These indicators are cross-cutting and capture both direct and additional (indirect) contributions from multiple ESMAP initiatives (e.g., energy access directly contributes to the number of people with access and may additionally contribute to metric tons of CO₂ 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](#).

4 These amounts reflect World Bank mobilization supported by ESMAP.

5 Climate finance refers to the share of World Bank lending commitments that contributes to climate change mitigation and/or adaptation.

SECTION II OUR IMPACT IN FY2023

ENERGY DATA



Accessible, timely, and quality energy information and data are key to gauging the world's progress toward the Sustainable Development Goals (SDGs) on energy access and the transition to clean energy. Data and their analyses form the basis for making well-informed decisions. Without up-to-date, detailed end-user, and supply-side data, governments would have difficulty understanding consumers' needs and identifying effective interventions.

ESMAP's [Energy Data and Analytics Hub](#) is an all-inclusive online data and knowledge platform offering free access to energy-related information. 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](#).

The work of the Data and Analytics Hub is central to the development community's efforts toward universal access to clean energy. This year, through data collection and analysis, ESMAP and partners highlighted the gaps in achieving SDG 7 (universal access to clean and affordable energy by 2030), deploying renewable energy, and improving energy efficiency. The key message is that the world is off track to ensure access to affordable, reliable, sustainable, and modern energy for all by 2030.

\$675
million

Soaring energy prices caused by Russia's invasion of Ukraine have affected the most vulnerable people, particularly in developing economies. High energy prices may slow progress toward realizing SDG 7; hence, the transition to clean energy is critical. Knowledge and data from ESMAP's Energy Data and Analytics Hub can help governments and the international community define effective policies, mobilize large-scale investment capital, and drive technological innovation.

During the UN High-Level Dialogue on Energy in 2021, the ESMAP Energy Data and Analytics team took a leading role in presenting lessons and insights from the Multi-Tier Framework which assesses the quality of energy access. One of the key recommendations is to fully understand the linkages between energy access and other SDGs. It stressed particularly the link between SDG 7 (energy) and SDG 13 (urgent action on combating climate change and its impacts). This link requires incorporating energy access's benefits for health, education, jobs, and resilient livelihoods. Also, to establish these links, it is critical to improve the availability of quality open-source, verifiable energy information and data analysis as they pertain to national, subnational, and local contexts.

Progress in the fields of big data and artificial intelligence is making more comprehensive and accurate analyses of complicated energy issues possible. The ability to process complex data sets also supports making cross-sectoral linkages. Using such tools, we can try to bridge the significant energy data shortfalls, particularly in poor countries that have the largest gaps in energy access, while also exploring new business models targeting scale-up more effectively.

In 2021, 675 million people still lived without access to electricity, down from 733 million the previous year. Most of them live in Africa where around 50% of the population is not connected to electricity. Closing this gap by reaching poor people in remote areas is critical to meeting SDG7.



SUSTAINABLE DEVELOPMENT GOAL 7

[SDG 7](#) is one of the 17 [Sustainable Development Goals](#) established by the United Nations General Assembly in 2015. Progress toward achieving SDG 7—to “ensure access to affordable, reliable, sustainable and modern energy for all” by 2030—is measured through six primary indicators.

SDG 7 Targets	Indicators	2010	Latest Year
Target 7.1 By 2030, ensure universal access to affordable, reliable, and modern energy services	Indicator 7.1.1 Proportion of population with access to electricity	1.1 billion people without access to electricity	675 million people without access to electricity (2021)
	Indicator 7.1.2 Proportion of population with primary reliance on clean fuels and technology	2.9 billion people without access to clean cooking	2.3 billion people without access to clean cooking (2021)

SDG 7 Targets	Indicators	2010	Latest Year
Target 7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	Indicator 7.2.1 Proportion of population with primary reliance on clean fuels and technology	16% share of total final energy consumption from renewables	19.1% share of total final energy consumption from renewables (2020)
Target 7.3 By 2030, double the global rate of improvement in energy efficiency	Indicator 7.3.1 Energy intensity measured as a ratio of primary energy and GDP	5.54 MJ/USD primary energy intensity	4.63 MJ/USD primary energy intensity (2020)
Target 7.a By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology	Indicator 7.a.1 International financial flows to developing countries in support of clean energy research and development and renewable energy production, including in hybrid systems	\$11.9 billion international financial flows to developing countries in support of clean energy	\$10.8 billion international financial flows to developing countries in support of clean energy (2021)
Target 7.b By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing states, and landlocked developing countries, in accordance with their respective programs of support	Indicator 7.b.1 Installed renewable energy-generating capacity in developing countries (in watts per capita)	101 watts per capita installed renewable electricity-generating capacity in developing countries	268 watts per capita installed renewable electricity-generating capacity in developing countries



ENERGY DATA AND ANALYTICS HUB PRODUCTS

ESMAP's [Energy Data and Analytics Hub](#) is leading efforts to provide quality energy information and analysis to accelerate the pace of access and transition to clean energy. Its data and knowledge platform delivers outputs through its six complementary flagship products: [Tracking SDG 7: The Energy Progress Report](#), [Multi-Tier Framework for Energy Access](#) (MTF), [Energy Data Hub](#), Energy Data Integration and Innovation Hub, [Regulatory Indicators for Sustainable Energy](#) (RISE), and the [Global Electricity Regulatory Benchmarking Index](#) (GERI). In addition, the Electricity Demand Estimation activity enables World Bank Group operational teams and clients to use demand estimation tools and data for the residential and agricultural consumer components to support electrification strategies and project design.

During FY2023, the hub continued to provide the institutions of the World Bank Group and its development partners with access to energy sector-related data and advanced analytics to inform strategic and project-level decision making.

The [Tracking SDG 7: The Energy Progress Report](#) is a comprehensive tool that tracks the progress of more than 200 countries on energy access, energy efficiency, renewable energy, clean cooking, and international cooperation to advance achieving SDG 7. Since 2018, the report has been jointly produced by the five SDG 7 custodian agencies: World Bank/ESMAP, International Energy Agency (IEA), International Renewable Energy Agency (IRENA), United Nations Statistics Division (UNSD), and the World Health Organization (WHO), with the support of the SDG 7 Technical Advisory Group at the United Nations. As the custodian agency for SDG 7.1.1, the World Bank/ESMAP team is responsible for data on electrification and the report's chapter on access to electricity. The ninth edition of the report, launched in June 2023, highlights that progress made across the indicators up to that point is insufficient for countries

to achieve the 2030 targets. Some of the economic factors influencing this outcome include the residual effects of the COVID-19 pandemic and rising energy prices. *Tracking SDG 7's* content has also been used to identify lessons learned and generate such reports as the [2023 Sustainable Development Goals Report](#); [Building Evidence to Unlock Impact Finance: A Field Assessment of Clean Cooking Co-Benefits for Climate, Health, and Gender](#); the [Guidebook for Improved Electricity Access Statistics](#); and the [Renewable Energy Market Analysis: Mano River Union Region](#).

The [Multi-Tier Energy Access Tracking Framework](#) (MTF) uses country data on electricity use to provide accurate information on households' actual electricity services. The tool is designed to recommend ways to eliminate barriers to electricity access. This extends data collection and analysis beyond the usual binary measures of "connected or not connected." Since its introduction in 2015, the MTF has collected data from 25 countries, and during FY2023, the framework was used to track the progress of Rwanda's electrification since 2016, when the first round of the MTF survey was conducted there. In collaboration with the United Nations High Commissioner for Refugees (UNHCR), the MTF team added a module on refugees to the Rwandan MTF survey to assess the status of electrification and access to clean cooking solutions among displaced persons.

The team also supported the Sudanese government in assessing the supply and demand sides of the off-grid sector and informed the preparation of a new World Bank loan. The Malawi government requested that the ESMAP team support the design and implementation of an energy survey using the MTF approach. The data collection was completed in July, and the team is currently conducting the data analysis to facilitate the energy sector dialogue in Malawi.

The [Regulatory Indicators for Sustainable Energy](#) (RISE) is the first global policy scorecard that captures the policies and regulations that countries establish to create electricity access. RISE is published biannually and provides free access to an online

data platform that enables users to download country scores and customize the information in infographics to compare countries' power sector and regulatory and policy frameworks. RISE indicators are included in outputs of several well-established global initiatives. The 2022 edition of the scorecard, published in December 2022, includes information on due diligence conducted by multinational law firms with a significant presence in the energy industry. The next edition of the scorecard is expected in the fourth quarter of FY2025. It will include data from 140 countries and feature a set of refined indicators and sub-indicators.

During FY2023, RISE indicators contributed to enhancing global initiatives, including the International [Energy Agency's Energy Transition Indicators](#) and the [World Economic Forum Energy Transition Index](#). Since the scorecard's 2022 publication, it has garnered over 4,300 views on the RISE website alone. More than three-quarters of the views were new visitors to the website. ESMAP has received requests for RISE sub-indicator level historical data from several prominent private sector and international organizations for their analytical and investment work, including *The Economist*, World Economic Forum, Siemens, Vestas, Fraunhofer Institute, Boston Consulting Group, ENEL, USAID, and the IEA. RISE indicators are also a key component of the [MTF electricity access and clean cooking](#) country profiles. RISE mini grids indicator data was also used to assess regulatory progress in the widely circulated ESMAP publication [Mini Grids for Half a Billion People](#). RISE data was also used to contribute to the [UN's SDG7 Policy Briefs](#) for the 2023 UN High-Level Political Forum.

The [Global Electricity Regulatory Index](#) (GERI) is jointly produced by the African Development Bank (AfDB) and World Bank/ESMAP as a companion piece to the RISE scorecard. GERI collects data from more than 100 developing countries to track the gaps between regulation and actual implementation. This enables users to identify gaps in their own country's regulatory framework and

benchmark their performance against global peers. The [December 2022 edition of the GERI report](#), including data from 82 countries, illustrates that most developing countries are at an intermediate level of development of power sector regulations and that additional action is needed to strengthen regulatory frameworks.

The [Electricity Demand Estimation](#) program supports World Bank operations in applying reliable and transparent estimation tools and data to the electrification strategy's residential and agricultural customer segments. During FY2023, the program continued to collaborate with the World Bank's Agriculture and Water Global Practices to provide technical assistance and co-sponsor knowledge and learning events. In Uganda, the team conducted data collection activities on irrigation and agro-processing. In South Sudan, the team worked with counterparts in the Infrastructure, Transport, and Digital Development Global Practices to develop an integrated infrastructure planning framework. The team developed a methodology to assess the electricity needs in Liberia's agriculture and productive use of energy sectors.

The [Energy Data Hub](#) developed several data tools and applications and generated country data in FY2023. It expanded the [EnergyData.info](#) platform to host 981 datasets with more than 115,000 users annually. The Energy Data Hub features dozens of applications, including the Renewable Zoning Tool and the newly released Women in the Power Sector Network ([WePOWER](#)) site, a platform to facilitate knowledge sharing among women in energy in the South Asia region. In addition, flagship tools received updates. These included the [Global Solar Atlas](#) and [Global Wind Atlas](#), a site owned by Denmark's Technical University and developed in partnership with ESMAP. The Global Wind Atlas was used to inform offshore wind roadmaps in the Philippines, and the Global Solar Atlas was used to aggregate and disseminate solar measurements in East Africa. The Energy Data Hub also developed a new, innovative methodology for detecting transmission grids using artificial intelligence (AI) and satellite

imagery, and it was piloted for Bangladesh, Dominican Republic, and Liberia.

The **Energy Data Integration and Innovation**

Hub was initiated in FY2023 to leverage AI, machine learning, and cybersecurity to help client countries advance the use of innovative approaches to energy sector management and climate resilience planning. The hub partnered with the European Space Agency to provide advanced climate resilience analytics to operations in Bangladesh. This method will be scaled

to include additional countries in FY2024. In Georgia, the hub is supporting the use of AI for advanced hydropower forecasting, and in Nigeria, the hub is partnering with the energy access team to deliver a responsible data-sharing framework for mini grids. This framework will enable more effective use of mini grid data for energy management and planning. In Tajikistan, the hub provided technical assistance to improve cybersecurity capacity and strengthen cyber resilience planning. This work will be expanded to include Côte d'Ivoire, Moldova, and Ukraine in FY2024.

SECTION II OUR IMPACT IN FY2023

FOUNDATIONS FOR THE ENERGY TRANSITION

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The global energy sector has suffered shockwaves from the compounding crises of COVID-19, high debt burdens, high inflation, volatile energy markets triggered by the Russian invasion of Ukraine, and increasingly disrupting impacts of climate change. This has led to sharp growth in country demand for World Bank and ESMAP support to strengthen energy sector fundamentals that are essential to safeguarding accessibility, reliability, affordability, and sustainability of energy sectors. Moreover, the massive scale up of energy access, renewable energy, and energy efficiency that is required by 2030 cannot be accomplished without proper energy systems, regulations, institutions, and benefit sharing.

Through its cross-cutting [Foundations for Energy Transition](#) Program, ESMAP provides advice on such comprehensive policy frameworks for the energy transition. The program delivers concrete development results on universal energy access, climate change mitigation, climate change adaptation, and gender inclusion. It does so by developing and disseminating global knowledge, enhancing tools for data-driven decision making, providing technical assistance to government institutions, designing and co-financing reforms and modernization, and organizing capacity building and peer-to-peer learning.

As one part of the energy transition, governments need to lay the critical groundwork to incentivize markets to adopt low carbon energy solutions and safeguard vulnerable people's interests. Given high fossil fuel prices caused by Russia's invasion of Ukraine and continuously dropping costs for renewables, the market has been trending in the right direction over the past few years. And yet,

to work efficiently, ESMAP helps governments to provide appropriate price signals to energy markets to guide electricity output and inform investment decisions. Doing so facilitates integration of ever more solar and wind energy into power systems without jeopardizing supply reliability.

Energy subsidies are a tool that governments are prone to use at times of price hikes as they seek to shelter citizens and businesses from rising costs. In FY2023, 60+ countries did so, introducing or expanding fuel subsidies as the impact of the 2022 food and fuel price shocks were felt around the world. While understandable, ESMAP's work has shown that the subsidy instrument is often blunt and comes with considerable costs. ESMAP is therefore focused on assisting reforms of such subsidies to safeguard the interests of lowest-income populations.

ESMAP also supports improvements in the performance and governance of utilities at the center of energy systems. Wherever they lack viability, this has become a major bottleneck to clean energy and access efforts. ESMAP helps to create an enabling policy and regulatory environment for utilities and develop the tools and expertise to leverage technological innovations.

No doubt, people who are, or used to be, dependent on coal mining need government support as fossil fuels are phased down in the direction of net zero economies. ESMAP sees it as one of its core charges to help governments in developing countries transition through mine closure and plant repurposing toward more sustainable energy options.

\$600
billion

The power sector is undergoing a fundamental transformation. Digital technology generates vast amounts of data that help improve planning and operations of power grids. This data can help during expansion and modernization of energy grids as global investments need to double to \$600 billion by 2030.

Overlaying this work are new opportunities as big data analysis and predictive models become ubiquitous. The power sector, like so many others, is undergoing a digital transformation, with digital technology and sensors making vast amounts of data available that utilities use to analyze and improve their planning and operations. By supporting such opportunities, ESMAP is looking to help realize efficiency gains that advance the goals of universal access to affordable, reliable, sustainable, and modern energy and the clean energy transition. This is particularly relevant in the expansion and modernization of energy grids where global investments need to double to \$600 billion by 2030, according to IEA. Technologies such as AI, machine learning, sensors and drones, and digitalization can help countries increase their rate and pace of integration of intermittently available renewables into the grid.

UTILITIES FOR THE ENERGY TRANSITION

Like many other industries, the power sector is undergoing a digital transformation where smart grids and digital technologies enhance operational efficiency, support automation, strengthen customer engagement, and enable new business models. Digitalization also supports the introduction of renewable energy, such as solar and wind, across the electricity supply chain. The use of digital technologies and sensors is making vast amounts of data available that utilities and other stakeholders can analyze to improve planning and operations. Because electricity utilities are at the center of the power sector, such efficiency gains are particularly relevant for achieving universal energy access and the transition to clean energy.

ESMAP's [Utilities for the Energy Transition](#) Program helps improve the performance of utilities in developing and emerging economies by supporting the effective use of smart technology, data analytics, and innovative business models. The program helps harness the potential of big data, artificial intelligence, and digital technologies to optimize grid operations,

improve operational efficiency, and make informed decisions for a more sustainable energy ecosystem. The program was initiated under the current ESMAP business plan, in recognition of the need to support client countries in assessing and capturing opportunities while also tackling challenges associated with the digital transformation of the power sector. The program has seen growing demand from client countries and utilities and is currently supporting utility modernization technical assistance and investments in all continents where the World Bank operates.

In FY2023, the program designed and began implementing three global knowledge activities: (1) a study on data-driven transformation of electricity utilities; (2) an analysis of advanced metering infrastructure deployment and use in World Bank projects; and (3) a set of knowledge exchange activities. These are aimed at informing regional teams and policy dialogues in the energy sector to better harness digital technology and innovate in a more systematic way. The goal is to improve operations and integration of variable renewable energy sources.

In India, the Utilities for the Energy Transition Program is supporting the automation of electricity distribution networks to facilitate the integration of renewable energy and improved power supply. The ESMAP team examined the integration of the planned distribution automation projects in the West Bengal State Electricity Distribution Company. The analysis will contribute to the design of a Smart Electricity Distribution Operation Center and provide an integration platform for automation technologies. The team also awarded a grant to support the modernization of the grids in the Indian states Madhya Pradesh and Rajasthan using information technology upgrades.

In Africa, the program worked with the Kenya Power and Lighting Company to assess the design of a pilot financing program for income-generating use of household appliances to boost the benefit of electrification among households in underserved

locations. The assessment recommended a simple model where Kenya Power and Lighting Company would define customer target areas, share relevant customer data with program financiers, and support demand mobilization. The assessment has informed the design of the demand stimulation program under the Kenya Green and Resilient Expansion of Energy program.

In collaboration with the World Bank's Global Energy Knowledge team, ESMAP continued to build on the Utilities Knowledge Exchange Platform launched during the previous fiscal year. The platform has facilitated peer-to-peer knowledge sharing between global utility practitioners on several topics, including smart metering rollout for utilities. This event focused on smart metering's role in reducing energy losses, improving reliability and optimization in asset utilization, and overall improvements in system efficiency.

ESMAP's program also created a data platform called [UPBEAT](#) (About the Utility Performance and Behavior in Africa Today), which discloses validated information on the performance of electric utilities in Sub-Saharan Africa with performance indicators along financial, operational, and transparency and accountability dimensions. The objective is to facilitate understanding of utilities' performance at a given point in time, track the changes in their performance, and benchmark utilities' performance against their regional peers. In FY2023, the program supported the second phase of UPBEAT, updating the platform with data for 2019 and 2020. Similarly, ESMAP supports the [Utility Knowledge Exchange Platform](#) (UKEP) that aims to facilitate partnerships and knowledge exchange between power utilities.

Finally, the program contributed to the third study on distributed solar photovoltaic (PV), [From Sun to Roof to Grid](#), led by ESMAP's Innovative Solar program. It also collaborated with the Gender and Energy team to develop and launch an educational tool to bolster women's employment in energy utilities in developing countries, the [Women's Employment in Energy Sector Utilities Toolkit](#).

ENERGY MARKETS, CONNECTIVITY, AND REGIONAL TRADE

Clean energy continues to become more affordable and mainstream as renewable energy and storage technologies advance and the urgency to transition away from fossil fuels continues to grow. Therefore, energy experts have been exploring opportunities to redesign electricity markets to provide efficient price signals. These signals would guide the level of electricity output (also known in the industry as "generation dispatch") and inform investment decisions in generation and grid infrastructure. This would encourage the market-led entry of renewables and facilitate the integration of higher shares of solar and wind energy into power systems without jeopardizing supply reliability. These efforts will enable markets to function efficiently and securely and transition to more sustainable power systems to achieve energy access for all by 2030, per SDG 7.

ESMAP's [Energy Markets, Connectivity, and Regional Trade](#) (MARCOT) Program is a consolidated center of expertise on power market design and operation supporting governments in developing countries, regional institutions, and World Bank operational teams. Building well-functioning, stable power markets is particularly important as many countries seek to accelerate sustainable economic growth following downturns during the COVID-19 pandemic.

In FY2023, the MARCOT Program continued to focus on the development of grid interconnectivity across borders and regional markets such as the African power pools. Countries in Africa have collaborated to integrate grids and electricity markets to leverage the diversity of energy resources across the continent. The program allocated about \$1.5 million in new grants across five projects during the fiscal year to support regional energy integration in West and Central Africa as well as South Asia. For example, MARCOT's South Asia Regional Electricity Markets Program have contributed to the preparation of regional hydropower projects in the region, including the Sustainable Hydropower Development Project

in Bhutan and the Upper Arun Hydroelectric Project in Nepal. Through the Accelerating Regional Energy Projects Multi-Donor Trust Fund (AREP MDTF)—an ESMAP associated trust fund—approximately \$3.8 million was disbursed to support advancing regional grid connectivity and electricity trade in the Southern and Eastern African Power Pool regions. The programs build on previous work and facilitate knowledge exchange and capacity-building activities among various regions targeting policymakers and World Bank teams.

While the MARCOT program originated from the AREP MDTF, the latter now operates as a stand-alone programmatic trust fund, with two independent assistance programs: one targeting the Southern African Power Pool region and the other the Eastern African Power Pool region. In FY2023, a total disbursement of around \$463,000 was executed to support their ongoing efforts. For example, funding from AREP MDTF has been instrumental in advancing the preparation of regional energy projects in the Southern African Power Pool region. These projects include the Mozambique–Malawi Interconnector, the Zambia–Tanzania Interconnector, and the Angola–Namibia Interconnector. Furthermore, AREP has facilitated studies and other activities to help establish the Southern African Power Pool’s Regional Transmission Infrastructure Financing Facility (RTIFF), which will serve as a platform to provide blended financing for transmission projects of regional priority and to foster private sector participation.

The MARCOT Program also provided support for electricity market reform in client countries. It allocated \$200,000 in grants for two projects in the Europe and Central Asia region to support activities focused on enhancing domestic electricity market mechanisms.

Published in FY2023, the guidance note [Wholesale Electricity Market Design: Rationale and Choices](#) offers insights into key market design elements and design choices for developing countries transitioning towards a wholesale electricity market. The policy research

working paper [Should Electricity Market Designs be Improved to Drive Decarbonization?](#) provides an overview of the existing literature concerning the effectiveness of current market structures in facilitating the decarbonization of power systems. In addition, the program prepared a series of papers to highlight market-led decarbonization to set a theoretical foundation and analytical models that have since found applications in Georgia, India, and Ukraine. In Georgia, the modeling is used to determine whether the proposed energy-only market design is adequate to achieve long-term decarbonization goal. The analysis found support in favor of the proposed market design, although it also pointed out that such a design may expose the system to a higher risk of unserved energy in extreme dry year scenarios. The Indian case studies explored the role of ancillary service markets to support the 500 GW renewable energy target by 2030. Part of the analysis focused on the need to couple market fragments under different Power Exchanges and the fleet of interstate generation stations (ISGS) operated by the system operator. The analysis pointed to significant economic benefits of such integration and a reduction in market prices. In Ukraine, the model made a strong case for energy storage which became the analytical foundation of a World Bank-led investment project. The analysis also pointed out the need for a co-optimized ancillary service market to support storage and other providers of ancillary services.

A global market observatory, currently under development, will provide a comprehensive database of power market indicators to support market reform efforts through global benchmarking. The [Market Learning Academy series](#) provided capacity building for both World Bank and government officials and featured several foundational training sessions. This will be complemented by the peer learning and knowledge exchange activities under the [Regulatory Energy Transition Accelerator](#) (RETA) initiative, developed with the IEA and the IRENA. MARCOT Program activities were supported by an external panel of experts in FY2023, comprising globally renowned market practitioners and academics.

ENERGY SUBSIDY REFORM FACILITY

Reforming energy subsidies is a complex, technically demanding, and politically sensitive undertaking. ESMAP's [Energy Subsidy Reform Facility](#) (ESRF) was established in 2013 to support developing country governments' energy subsidy reform efforts. The facility supports World Bank teams in providing comprehensive multi-disciplinary technical assistance and advisory support to governments, utilities, and regulators on various aspects of energy subsidy reform, including assessments related to poverty and distributional impacts, social protection, fiscal dimensions, macroeconomic, political economy, and climate change implications of energy subsidies and their reform options.

Over the past two years, governments' use of energy subsidies increased substantially as leaders sought to protect citizens, economies, and businesses from the impact of the 2022 food and fuel price shocks. Between July 2021 and April 2023, at least 64 countries introduced or expanded fuel subsidies, and at least 143 countries announced 439 energy-related measures, including fuel, electricity, and transport subsidies, according to an ongoing [global tracking effort](#) by the World Bank. Latest estimates from the [IEA](#) show that total global energy consumption subsidies will exceed \$1 trillion by the end of 2022.

While universal energy price subsidies help to keep energy prices low, they do so indiscriminately across all income groups and hence come with significant costs for the economy, society, and the environment. Against this background, there is a strong and growing demand for ESRF's support in reforming such untargeted energy subsidies to safeguard the interests of the lowest-income and most vulnerable population groups. Since FY2014, ESRF has allocated \$27.5 million in technical assistance to energy subsidy reforms. ESRF-funded technical assistance helped prepare 64 World Bank lending operations across 36 countries, totaling \$23.7 billion in volume. In FY2023, \$1.9 million was

provided through ESRF technical assistance grants to World Bank teams supporting client countries in their reform efforts. Most grant-funded activities focused on helping governments strengthen the energy sector's financial viability.

In FY2023, ESMAP published a technical report entitled [Cash Transfers in the Context of Energy Subsidy Reform: Insights from Recent Experience](#). This report, one of the technical background papers to a forthcoming ESRF stocktaking study, discusses how cash transfers have been deployed to help governments address the impacts of energy price increases on the poor and vulnerable and those that stand to be most affected by reforms. The report undertakes a global stocktaking of energy subsidy reforms over two decades during which governments introduced new—or leveraged existing—social assistance initiatives. The analysis shows that with good design and proper implementation, cash transfers can mitigate potential negative distributional impacts of energy subsidies and help build public trust. The report concludes that mitigation measures should be an integral part of reforms early on and based on a solid analytical understanding of who can be impacted by different reform options.

A grant from ESRF supported the development of a Practitioners' Toolkit for Repurposing Agriculture Policies. It was completed in collaboration with the Food and Agriculture Organization of the United Nations (FAO) to support measuring the extent and nature of support for the agriculture sector, assess its alignment with sector goals, and identify repurposing options to make agriculture more productive, resilient, and green.

In addition to providing technical assistance grants, ESRF engages in global advocacy and knowledge exchange in energy subsidy reform by contributing to ongoing debates and developing knowledge products to share recent experiences and emerging research with energy subsidy reform practitioners.



WORKING WITH GOVERNMENTS TO PROTECT VULNERABLE POPULATION GROUPS

A multi-country grant supported analyses of energy subsidies in countries in the Economic and Monetary Community of Central Africa (CEMAC). The work explored the status, scale, and distributional implications of existing energy subsidies in each country and shared insights from international experience. In addition to contributing to the policy dialogue in these countries, the analytical work informed special chapters focused on energy subsidies in each of the World Bank Country Economic Updates for Cameroon, Central African Republic, Chad, Equatorial Guinea, Gabon, and the Republic of Congo, thereby disseminating the findings to broader audiences. A special focus was on mitigation options to protect poor and vulnerable households.

In the Dominican Republic, ESRF continued to support key energy and social protection activities linked to the government's effort to strengthen social protection systems and improve the targeting of energy subsidies. In this context, a technical assistance grant supported a poverty and social impact assessment, identifying critical aspects of the government's electricity subsidy scheme (Bonoluz) that should be better integrated into the national social assistance program (Superate). Informed by this work, the government introduced specific measures to mitigate the impact of tariff increases on vulnerable consumers, including female-headed households.

In Malawi, ESRF-funded analytical work has informed government efforts to turn around the Electricity Supply Corporation of Malawi (ESCOM). A comprehensive assessment was completed. It included support for updating ESCOM's financial model and developing options for its financial recovery. Based on this analysis, ESCOM's financial turnaround options were created, and the government was able to take timely action toward improving economic viability.

SUPPORTING COAL REGIONS IN TRANSITION

Globally, coal remains the most widely used source of electricity. It satisfies the minimum demand on an electrical grid (baseload) most affordably and profitably in countries that have coal power generation. Even with a 4 percent reduction in coal demand during the COVID-19 pandemic, there has been a gradual increase in its consumption of nearly 1 percent per year globally, driven by the East Asia Pacific and South Asia regions. Consequently, low-income countries need support in sustainably phasing out fossil fuels and transitioning to clean energy. This requires strengthening local and regional institutions and expanding social protections, especially in communities near coal mining.

ESMAP's [Supporting Coal Regions in Transition](#) Program assists governments in transitioning from coal to more sustainable energy options. The program helps governments in developing countries transition through mine closure and plant repurposing.

Such transitions require customized regional strategies, including strengthening local and regional institutions and expanding education and economic innovation programs. Support also includes:

- Exchanging knowledge
- Assistance in developing transition roadmaps
- Comprehensive social protection packages for families impacted by the transition
- Reskilling and job transition programs
- Potential pathways for economic transition

ESMAP's program supports governments in these aspects, helping ensure that communities are protected during the coal phaseout while countries transition toward cleaner energy sources. During FY2023, the program allocated \$1.1 million in new grants for coal transition activities in Bosnia and Herzegovina, India, and South Africa.

In India, the ESMAP team supports a transition project in three coal-dependent districts in the country's Jharkhand State. A proposal has been submitted to

the government for a World Bank lending operation to provide social and environmental intervention to support the closure of coal mines over 10 years.

In Vietnam, the team has supported a government project to decommission and repurpose the country's Ninh Binh coal power plant over the past two years. The project is expected to serve as a model for closing coal mines that can potentially be repurposed for sustainable energy generation.

With ESMAP coordination support, the Accelerating Coal Transition Program of the [Climate Investment Funds](#) (CIF) selected North Macedonia as one of 14 countries to carry out operational activities, including land use restructuring, clean energy scale up, and energy efficiency. CIF is reviewing a \$85 million investment plan which aims to support the decommissioning of the 125 MW TPP Oslomej and 699 MW TPP Bitola coal-fired power plants by 2030, emitting around 2.7 million tons of CO₂ annually.

ESMAP's Supporting Coal Regions in Transition team provides thought leadership by exploring the business case for transitioning away from coal and options for mitigating the impacts on workers, their families, and local economies.

During FY2023, the team published [Business Models for the Transition of Coal Generating Capacity](#) in collaboration with the World Bank's Climate Change Group (GGS-CCG). The report explores different approaches in developed and developing countries and their merits and drawbacks. A case study focused on the socioeconomic impacts of the transition away from coal in the Appalachian region of the United States was also finalized in FY2023, with the idea that this region's lessons can be applied to mining areas in developing countries. [The Global Perspective on Coal Jobs and Managing Labor Transition Out of Coal: Key Issues and Policy Responses](#) report examines the status of coal phaseouts worldwide and their impact on jobs and labor transitions. The team also developed the [Repurposing of Land and Other Assets: A Toolkit for Implementation](#), pilot-tested in Bosnia and Herzegovina, Greece, and Poland.

DECOMMISSIONING COAL PLANTS TO TRANSITION TO RENEWABLE ENERGY IN SOUTH AFRICA

In South Africa, ESMAP helped lay the foundation for decommissioning coal power plants and transitioning to renewable energy. This work was the basis for the Just Energy Transition Project of Eskom, South Africa's utility company (approved in November 2022). This is a \$497 million lending project to decommission and repurpose the 990 MW Komati coal-fired power plant. The plant will be turned into an installation with 220 MW renewable energy generation and storage (including 150 MW solar PV, 70 MW wind, and 150 MWh batteries). Under the Komati project, the workers will be supported through a comprehensive transition plan developed jointly with input from the staff and unions. Ongoing dialogue on the potential decommissioning of three other coal-fired power plants totaling 5.6 GW in capacity—Hendrina, Grootvlei, and Camden—is a part of the Climate Investment Funds' \$2.6 billion Accelerating Coal Transition Investment Program, approved in October 2022. As part of the plan, the Accelerating Coal Transition Program awarded \$500 million of concessional funds to support further a just transition in coal mine/coal-fired power plant closures. The World Bank is leading the investment plan, supported by IFC and the African Development Bank. ESMAP will fund owner's engineers' training for decommissioning and repurposing and local solar technicians to build new local capacity in the renewable energy sector as part of the just transition in South Africa.

REPURPOSING COAL PLANTS IN INDIA

In India, ESMAP's support has enabled significant progress in the phasing out of the West Bengal and Madhya Pradesh coal mines over the past two years. A preliminary assessment of two West Bengal Coal plants (four units: 2 x 60 MW, 2x 210 MW) identified opportunities to repurpose these sites as locations for battery storage, solar PV, and synchronous condensers. Madhya Pradesh has some of the country's oldest generating units, including Satpura Thermal Power Station in Sarni. The Sarni stage II and III coal power units, totaling over 800 MW, have operated for over 35 years and are now under forced outage. ESMAP is supporting assessments to determine the feasibility of closure and repurposing of these sites.



WHEN THE SUN DOESN'T SHINE AND THE WIND DOESN'T BLOW

How ESMAP and the World Bank made solar plus storage feasible in the Maldives

Nothing quite epitomizes a dream vacation as much as overwater bungalows, thatched-roof guestrooms on stilts in crystal clear waters off the island coasts of the Seychelles or Maldives. However, if conditions continue as they are now, honeymooners will soon have to find alternative locations to celebrate their nuptials: the Maldives, for example, may see as much as 80 percent of their territory, some 1,200 islands, drown in the Indian Ocean over the next couple of decades.

To make matters worse, climate change and rising sea levels aren't the only threats that fossil fuels pose for small island developing states. Their small economies are not diversified and are particularly vulnerable to external shocks, such as the collapse of tourism during the COVID-19 pandemic or skyrocketing energy and food prices in the wake of Russia's invasion of Ukraine. Each year, the Maldives spends over 10 percent of its gross domestic product (GDP) on importing diesel to meet its energy needs, putting a severe strain on the South Asian island nation's budget.

Switching to renewable energy is the obvious solution, as solar power and storage are significantly cheaper than importing diesel. However, exorbitant financing costs with interest rates of up to 20 percent made solar projects combined with battery storage a non-starter in the past. ESMAP's [Energy Storage](#)

[Program](#), together with other World Bank partners and the private sector, showed a way forward.

"After the World Bank offered to underwrite the risks of default, changes in currency exchange rates, and contract termination, the cost of the project fell to 9.8 cents per kilowatt hour from 21 cents," former Maldives environment and technology minister Aminath Shauna wrote in [The New York Times](#) in October 2023. "This is the third and largest project we have done with the World Bank, and we see it as a breakthrough. Sixty-three investors expressed interest, and the cost is one of the lowest for any small island developing state."

Strong investor interest and lower prices are the result of a robust risk mitigation package, including a three-tier risk mitigation structure comprised of World Bank, IFC, and MIGA guarantees, a payment security mechanism, and a currency convertibility clause.

Storing solar- and wind-generated energy in batteries for times when the sun doesn't shine, the wind doesn't blow, or demand is particularly high increases reliability and availability of power and is therefore crucial in the transition away from thermal fossil fuel generation.

Significantly, in the Maldives case, ESMAP project preparation and execution advice, the World Bank Group risk guarantees, and just \$12.4 million in

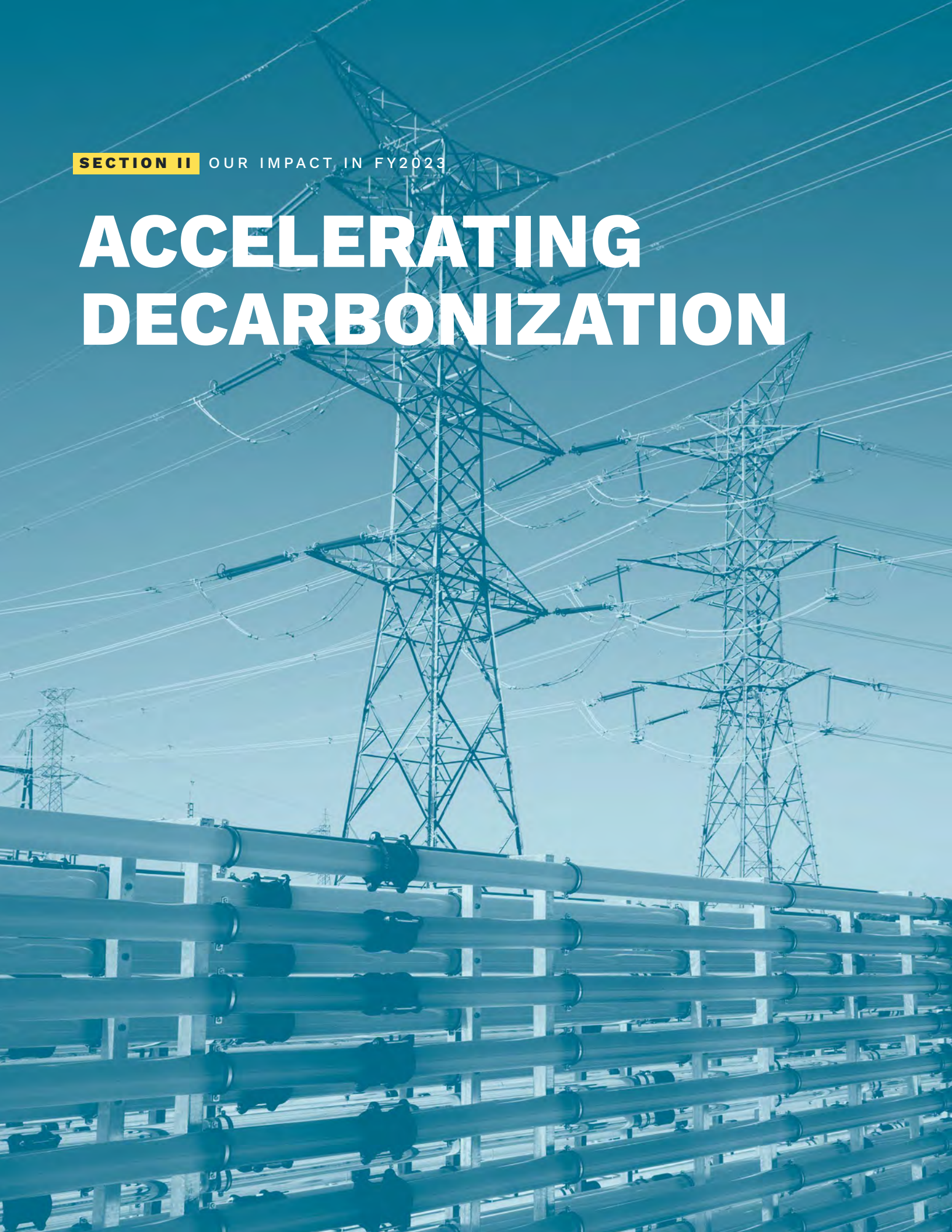
World Bank concessional financing leveraged another \$140 million in financing—or 12 times the amount of funding for every dollar spent—including contributions from the private sector. The Maldives’s success in attracting private investors has helped it expand renewable energy use, reduce import costs, and generate affordable and reliable clean energy.

In [*Unlocking the Energy Transition. Guidelines for Planning Solar-Plus-Storage Projects*](#), ESMAP has distilled the global experience of the World Bank and other players with projects combining solar energy generation with energy storage systems and provided a framework for planning and executing them.



SECTION II OUR IMPACT IN FY2023

ACCELERATING DECARBONIZATION



COP28 emphasized the urgent need to triple global renewable energy capacity, double the rate of energy efficiency improvements, and expedite the transition away from fossil fuels by 2030, all while ensuring fairness and equity. Today, unabated fossil fuels account for nearly three-quarters of the global energy mix, and carbon-intensive coal power generation represents slightly above 30 percent of global electricity supply. Moreover, “end-users” such as buildings, utilities, industries, and transport contribute significantly to CO₂ emissions. Hence, substantial changes in energy consumption patterns are necessary. Decisive decarbonization steps are critical when the expanding world population and economic growth (resulting in rising average income), industrialization, and accelerating urbanization are pushing greenhouse gas (GHG) emissions upward—while millions remain without access to electricity.

Boosting clean energy generation alone cannot achieve net zero targets, and a substantial portion of emissions stem from beyond the power sector. Therefore, ESMAP’s work under the [Accelerating Decarbonization](#) pillar supports innovative technologies and strategies that help take carbon emissions out of energy use by power-intensive industries, vehicles, and buildings.

In hot climates, and with global temperatures rising, cooling becomes an ever more vital service. ESMAP’s [Efficient and Clean Cooling](#) Program helps meet food and medicine cooling needs through efficient equipment and clean and renewable energy sources. Our [Industrial Decarbonization](#) Program facilitates accelerating the decarbonization of industries such

as the production of cement, steel, or chemicals in low- and middle-income countries by supporting the adoption of innovative technological solutions that avoid the traditional practice of emitting CO₂ directly into the atmosphere. As most of these industries are private sector led, ESMAP works closely with IFC to enable investments in innovative decarbonization and circular economy technologies. Public sector emissions are also significant as up to a fifth of a country’s energy consumption can be traced to public institutions and facilities, such as buildings, utilities, and public transport. ESMAP’s [Zero Carbon Public Sector](#) Program helps governments devise and adopt policies and regulations that aid the decarbonization of public sector operations.

Two of ESMAP’s programs focus on cutting-edge technologies that help replace carbon-based fuels. One is the use of heat energy or fluid directly from geothermal sources without converting it to other forms of energy, like electricity. ESMAP’s [Geothermal Direct Use](#) program helps expand the use of geothermal resources by increasing awareness of their value in creating new economic opportunities and decarbonizing existing industries. The other technology is green hydrogen, a gas produced from water electrolysis using electricity from wind, solar, or biomass. It can be a climate-friendly source of power, especially for heavy industries, such as steel and fertilizer production, shipping, and aviation. ESMAP’s [Green Hydrogen Support Program’s](#) mission is to raise awareness of green hydrogen’s potential to decarbonize high energy-consuming industries and help green hydrogen projects come to fruition in emerging economies and developing countries.

Not only heavy industry emits large quantities of CO₂, so do government-run business and institutions. Up to 20 percent of an average country’s energy consumption can be traced to public institutions and facilities, such as buildings, utilities, and public transport.

Up to
20%

EFFICIENT AND CLEAN COOLING

Providing access to sustainable cooling is an urgent development challenge. In 2023, global warming indicators reached new highs. The year was the hottest on record, while also breaking records for ocean heat, sea level rise, Antarctic Sea ice loss, and glacier retreat. Without reliable energy access and income sufficient for populations to afford cooling, heat threatens human health, safety, and livelihoods, particularly where reliable cold chains are necessary for food preservation, agricultural production, and vaccine storage. An estimated 1.12 billion people among the rural and urban poor are at high risk due to a lack of access to cooling, while 2.3 billion people may be exposed and vulnerable to heat waves by 2030. Sustainable cooling is essential for populations to adapt to rising temperatures and increasing climate extremes, such as heat, droughts, and floods. At the same time, meeting cooling needs with inefficient solutions is likely to cause a drastic increase in energy demand and harmful emissions. Sustainable cooling can help mitigate such unintended consequences by reducing emissions through efficient and clean equipment that minimizes refrigerants with high global-warming potential.

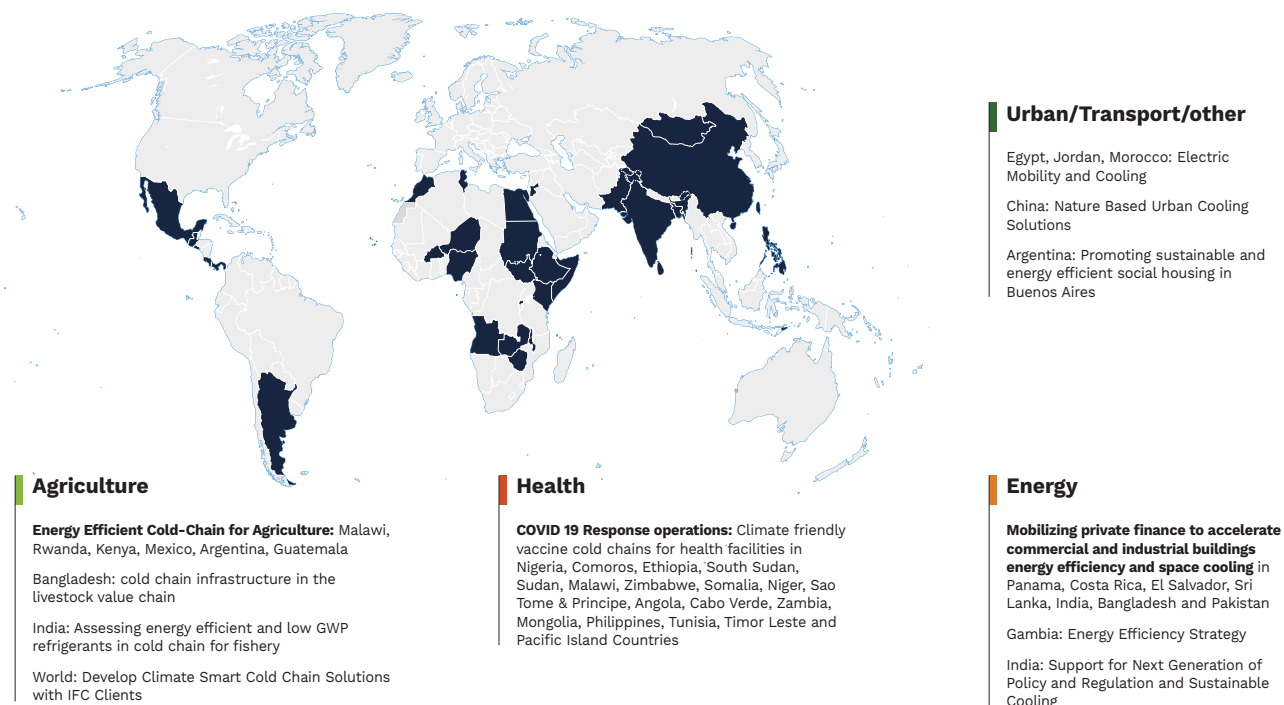
ESMAP's [Efficient and Clean Cooling](#) Program addresses sustainable development goals by increasing access to cooling while minimizing potential adverse climate and environmental impacts of inefficient equipment. Our innovative work on sustainable cooling cuts across traditional

sectors and dimensions of development activities. Space cooling is needed in homes, schools, clinics, hospitals, and businesses in urban and rural areas. Refrigeration is needed to preserve the nutritional value of food in homes and businesses and to preserve agricultural produce, meat, dairy, and fishery production, and increase producers' incomes. Refrigeration is also critical in the healthcare sector to protect and preserve vaccines, blood products, and samples as well as provide cooling within medical equipment. Consequently, ESMAP's work on cooling is closely integrated with numerous World Bank global practice sectors, such as health, agriculture, urban, and transportation in addition to cross-cutting dimensions such as energy, environment, and climate change.

ESMAP's Cooling Program has supported 40+ technical assistance activities in 30+ countries (as well as global and regional activities) with grants of \$10M+ between FY2021 and FY2023. These activities have informed \$4.2 billion+ of World Bank Group financing and will save over 24 million tons of CO₂e. There are four main areas of ESMAP's cooling work:

- Energy-efficient cold chains for agriculture
- Climate friendly vaccine cold chains for COVID-19 response operations in the health sector
- Energy efficiency and climate friendliness in cooling equipment
- Sustainable cooling in cities, including urban spaces, housing, and transport

Figure 2.1. ESMAP’s Main Cooling Activities by Area, FY2021-23



Examples of ESMAP’s support to operations on the ground include work in Timor Leste. There, health facilities are exposed to intense climate shocks and extreme weather events such as heat, cyclones, and flooding. At the same time, these facilities’ power consumption regularly overburdens the weak electricity grid. In FY2023, ESMAP supported an energy audit of primary health care facilities on the island as part of the Healthcare Action Through Infrastructure Improvements Project. The program helped develop energy-efficient and climate-resilient design standards for the construction of municipal hospitals and the standards are expected to be adopted nationally. Insights and lessons from this work were applied in the design of project components that will finance the construction or upgrade of medical facilities (1 hospital, 50 community and health centers, and 2 tertiary care facilities) using passive cooling solutions or energy-efficient and sustainable cooling equipment.

In Niger, ESMAP helped to assess whether and how drones can transport vaccines in conflict situations.

The objective of this assessment was to better understand options for supplying vaccines to the remote and conflict-torn locations that make it difficult to transport vaccines and COVID-19 samples by land, supporting an equitable and comprehensive distribution. The effort is also informing the implementation of the Niger COVID-19 Emergency Response Project, which aims to enable affordable and equitable access to COVID-19 vaccines for all. The project helps to prevent, detect, and respond to COVID-19 (raising detecting rates to 100 percent and equipping 4 laboratories in the country with COVID-19 diagnostic equipment), and by strengthening the readiness of Niger’s national public health system at both the central and regional levels.

In Bangladesh, the ESMAP team provided technical assistance to support a pilot study to improve the viability of energy-efficient cold chains of livestock farmers and agri-businesses to increase food security and economic opportunities for farmers. The ESMAP financed study contributes to the

design and implementation of the project, which intends to help 500,000 farmers to adopt improved agricultural technology.

Together with the World Bank's Energy Climate Finance team, ESMAP mobilized \$157 million in concessional climate finance from the [Green Climate Fund](#) (GCF) in FY2023 to establish a multisector Cooling Facility. The facility covers nine countries (Bangladesh, El Salvador, Kenya, Malawi, North Macedonia, Panama, São Tomé and Príncipe, Somalia, and Sri Lanka) and is designed to enable policy, regulatory, and environment support plus contribute to cooling investments. One of the facility's first projects was preparation of the third additional financing in São Tomé and Príncipe under the COVID-19 Emergency Response Project. The financing includes a \$1 million grant from GCF and a \$300,000 grant from ESMAP. In Somalia, the GCF contributed a \$4.25 million financing grant to help improve healthcare services in the country. The objective of the investment is to strengthen vaccine deployment and conservation for COVID-19 and routine vaccines scale through sustainable cooling solutions while contributing to the government's efforts of moving towards universal healthcare coverage especially in rural and peri-urban areas.

As part of ESMAP's mandate to develop and disseminate knowledge on key energy topics, the program concluded the Climate-Friendly Cold Chains Planning tool and vaccine guidance notes for the World Bank Health Global Practice on climate-friendly transportation solutions, climate resilience of cold chain infrastructure, and the private sector's role in vaccine rollout. In partnership with Sustainable Energy for All (SEforALL), ESMAP has prepared a report on the nexus between access to electricity and access to sustainable cooling, exploring the importance of providing efficient cooling in off-grid rural areas and maximizing synergies between electricity and cooling access (expected to be published in 2024).

Given the multi-sectorial nature of cooling, the program is partnering with World Bank units and

development institutes, including partners such as the Cool Coalition, (led by the United Nations Environmental Program), the Cooling for All program of SEforALL, the International Institute for Refrigeration, and the Efficiency for Access Coalition. It is also working with academic centers in the field of cooling and its application, such as the African Center of Excellence for Sustainable Cooling and Cold Chain and the Dutch Wageningen University and Research Institute.

INDUSTRIAL DECARBONIZATION

The industrial sector—encompassing the production of cement, steel, chemicals, and the like—is responsible for about 25 percent of global emissions and over 40 percent of global gross domestic product (GDP). While industrialization is an integral component of global development, growing the sector will also mean growing its CO₂ emissions unless steps are taken to abate them. As many developing countries continue to rapidly industrialize, they are looking to decarbonize industrial activity to meet their national emissions reduction targets and improve their industrial sector's competitiveness.

ESMAP's [Industrial Decarbonization](#) Program works to accelerate the decarbonization of industrial sectors in low- and middle-income countries by supporting the adoption of innovative technological solutions that avoid the traditional business practice of emitting CO₂ directly into the atmosphere. ESMAP provides technical assistance, market development support, capacity building, and sharing of global best practices.

The program's goal is aligned with the World Bank Group's strategic vision of scaling up financing for clean energy transitions, including projects targeting industrial decarbonization. Since its inception in 2019, ESMAP's Industrial Decarbonization Program has advised on World Bank lending projects worth more than \$2 billion

in lending volume for industrial decarbonization and the deployment of clean energy technologies, including green hydrogen.

During FY2023, following the successful completion of Morocco's [Country Climate and Development Report \(CCDR\)](#), the World Bank worked with the Ministry of Industry to select five industrial zones in which to implement carbon abatement practices and technologies.

In Pakistan, ESMAP has supported the country's manufacturing sector in reducing the uncoordinated and hence wasteful use of natural resources, such as energy and water. The ESMAP program helps the government identify industrial decarbonization projects plus a market study to determine gender diversity in technical roles in Pakistan's manufacturing industry.

In Türkiye, the program supports the greening and decarbonization of industrial zones through the deployment of low carbon technologies. Specifically, it assesses the potential application of decarbonization technologies, including using alternative fuels, such as biomass, instead of fossil fuels for clinker production. The program also advises on how best to deploy green hydrogen in steel production and how to recover heat from blast furnaces that would otherwise go to waste.

Similar to the public sector work, the ESMAP program collaborates with IFC to prepare private sector investments in decarbonization programs. In FY2023, the ESMAP supported IFC engagements with a tile company in Ghana and an aluminum company in Türkiye, leading to \$259 million of climate-friendly investments.



GREENING THE INDUSTRIAL SECTOR IN MEXICO

The industrial sector in Mexico is responsible for about a third of the country's GDP and employs about a quarter of the labor market. The sector also consumes about a third of the country's energy supply. Starting in FY2023, ESMAP's Industrial Decarbonization Program has worked with Mexico to improve the competitiveness of its industry value chains by supporting project partners in implementing decarbonization and adaptation measures. By greening the sector, Mexico should be able to reduce European Union or United States (US) import tariffs on carbon-intensive products, such as steel, cement, or electricity. Also, applying highly efficient equipment and fuel switching solutions reduces initially 20 to 40 percent of emissions in energy-intensive industries. This decreases energy consumption and hence costs, thereby increasing competitiveness.

The ESMAP technical assistance project supports the Mexican government and private sector in developing eco-industrial parks, energy-intensive large industries, and small and medium enterprises. This includes finding sustainability-linked financing options, identifying technologies that help reduce energy and water consumption or switching away from fossil fuels, and planning policies and regulations that make energy-efficient operations the norm. The program also advises the government on ways to expand energy-efficiency investments.

Given the industrial sector's importance to the Mexican economy, especially considering post-pandemic recovery efforts and current nearshoring trends, the program works with the government and private sector to identify opportunities for strengthening and greening global value chains. This will contribute to the development of a roadmap and standards for Mexican eco-industrial parks, helping the country meet its greenhouse gas mitigation and climate commitments while also attracting foreign direct investments.

GEOTHERMAL DIRECT USE

At least 60 percent of GHG emissions come from sources other than electricity generation, such as agriculture, industry, transportation, and individual or district heating and cooling. To reduce these emissions, efforts to decarbonize these sectors must focus on increasing renewable heating, such as geothermal energy (geothermal direct use).

Direct use of geothermal resources refers to using heat energy or fluid directly from geothermal sources without converting it to other forms of energy, like electricity. Geothermal direct use applications include heating, cooling, and drying in agriculture, district (and individual) heating and cooling, balneology (using mineral springs for therapeutic purposes), and industrial processes. The heat from geothermal energy has been successfully used for centuries, especially for individual and district heating, in parts of China, North America, and Northern Europe. More countries are seeking to scale up their efforts to harness the potential of geothermal energy directly. Still, despite its great potential, it continues to be underused due to a lack of knowledge and initial resource risk.

ESMAP's [Geothermal Direct Use](#) Program helps expand the use of geothermal resources by increasing awareness of their value in creating new economic opportunities and decarbonizing existing industries.

Many countries face barriers such as resource risk and the lack of expertise and knowledge of geothermal resources as an energy alternative. The program coordinates capacity building and knowledge generation activities at the regional and country levels for sector experts, government officials, and other stakeholders (see Box 2.6).

In FY2023, the program conducted studies on the potential use of geothermal energy beyond electricity in Dominica as part of the Caribbean island's transition to more sustainable, efficient, and resilient energy sources. Pre-feasibility studies were also conducted in El Salvador to estimate the potential for geothermal direct use projects in selected sites in the Conchagua and Ahuachapán regions. The government has indicated interest in taking steps to harness the country's geothermal resources.

The program also provided \$200,000 to enable Azerbaijan to conduct a market assessment, evaluate the country's geothermal direct use potential, and prepare a roadmap for geothermal development for commercial and residential heat use.

In Türkiye, the team supported improving the agriculture and food sector's capacity for renewable energy sources. This project also has a component that will focus on horticultural production using modern geothermal-operated technology-based greenhouses (see Box 2.7).

THE ICELANDIC STUDY TOUR

In November 2022, ESMAP's **Geothermal Direct Use** team collaborated with Iceland's Ministry of Foreign Affairs to organize a [study tour](#) for more than 30 country representatives, including from Costa Rica, Egypt, Indonesia, Papua New Guinea, and Türkiye. Participants visited geothermal direct use facilities in Iceland to better understand how geothermal can be used as an energy source and replace fossil fuel use in industry, agribusiness, transportation, and other areas.

The tour consisted of a half-day presentation on the enabling environment, focusing on the legal and regulatory framework. This was followed by two days of site visits to a fish drying facility, fish farm, Blue Lagoon cosmetic production facility, green hydrogen power plant cogenerating heat and power, mushroom farm, district heating facility, tomato greenhouse and restaurant, and beer brewery.

TÜRKIYE GREENHOUSE INDUSTRIAL ZONE

In FY2023, \$400,000 was provided to finance implementation support and capacity building in the Türkiye Climate Smart and Competitive Agricultural Growth Project. The project will focus on horticultural production through modern geothermal-operated technology-based greenhouses. The government has expressed interest in scaling up the direct use of geothermal energy-operated greenhouses, with potential investments in the area. The project implementation team is currently finalizing a feasibility report and will soon begin conducting an environmental social impact assessment to ensure best practices are applied throughout the project.

When completed, the project will have installed approximately 140 hectares of greenhouses and 40-hectare industrial parcels to be heated with a 150 MWth geothermal heating system. Twenty wells will provide heat with temperatures of 80°C to 110°C. By using geothermal energy, the project is estimated to displace 1.5mt CO₂ of lifetime emissions.

GREEN HYDROGEN SUPPORT PROGRAM

Green hydrogen, a gas produced from water electrolysis using electricity from wind, solar, or biomass, can be a climate-friendly source of power, especially for heavy industries such as steel and fertilizer production, shipping, and aviation. Since their smelters, processors, and engines are highly energy intensive, replacing the use of fossil fuel with green hydrogen helps to decarbonize such sectors and reduce GHG emissions.

ESMAP's [Green Hydrogen Support Program's](#) mission is to raise awareness of green hydrogen's potential to decarbonize energy-consuming heavy industries and create economic opportunities in developing countries. It assists governments of more than 20 countries in identifying opportunities and overcoming challenges in deploying green hydrogen. The program provides grants and technical assistance to help governments scale up green hydrogen projects. It collaborates with development partners in integrating technology, infrastructure, and energy systems, enabling policy frameworks and regulations, investments, financing, and procurement. Moreover, it examines the socioeconomic and sustainability impact of introducing green hydrogen solutions.

During 2023, the World Bank approved with ESMAP support a total of \$1.65 billion in concessional financing in India and Chile to ramp-up the deployment of clean hydrogen. The World Bank Group's long-term strategy may result in at least \$3 billion of lending for hydrogen operations between FY2024 and FY2026. During FY2023, ESMAP supported national and regional governments

in better understanding the business conditions necessary to accelerate the deployment of green hydrogen. To generate and share knowledge, improve capacity, and facilitate investments, ESMAP helped found the [Hydrogen for Development Partnership \(H4D\)](#) at the UN climate conference COP27 in Sharm El Sheikh, Egypt. Since its inception, it has tripled its membership to 35 partners (Box [2.8](#)).

In Brazil, for example, the program has worked on the Clean Energy Transition project to implement a national hydrogen strategy. This includes helping the country's power trade chamber develop expertise to reliably evaluate and certify hydrogen projects. ESMAP also supported the mapping of Brazil's clean hydrogen value chain and identifying and analyzing six of the country's clean hydrogen hubs.

In India, the program is implementing a grant activity to create a roadmap of green hydrogen opportunities in support of the country's transition to a low carbon economy. The program has identified five potential sectors for adopting green hydrogen: fertilizer, refineries, steel, methanol, and transport.

In Mauritania, the program has provided grant funding to work with the government to assess the country's hydrogen infrastructure requirements. This will help identify the infrastructure needed to deploy renewable energy projects, maximize the accompanying socioeconomic benefits, and reduce the environmental, climate, and social impacts.

In addition to providing practical advice and building capacities in client countries, the program works with development partners to generate and disseminate knowledge, support ongoing technology and business innovations, and improve policy coordination.



THE HYDROGEN FOR DEVELOPMENT PARTNERSHIP

The [Hydrogen for Development Partnership](#) (H4D), launched during COP27 in Egypt, is a global platform designed to generate knowledge, improve capacity, and facilitate hydrogen investments in emerging markets and developing countries. The aim is to support their climate and energy goals by taking advantage of the growing hydrogen economy, ensuring sustainable development and socioeconomic benefits.

H4D comprises 35 partners, including governments, international organizations, and business associations. Four working groups have been set up to generate knowledge products and provide capacity building opportunities for target countries. Since its launch, two partnership meetings have been held in [India](#) and [Chile](#) respectively, commissioning, among other things, an analysis of the shared infrastructure for green hydrogen hubs in India.

In May 2023, representatives from Egypt, France, Jordan, and South Africa joined experts at the World Hydrogen Summit in Rotterdam and made significant progress in identifying opportunities and challenges in supporting hydrogen projects in their countries.

The program has also collaborated with the embassy of the Netherlands in Washington, DC, to organize a webinar on how low carbon and green hydrogen technologies developed by Dutch companies can present an opportunity for developing countries. The session highlighted Dutch expertise and technology solutions across the hydrogen value chain, from engineering, procurement, and production to transport and consumption.

H4D has also worked with the [Hydrogen Council](#) to launch a report covering the sufficiency, sustainability, and circularity of critical materials for clean hydrogen. It uses new data to estimate the amount of essential minerals and the overall footprint needed to scale up clean hydrogen.

ZERO CARBON PUBLIC SECTOR

Up to 20 percent of an average country's energy consumption can be traced to public institutions and facilities, such as buildings, utilities, and public transport. This means that by adopting innovative approaches, the public sector can lead the charge to a net-zero carbon future and contribute to market transformation through planning, policy, and procurement. Improved policy and regulation can significantly impact decarbonization in buildings, transport, and public services. In addition, procurement practices and investments in public facilities can contribute significantly to decarbonization. However, data from ESMAP's [Regulatory Indicators for Sustainable Energy](#) (RISE) indicate that few developing countries have adopted the regulations required to support decarbonization on a sufficiently large scale.

During FY2023, ESMAP's [Zero Carbon Public Sector](#) Program advised developing country governments on prioritizing zero-carbon pathways and low carbon activities for public sector institutions and facilities, including public buildings, public transport, street lighting, water treatment and supply, waste disposal, and district energy.

In Timor Leste, the program supported energy efficiency and decarbonization activities targeting primary health care facilities. This involved introducing energy-efficient building design standards for the construction of municipal hospitals.

In Grenada, Guyana, and St. Lucia, the ESMAP team conducted public building audits to assess opportunities for implementing energy efficiency and renewable energy options such as efficient lighting, efficient air conditioning, and roof-top solar PV. Additional work was done to prepare the Energy Efficiency Act in Grenada and identify finance mechanisms, such as the design of an energy-efficiency fund and ways to attract private finance.

In India, an ESMAP-supported study explored integrated regulatory solutions and roadmaps to

introduce sustainable electric mobility in selected states. The second phase of the project focuses on facilitating financing for electric two- and three-wheelers through innovative mechanisms and implementing charging and battery-swapping systems. The third phase will expedite the introduction of electric buses through commercial financing and a payment security mechanism.

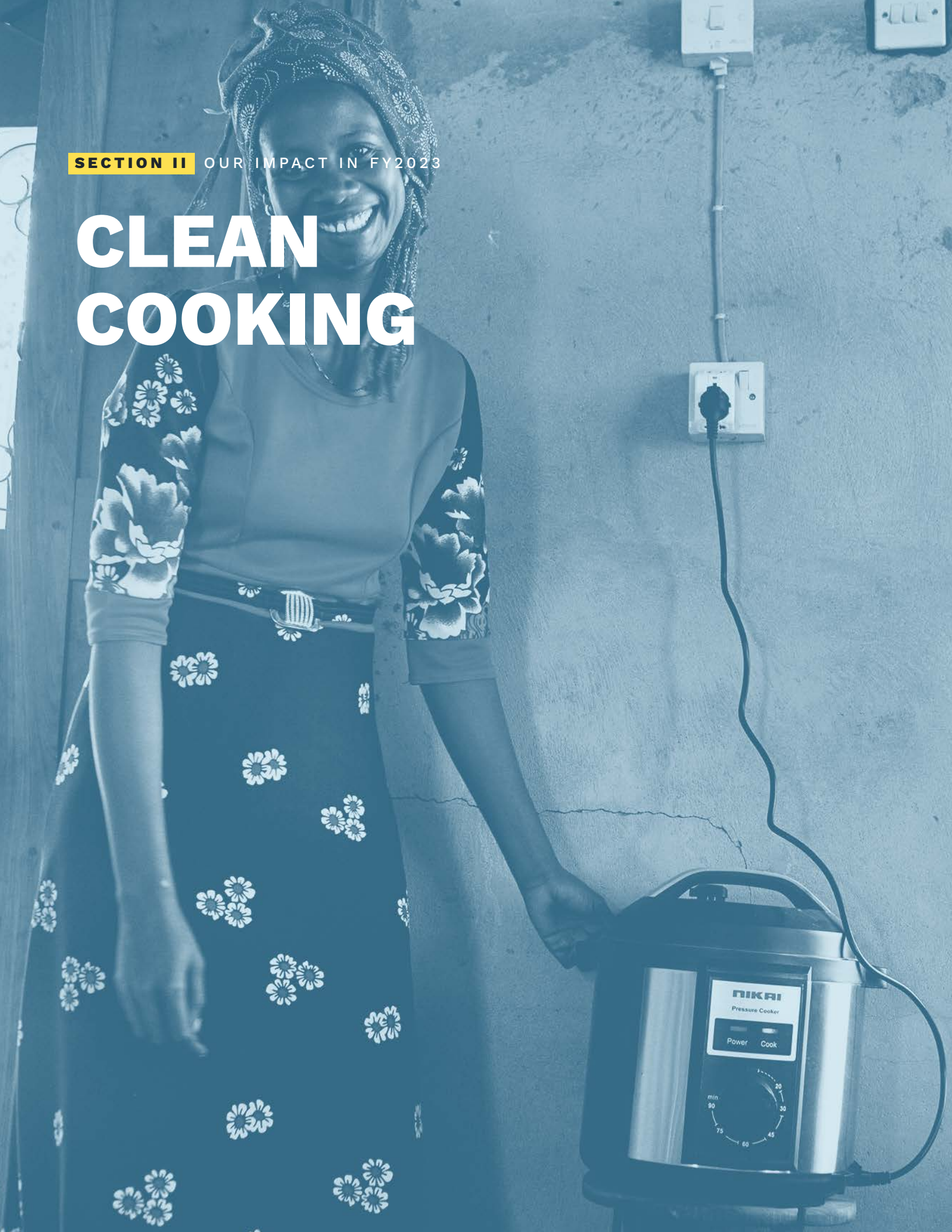
Similarly, in the Maldives, ESMAP assisted the government in devising a national e-mobility strategy and action plan, which includes feasibility assessments, policy analysis, and financing recommendations. This activity will be key in the future deployment of battery swapping solutions for electric two- and three-wheelers.

ESMAP's Zero Carbon Public Sector Program also collaborated with the World Bank's Water Global Practice to explore options for improving energy efficiency and implementing biogas capture and use in wastewater treatment facilities. Specific activities involved incorporating decarbonization measures in project design and operations.

During FY2023, ESMAP led the compilation and dissemination of innovative knowledge products to highlight the importance of decarbonizing the public sector. The program collaborated with the World Bank's Transport Global Practice on the November 2022 flagship study [The Economics of Electric Mobility](#). The March 2023 technical report [Electric Mobility and Power Systems: Impacts and Mitigation Strategies in Developing Countries](#) builds on the previous report and serves as an innovative take on the energy dimension of electricity mobility. While the transition to e-mobility is promising for a clean transport future, the exponential rise of electric vehicles—expected to reach 240 million by 2030—poses technical challenges for power systems and may strain already overwhelmed grids. The ESMAP report suggests that utilities can explore the use of smart-grid technologies to help manage the increased demand for electricity from EVs while improving system efficiency and reducing costs.

SECTION II OUR IMPACT IN FY2023

CLEAN COOKING



The world is not on track to deliver universal access to clean cooking by 2030. Today, 2.3 billion people globally still cook with traditional polluting technologies. Globally, the number of people gaining access to clean cooking has increased significantly in recent decades. However, population growth has outpaced these improvements, particularly in Sub-Saharan Africa. Without accelerated action, 1.9 billion people will remain in cooking poverty in 2030.

For people in extreme poverty, cooking is the service with the highest energy consumption. In 2020, total emissions from the cooking sector were estimated at 3 percent of GHG emissions—equivalent to global air transport emissions. Annually, 3.7 million premature deaths result from household air pollution, impacting mostly women and children.

Launched during the UN Climate Action Summit in 2019, the ESMAP [Clean Cooking Fund](#) (CCF) has been operational since early 2020 and has directly supported clean cooking components of World Bank projects in 27 countries, across seven regions. The CCF's advocacy and knowledge work has been central to mainstreaming clean cooking in the global energy and climate dialogue. Currently, 98 developing countries have included household energy or clean cooking measures in their Nationally Determined Contribution (NDC). The CCF also influences the global narrative by having provided technical support for the UN's Clean Cooking Roadmap which outlines the role clean cooking plays in transitioning in a just and inclusive way from the 2030 SDG energy goals to the 2050 net zero climate target. Similarly, the CCF's toolkit estimates the cost of delaying the transition to clean cooking inaction which has supported global calls for action. It is also worth noting that the CCF supported and enabled the doubling of IDA funding

\$1.9
billion

to clean cooking activities. In four year of operations, important lessons have emerged from the CCF's work:

- Co-finance and leveraging concessional finance from the World Bank Group and other multilateral development banks are essential to attract private-sector investments. Blending grants and IDA/IBRD funds are necessary to cover the cost gaps for vulnerable consumers; this is essential to promoting sizable programs.
- The inclusion of clean cooking components in larger operations is key to decreasing transaction costs and allows multiple entry points to implement operations.
- Innovative financing instruments are necessary for linking incentive payments with verified co-benefit results at the output, outcome, and impact levels.
- Derisking instruments are important, especially in cases where market development is mature enough to use private financing structures.

To meet the SDG 7 target, the CCF and the clean cooking community in general will need to focus on several key challenges:

- **Timely fundraising.** The CCF was able to build a strong pipeline of projects with clean cooking components, but to keep up with demand, the pace of fundraising needs to increase.
- **Broadening instruments.** The set of instruments to accelerate the deployment of clean cooking must grow, based on different needs in different settings.
- **Carbon finance leverage.** Carbon finance is an opportunity to leverage private capital. ESMAP and other actors are working to decrease the current transaction costs to access carbon financing, and mitigate risks associated with assessing avoided emissions.

At the current pace, the world will equip 400 million people with clean cooking tools by 2030, reducing the number of those cooking in the traditional, polluting way to 1.9 billion from 2.3 billion today. While progress, it would still be insufficient to meet the 2030 goal of universal clean cooking access.



ESMAP'S CLEAN COOKING STRATEGIC LEAD

- ESMAP is strategically positioned to **coordinate between relevant global practices** (energy, health, education, climate/clean air, environment, gender, agriculture) within the World Bank to design multisectoral approaches to clean cooking. ESMAP also facilitates dialogue with governments and regulators at multisectoral level.
- ESMAP has long-term experience in **mobilizing climate financing** for energy projects.
- ESMAP is a strong actor on clean cooking on the global stage, **catalyzing clean cooking initiatives along with partners** including the Modern Energy Cooking Services (MECS), Clean Cooking Alliance, SEforALL, World Health Organization (WHO), UN Department of Economic and Social Affairs (UNDESA), and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ/the German Development Corporation)/Energising Development (EnDev), among other stakeholders.

CLEAN COOKING FUND

The [Clean Cooking Fund](#) (CCF) is the largest dedicated fund for galvanizing political commitment, scaling up public and private investment, and catalyzing innovation in clean cooking. Throughout FY2023, the CCF consistently drove transformative progress in improving the overall clean cooking ecosystem. This was achieved through investments, knowledge, and partnerships, positioning the World Bank as a global leader in the clean cooking sector. The CCF provides: (1) upstream support by integrating clean cooking into World Bank strategic documents, such as Energy Compacts, Country Climate and Development Reports (CCDRs), and Systematic Country Diagnostics (SCDs) that guide Country Partnership Frameworks (CPFs); (2) midstream support by providing data, tools, technical advice, and operational design; and (3) downstream support by co-financing World Bank lending operations.

During FY2023, the CCF continued to make transformative progress in improving the sector's overall ecosystem and positioned the World Bank as the global leader in knowledge, innovation, and financing in the sector, leveraging sizable public and private investments. To date, the CCF has expanded its co-financed country and regional investment projects to \$50.65 million in CCF grants spanning seven countries, including Chad, Democratic Republic of Congo, Mozambique, Niger, Rwanda, Tanzania, and Uganda. These projects have leveraged \$72.5 million from IDA and \$10.81 million from carbon finance, projected to help 12.7 million people and 750 schools access clean cooking solutions while reducing emissions by 15.56 million tCO₂eq.

In Tanzania, the CCF supported a project focusing on off-grid solar, clean cooking, and productive use of electricity. The clean cooking component of \$10 million will cover efforts to provide 200,000 households with access to improved and clean cooking solutions.

Ghana's National Clean Cooking Strategy (NCCS) received strong ESMAP support. The NCCS report is presently undergoing the finalization process. Moreover, the CCF is working with the World Bank's Social Protection Global Practice to provide grant funding to provide clean cookstoves in 2,000 schools as part of the country's school feeding program.

The team made significant progress in advancing the clean cooking sector in Sierra Leone. A rapid assessment of clean cooking was followed by a supply-side market survey to examine the challenges and opportunities for major stakeholders in the country's cooking sector. A National Stakeholder Consultation Workshop on Clean Cooking, with over 100 participants, was held in September 2023. A National Clean Cooking Strategy, supported by the CCF, is currently under development. This is a critical step in preparing and designing a national clean cooking program.

The CCF is also actively providing 34 country and regional grants to support clean cooking activities. Through these grants, ESMAP's technical support was instrumental in creating an enabling environment for the clean cooking sector. This includes contributions to initiatives such as Rwanda's Ministerial Guidelines for Clean Cooking Technologies, Ghana's National Clean Cooking Strategy, and Mozambique's National Clean Cooking Strategy and Investment Prospectus, among others. Through technical studies and assessments, ESMAP is helping shape the country and sector dialogue by designing and implementing 26 operational projects and building local and institutional capacity. Further, the CCF is supporting an increasing number of country programs, for example, in Mauritania, Nepal, Panama, and Uganda, to assess and pilot highly efficient electric cooking appliances as a modern cooking solution for households as well as for public institutions.

In Rwanda, the CCF provided co-financing to clean cooking activities under the [Rwanda Energy Access Quality Improvement Project](#) (EAQIP). Sixteen clean cooking companies have been approved to join the Results-Based Financing Facility with 11 of those having distributed over 100,000 cookstoves. Also under the project, ESMAP provided \$3.15 million to support institutional cooking in Rwandan schools, in addition to the \$10.8 million from the [Carbon Initiative for Development](#) (Ci-Dev), a World Bank trust fund, for the purchase of emission reductions arising from the project.

ESMAP continues to play a key leadership role in generating knowledge assets and introducing training modules centered around clean cooking. The introductory online course, "[The Hidden Side of Energy Access: Understanding Clean Cooking](#)," was followed by two advanced courses tagged Hidden Side 2.0, which focus on [the behavioral](#)

[science of clean cooking](#) and the importance of [applying a gender lens to clean cooking activities](#).

Moreover, the CCF led the development of the UN-Energy Policy Brief on the Global Roadmap for Just and Inclusive Clean Cooking Transition in collaboration with the UNDESA and WHO. This policy brief outlines a global roadmap with a focus on a just and inclusive transition for the clean cooking sector, aiming to achieve net-zero CO₂ emissions by 2050 through key milestones and priority actions. Published by UN-Energy/ UNDESA as an important input to the High-Level Political Forum in July 2023, it further galvanized high-level political commitment at the SDG Summit in September 2023. The CCF also launched the flagship report [Unlocking Clean Cooking Pathways: A Practitioner's Keys to Progress](#), which provides a comprehensive analytical framework and key building blocks on how to engage, design, and implement clean cooking projects.

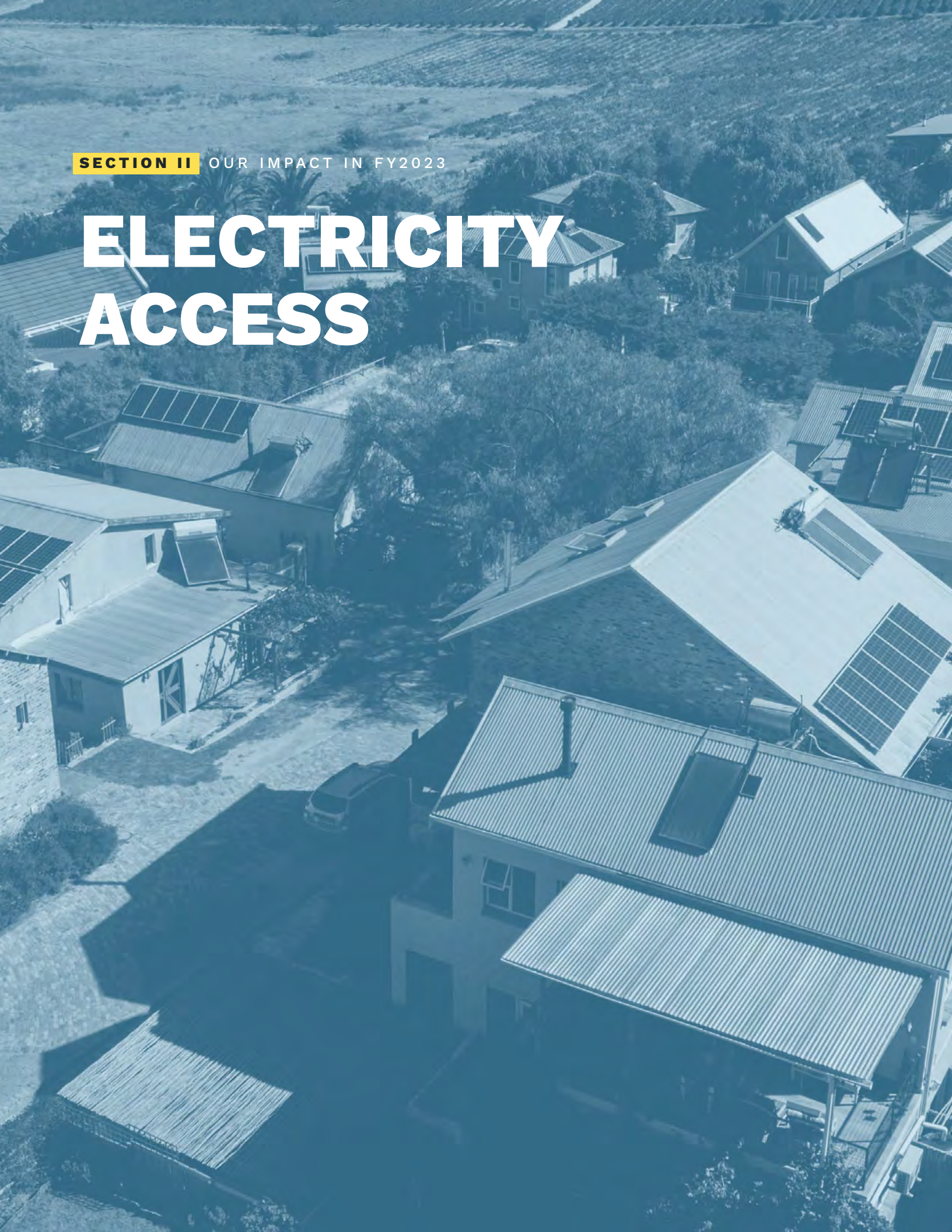


PROVIDING CLEAN COOKING SOLUTIONS AND CREATING JOBS IN THE DEMOCRATIC REPUBLIC OF CONGO

In FY2023, the World Bank Group board approved the implementation of the Democratic Republic of Congo's Forest and Savanna Restoration Investment Program, which has a \$25 million clean cooking component, with \$15 million from IDA and \$10 million in co-financing from the CCF. The program, which will be implemented in seven provinces in the country, focuses on improving the capacity of stakeholders to efficiently transition to cleaner cooking solutions by supporting more efficient charcoal production and market development for efficient and cleaner cooking technologies. It will result in new or improved access to clean cooking solutions for about 500,000 households (about 3 million people); create about 10,000 local jobs in stove production, sales, and distribution; and leverage \$15 million to \$20 million in private financing. This project will also support regulatory and research and development (R&D) efforts to expand the market size for clean fuels and technologies and enhance industry performance to meet international standards.

SECTION II OUR IMPACT IN FY2023

ELECTRICITY ACCESS



About 675 million people still lack access to electricity. The World Bank is at the forefront of energy access scale-up in the developing world. This is particularly true in Sub-Saharan Africa where, in the past four years, World Bank financing of energy access has grown from an average of \$400 million per year in FY2018-20 to more than \$1 billion per year in FY2021-23. This support is much needed in a region where only 48 percent of the overall population—and just 26 percent in rural areas—has access to electricity.

To reach sparsely populated, low-income areas, as well as fragility, conflict, and violence contexts, where traditional grid expansion would not be economically viable, the Bank has strategically increased its focus on distributed renewable energy (DRE). DRE systems involve renewable power generation paired with energy storage.

DRE is revolutionizing energy access in Sub-Saharan Africa. With cost-competitive, consumer-centered models and consumer financing options, DRE companies are bringing much needed innovation to the energy access space. These companies, however, are facing challenges reaching the poorest of the poor, where markets need to be supported by government intervention. They require public funding in the form of household or business subsidies to electrify the last mile.

DISTRIBUTED ACCESS THROUGH RENEWABLE ENERGY SCALE-UP

In November 2022, the World Bank Group announced at COP27 the [Distributed Access through](#)

\$490
million

[Renewable Energy Scale-Up \(DARES\)](#) Platform. DARES is an initiative across the World Bank, MIGA, and IFC to accelerate the deployment of DRE in Africa, with five core areas, including mini grids, off-grid solar markets, and systems for schools and health facilities. The platform received pledges from the World Bank Group and donor partners, including to fill funding gaps to enable private companies to service the most remote areas.

To achieve the objectives established with this platform, the World Bank approved in 2023 the [Accelerating Sustainable and Clean Energy Access Transformation \(ASCENT\)](#) Multi-Phased Approach (MPA), which aims to bring quality electricity to 100 million people and to electrify 50,000 public institutions in up to 20 countries across Eastern and Southern Africa over the next 7 years. The program brings together large development partners. To scale up DRE solutions, the program will explore and develop innovative financial solutions to mobilize patient, private capital; facilitate viability gap funding, results-based financing, and small/ catalytic grants for companies; and aggregate climate benefits at the regional level to mobilize climate/impact financing.

Similarly, in West Africa, the World Bank approved Nigeria DARES, which aims to provide over 17.5 million Nigerians with new or improved access to electricity through distributed renewable energy solutions. Nigeria DARES will offer highly targeted subsidies to support the deployment of standalone solar systems to populations most in need.

ESMAP's Global Facility on Mini Grids estimates that mini grids can electrify nearly 490 million people by 2030, with the installation of 210,000 mini grids in electricity access-deficit countries. This would go a long way in electrifying the 675 million people remaining without electricity access today.

ESMAP AND DISTRIBUTED RENEWABLE ENERGY

Since its inception 40 years ago, ESMAP has provided unmatched expertise and knowledge in energy access. ESMAP has supported innovative technologies, such as off-grid solar, mini grids, and battery storage, as well as targeted financing, to support the Bank's energy access projects. ESMAP has also brought in donors and foundations to significantly address funding gaps in reaching the last mile. ESMAP's support has been and continues to be at the center of the Bank's DRE programs.

To support the preparation and implementation of projects geared toward the objectives set under DARES, ESMAP created Electrifying Africa, a large, multiyear programmatic technical assistance facility to help countries overcome the key challenges that are slowing progress on clean energy access. The activities include collecting and disseminating data, sharing knowledge, providing targeted technical assistance and capacity building, and achieving results through convening and collaborating.

ESMAP is present in DRE in multiple ways. The program:

- Works with governments to develop integrated energy access strategies and least-cost electrification plans, using geospatial planning
- Mobilizes grant funding for DRE projects, through its own donors, as well as by bringing in new partners
- Works with climate funds to assess climate benefits of DRE projects and to bring climate financing to DRE projects
- Provide by ESMAP experts critical just-in time support to DRE projects to deploy innovative solutions to achieve universal energy access

INTEGRATED ELECTRIFICATION STRATEGIES AND PLANNING

ESMAP's [Integrated Electrification Strategies and Planning](#) (IESP) program was created to improve the

ability of countries facing electricity access challenges to design and implement national electrification strategies and affordable electrification plans. IESP provides technical assistance and operational support to governments in geospatial electrification planning, including national least-cost electrification planning, preparation of geospatial-based mini grid investment portfolios, and analytics for the electrification of public institutions like schools and clinics. It also hosts the [Global Electrification Platform](#) (GEP), the first open source, interactive platform offering a high-level investment outlook for achieving universal electricity access by 2030. It is based on least-cost electrification pathways for 58 countries with significant electricity access deficits. The International Energy Agency (IEA) relies on the underlying model of the GEP—the [Open-Source Spatial Electrification Tool](#) (OnSSET)—for its analysis of least-cost electrification pathways for its World Energy Outlook and other publications. The program, together with Climate Compatible Growth and other partners, hosts several intensive training events annually to build capacity in client countries, also to ensure that they can fully utilize the GEP. Multiple countries have already developed variants of the GEP, customized for their individual needs.

During the COVID-19 pandemic, ESMAP's IESP program was integral to assessing the financing required to provide reliable, modern energy to health care facilities in low- and middle-income countries. GEP, along with facility-level survey data, was used to conduct the needs assessment for delivering both new electricity connections to health care facilities that do not have access to electricity and backup systems to health care facilities with an unreliable supply of electricity. This analysis was published in the January 2023 [Global Assessment of Electricity in Healthcare Facilities](#) report, written in collaboration with WHO, SEforALL, and IRENA.

During FY2023, the IESP team developed a climate module for GEP that incorporates carbon taxes into the modeling of least-cost electrification pathways. In the future, the program will advance the analysis by modeling least-cost options considering Nationally

Determined Contributions, drawing linkages between the drive for universal access and the costs associated with low carbon development. The program also continued to help countries develop appropriate geospatial least-cost electrification plans, consistent with their priorities and the reality on the ground, as well as identify investment strategies for implementing these plans.

IESP also assembles key partners and collaborates with them on data standards, data-sharing frameworks, and capacity building on modelling

tools. It organizes training sessions to build the capacity of governments, local academia, and other stakeholders for geospatial electrification planning. This has led to the development of an online learning curriculum on the Open University platform, and intensive, in-person training programs. In FY2023, the program organized two training and knowledge exchange events: The Energy Modelling Platform for Latin America & the Caribbean (EMP-LAC) (held in San José, Costa Rica, in January 2023), and The Energy Modelling Platform for Africa (held in Windhoek, Namibia, in April 2023).

BOX 2.11

SUPPORTING RURAL ELECTRIFICATION IN NIGERIA

The IESP program provided extensive support to the Rural Electrification Agency (REA) in Nigeria. REA is implementing an electricity access project with financing from the World Bank and the African Development Bank. As part of this project, the agency is scaling up the deployment of mini grids to reach low-income households that are off the main grid while also bringing electricity to essential social institutions like health care facilities and promoting the productive use of electricity (PUE). This will generate jobs and income for residents and improve the financial viability of the mini grid for the operator. ESMAP's [Integrated Electrification Strategies and Planning](#) (IESP) supported the development of a mini grid planning platform to identify, evaluate, and prioritize potential mini grid sites from the many thousands of settlements across the country, facilitating the effective deployment of project resources. The program also helped REA develop a geospatial platform to assess the importance of health care facilities in terms of the number of people they serve and the suitability for mini grid electrification in terms of whether the surrounding settlement can justify investment in mini grids. Finally, IESP helped REA with a particular use case for the mini grid planning platform. This enables distributors of PUE equipment, such as pumping, cooling, and milling, to collaborate with mini grid operators and microfinance companies to jointly plan for the promotion and provision of financing solutions for PUE equipment in mini grid communities.

GLOBAL FACILITY ON MINI GRIDS

Over the past five years, the mini grid sector, particularly in Sub-Saharan Africa, has been revolutionizing the power sector by providing modern energy services in access-deficit settings. Several factors, including a favorable policy environment and adequate access to affordable finance, have increased the scale and ambition of mini grid programs in many countries.

ESMAP's [Global Facility on Mini Grids](#) (GFMG) is designed to support the mainstreaming of mini grid projects in World Bank lending operations. The facility estimates that mini grids can electrify nearly 490 million people by 2030, with the installation of 210,000 mini grids in electricity access-deficit countries. For its part, the facility is contributing to this momentum by mobilizing World Bank lending to the sector. With the GFMG's direct facilitation and technical advice, the number of ongoing and pipeline projects with mini grid components in the World Bank portfolio has now reached 38 projects in 29 countries, with a record commitment of nearly \$1.4 billion of World Bank funding, which leverages an additional \$1 billion in private sector, government, and donor co-financing. These projects are set to deploy more than 3,500 mini grids that will serve 13 million people (see Special Section on Mini Grids). To date, over 275 mini grids have been built under these projects, with over 150,000 people receiving access to reliable, affordable, and modern electricity services. ESMAP analysis shows that the mini grid market, heavily propelled by solar PV, may be able to electrify as many as 490 million people by 2030, driven by falling component costs, digital advancements, and economies of scale.

The GFMG provides this strategic support to World Bank projects and country task teams through technical assistance and knowledge development,

by focusing on supporting 10 building blocks that are essential to scale up mini grid deployments at the national level: (1) solar hybrid technology and costing, (2) geospatial portfolio planning, (3) income-generating uses of electricity, (4) community engagement, (5) local and international industry, (6) access to finance, (7) training and skill building, (8) institutional frameworks, (9) workable regulations, and (10) enabling business environments.

The program has a strong focus on tracking the progress that countries and the broader mini grid sector are making in these building blocks, aligned with a set of five key performance indicators related to the cost, pace of deployment, access to finance, quality of service, and enabling environments for solar mini grids.

During FY2023, the facility continued to build on the success achieved over the recent past. The 2022 edition of its flagship publication, the [Mini Grids for Half a Billion People Handbook](#), was published in September 2022. It is the World Bank's most comprehensive and authoritative publication on mini grids and ESMAP's most downloaded book to date. The GFMG team continues to assist other World Bank teams operationalize the knowledge captured in the handbook. During FY2023-24, the handbook was translated into French to reach a wider audience and was subsequently published in October 2023.

The GFMG has built a strong reputation in the industry for generating frontier knowledge and convening market-building events. The foundation of the GFMG's knowledge products includes ongoing research, data collection, and global mini grid sector analysis. The facility continues to provide insights from ESMAP's analysis of mini grid sector statistics and exploration of cutting-edge issues, such as mini grids interconnecting with or operating alongside a national grid.

7TH ESMAP MINI GRID ACTION LEARNING EVENT

February 27 to March 3, 2023, the GFMG hosted the largest gathering of its flagship ESMAP [Mini Grid Action Learning Event](#), in Nairobi, Kenya. The event brought together over 800 leading sector stakeholders, representing governments, developers, financiers, appliance manufacturers, bilateral and multilateral donors, academia, and others. For the first time, the event was able to gather representatives from over 46 countries, including 39 World Bank client countries with ongoing and pipeline mini grid programs. The week-long event served as a catalytic forum for the sector to convene, network, and matchmake. It also included training for government officials working in the mini grid sector.

By attending this event, participants joined the leading public and private sector organizations, working together to remove barriers and accelerate the scale-up of mini grids across all energy access-deficit countries.

Throughout the week, the event covered crucial topics for the advancement of mini grids in Africa, including:

- Socioeconomic benefits and income-generating uses of electricity from mini grids
- The role of tariffs, grants, and concessional financing in kickstarting the deployment of mini grids
- How to create an enabling business environment for mini grids—lessons learned from deployment programs in Africa and beyond
- Driving down the levelized cost of energy (LCOE) of mini grids to \$0.20 per kWh

In addition, a series of “frontier” roundtable discussions took place to break through key challenges. The set of key challenges included:

- How to inform 290k communities about their mini grid potential with smart technologies?
- How to streamline approval processes with e-government/e-regulator tools?
- How to align productive appliance companies with the rollout of mini grid connections?
- How to align e-mobility and e-cooking growth with mini grid deployment?
- Are utilities opening up to interconnected mini grids as a solution to their end-of-line/remote reliability challenges?

OFF-GRID SOLAR/LIGHTING GLOBAL

Hundreds of millions of people worldwide still lack access to safe, affordable, and reliable energy. The majority of the remaining unconnected people are low-income, living in remote areas, and continue to rely on traditional lighting solutions, such as kerosene lamps, which provide poor lighting and carry serious environmental and health impacts. Affordability constraints and the high costs of serving households in these last-mile areas are among the main barriers constraining universal access to sustainable electricity.

ESMAP's [Off-Grid Solar](#) program, also known as [Lighting Global](#), has been working to increase access to clean, reliable, and sustainable electricity provided

by modern high-quality off-grid solar solutions for more than 15 years. Since the first pilot program in Kenya in 2009, Lighting Global has been at the forefront of the expansion of modern solar energy access for people living without it in low- and middle-income countries.

The program partners with governments, the private sector, development partners, financial institutions, end-users, and other stakeholders to unlock market barriers to expand affordable access to off-grid solar technologies. Through activities such as quality assurance, market development, and policy advisory services, the program has helped enable off-grid energy access to tens of millions of people, reduced GHG emissions, and informed World Bank lending and government policies.

Figure 2.2. The Impact of Lighting Global

OVERALL IMPACT



People are currently meeting at least their basic energy need through Lighting Global/VeraSol Quality-verified products.



Products meeting Lighting Global/Quality Standards have been sold since 2009.



Metric tons of CO₂e have been avoided due to the use of products meeting Lighting Global/Quality Standards. This is the emissions equivalent of taking 14 coal-fired power plants offline of a year.

Throughout its existence, the program has kept pace with sector developments, expanding support activities to encompass technologies ranging from single-point lanterns to solar home systems, productive use appliances, and public institutions, as well as for innovative payment methods such as pay-as-you-go (PAYG).

Lighting Global has also responded to external shocks, and in the case of COVID-19, the program worked with partners to encourage governments to classify off-grid solar as an essential service and collaborated on other resources to support the sector. Nonetheless, many off-grid solar companies struggled during the pandemic—but the sector has shown tremendous resilience since then. After a 22 percent decline in solar energy kit sales in 2020, the off-grid solar sector rebounded and recorded sales in the second half of 2022 that were 18 percent higher than the previous peak sales in 2019.

Since Lighting Global kicked-off, off-grid solar has catapulted from a largely unknown technology to one that is widely accepted as playing a key role in achieving SDG 7. To reach universal access, an estimated 1.1 billion people will need to be electrified by off-grid solar systems—but a significant increase in investment is needed. Non-customer revenue sources, such as carbon credits, could help companies bridge the affordability gap, and about \$4.5 billion is needed just to close the gap in affordability of solar energy kits. Studies confirm that end-user subsidies can be successfully disbursed to improve affordability, but given the persistent affordability challenge of the large, underserved population, an increase in well-designed and well-funded end-user subsidy programs is needed, particularly in deprived markets. Lighting Global is thus collaborating with Global Off-Grid Lighting Association (GOGLA) and other partners on the [End-User Subsidy Lab](#), a knowledge exchange platform to pool knowledge, technical expertise, and funding to enable stakeholders to jointly design effective end-user subsidies that will not distort the market.

Lighting Global has also brought together a group of leading practitioners to form the Renewable Energy Access Challenge (REACH) Partnership. REACH aims to expand first-time energy access in the poorest, most remote, and unstable (FCV) regions—where 89 percent of the population that could be served most cost-effectively through off-grid solutions, lives. During FY2023, the Lighting Global program team supported the development of sustainable markets and worked with governments to effectively integrate off-grid electrification into national strategies and programs, with solutions for serving the most remote population groups. Specific activities were carried out in countries with an extreme access deficit, including Burundi, the Democratic Republic of Congo, Ethiopia, Haiti, Niger, and Nigeria.

Team members were embedded into World Bank operational teams to advise governments on the off-grid solar market and potential scale-up options, and the program created and disseminated global knowledge products to inform lending projects. Some of the products developed include the [Gender Equality and Off-Grid Solar Operational Toolkit](#), which addresses the sector's gender gaps related to entrepreneurship and job opportunities and consumer awareness. The program team also developed a regulatory framework for Pay-As-You-Go (PAYG) off-grid solar, the [Off-Grid Solar Policy Toolkit](#), in collaboration with the Public-Private Infrastructure Advisory Facility (PPIAF). The PAYG Toolkit provides a roadmap for governments to improve the policy environment for off-grid solar market growth by highlighting relevant issues related to the energy, finance, and telecommunications sectors. It guides them in developing inter-ministerial collaboration to advance a policy and regulatory reform agenda with the private sector. The Off-Grid Solar program also created the [e-Waste Toolkit](#) to provide World Bank project teams and their government counterparts with the information and tools to develop adequate environmental and social safeguard instruments for the e-waste management of off-grid solar projects. It is being pilot-tested in a series of such projects, including the Regional Off-Grid Electricity Access Project (ROGEAP).

IMPROVING REGIONAL STANDARDS FOR SOLAR ENERGY KITS

ESMAP provided technical support to the Regional Off-Grid Electricity Access Project (ROGEAP), which aims to create a harmonized regional market across 19 West African countries and to advance private sector participation in solar standalone business in the region. The [Off-Grid Solar](#) team, with additional support from ESMAP-funded VeraSol, led the effort to harmonize the quality-assurance framework of standalone solar systems within the region. Regional industry ministers have adopted a harmonized quality assurance standard for solar energy kits up to 350 watts, which is aligned with the Lighting Global-developed International Electrotechnical Commission standard IEC TS 62257-9-8, a requirement for VeraSol-certification. This development is expected to improve the quality of solar energy products and increase access to energy in the Economic Community of West African States (ECOWAS) member states, by attracting more private sector participation in the project region. Adopting this regional standard will eliminate technical barriers to trade, create stronger quality assurance frameworks, and facilitate a more coherent incentive structure.

ROGEAP, which targets government policymakers and commercial financial institutions, has increased awareness of the benefits of extending access to financing through grants and credits to private solar entrepreneurs. ESMAP supported the project by raising grants, including contingent recovery grants from the Clean Technology Fund (CTF), which reduces the risk perception of the financial intermediaries by designing specific risk mitigation instruments when lending to private solar companies for solar kits—which are innovative in nature and lack long-term performance history. After a transition in the implementing agency and additional delays due to COVID-19, ROGEAP is now starting implementation by providing credit to off-grid solar companies through financial intermediaries. ROGEAP is also commencing to provide grants and technical assistance through a project fund manager who came on board in late 2023. Impacts on the ground are expected to ramp up in 2024.

Under ROGEAP the Lighting Global team also piloted an innovative business model for the electrification of public institutions with private sector participation. This includes a pilot test of the electrification of public facilities in Nigeria and Benin, and the team provided operational and analytic insights into the application of a private sector-led energy-as-a-service business model to electrify public schools and health centers. ESMAP, through ROGEAP also contributed advisory support to the World Bank's Uganda Energy Access Scale-up Project, aimed at increasing access to electricity for households, businesses, and public institutions in Uganda.

LEAVE NO ONE BEHIND

At the end of 2020, there were more than 80 million forcibly displaced persons worldwide, according to estimates from the United Nations High Commissioner for Refugees. Most of them are hosted in low-income countries in communities with limited resources and inadequate energy infrastructure. These conditions present several challenges, leaving displaced persons and their host communities vulnerable, and greatly hinder meeting the SDG 7 targets.

ESMAP's [Leave No One Behind](#) (LNBH) program was created to address these challenges by complementing the World Bank's humanitarian assistance activities in developing sustainable energy strategies for displaced persons and the communities where they find refuge. The program aims to integrate displaced persons, particularly women and children, into communities, improve their quality of life and economic prospects, and help achieve universal electricity access by 2030. LNBH conducts detailed assessments of the electricity needs of local populations and then develops adequate approaches and business models for solutions. The team works with national utilities and mini grid and off-grid companies to focus on displaced persons and their host communities. The program explores energy for tent lighting and other personal needs. It helps determine camp infrastructure electricity needs, such as external lighting, which drastically reduces the risks of violence, including gender based. It proposes smart ways to power clinics, water points, or bathrooms and enable productive activities such as sewing or welding. LNBH activities are being carried out in Bangladesh, Ethiopia, Kenya, Mauritania, Mozambique, Panama, Rwanda, Somalia, South Sudan, Uganda, and Yemen. These activities concentrate on closing the gaps in data analysis and collection, designing appropriate projects, improving implementation capacity, and convening power to ensure the success and scalability of operations.

During FY2023, the LNBH program continued to strengthen the relationship between stakeholders and integrate sustainable development strategies and humanitarian responses into displacement settings. The team represented the energy sector during the 2022 High Commissioner's Dialogue, hosted by the United Nations Refugee Agency.

The program continued to collect additional lessons and results from the ongoing support grant provided to the World Bank's operational teams. In FY2023, the team published its flagship report, [Leaving No One Behind: Rethinking Energy Access Programs in Contexts of Displacement](#), which showcases the issue of displaced persons and provides recommendations for addressing the key barriers to electricity access and prompting the necessary systemic change:

- Adapting energy access engagements in displacement settings. Such engagements need specific design and implementation strategies in order to address in a sustainable manner the impacts on local communities and the vulnerabilities of displaced people. From electricity that can switch on a lamp to electricity that can power machinery, there is a wide range of energy access that must be tailored to the needs and capacity of displaced people.
- Promoting cooperation between humanitarian and development actors. While humanitarian agencies are there initially to welcome the displaced people and cater to their basic needs when they arrive, these people face a mid- to long-term situation in their host communities that requires adapted energy infrastructure.
- Identifying the most effective sustainable energy solution for each intervention setting. Choosing the right product and service for a specific context requires both expertise and a full understanding of many factors, such as user needs and preferences, affordability, access to finance, and the regulatory environment. While in some settings, off-grid solar is most adapted, other settings will require a new transmission line.

The team also published the [Understanding the Interaction between Gender, Energy, and Forced Displacement](#) Livewire to highlight the gender inequalities in electricity access and the importance of combining basic services with tools and resources. The first phase of the HOMER-Enabled Tool to Electrify Displacement Settings—a tool

that allows calculating energy requirements in different displacement settings—was presented at a consultation workshop featuring relevant stakeholders and practitioners. In one of the solutions, the tool proposes introducing the initial parameters for retrofitting existing diesel-powered systems with solar PV modules and batteries.

BOX 2.14

WORKING WITH THE ROHINGYA IN COX'S BAZAAR, BANGLADESH

Nearly one million people from Myanmar's Rohingya community have been displaced to neighboring Bangladesh. Most of them have settled in the country's Cox's Bazaar district, thus creating the largest population of displaced persons in the world. The [Leave No One Behind](#) (LNBH) team supported the World Bank's Emergency Multi-Sector Rohingya Crisis Response Project (EMRCRP) to design a roadmap to meet the energy needs of refugees and host communities. Some of the energy solutions identified include distributed renewable energy electricity and energy efficiency improvements in lighting equipment. Also, the initial preparation of the roadmap allowed the Resilience and Disaster Risk Management and energy teams to roll out the proposed solutions in subsequent projects.

BOX 2.15

IMPROVING ACCESS TO ELECTRICITY IN CHAD

Host communities and displaced persons in Chad have been experiencing acute energy access-related issues combined with limited natural resources and extreme climate conditions. The [Leave No One Behind](#) (LNBH) program has provided technical assistance to the \$395 million Chad Energy Access Scale-Up Project (CEASP), which will provide electricity to about 6 million people, including displaced persons, in host communities. The project will also improve electricity access for 150 medical centers and 200 schools in these communities, promoting productive uses of electricity to increase and diversify the sources of livelihoods for the beneficiaries.

IMPROVING LIVELIHOODS AND HUMAN CAPITAL

With more than 90 percent of the global population now connected to electricity, considerable progress has been made to reach SDG 7. However, although these new connections are successfully powering household appliances, such as lamps, fans, or televisions, the use of electricity for income-generating machinery, such as water pumps or grinding mills (“productive use”) is still lagging. Without targeted measures, the increase in productive uses after electrification has been slower than expected in many communities. This has limited development benefits, financial performance, and the sustainability of electricity access. Moreover, without wide-based productive uses, too often, investments in increased access to electricity have disproportionately benefited higher-income groups.

ESMAP’s [Improving Livelihoods and Human Capital](#) (ILHC) program promotes the productive use of electricity and the electrification of public institutions. The program was launched during the COVID-19 crisis to complement the World Bank’s efforts during the pandemic and facilitate the post-pandemic economic recovery. ILHC activities have increased following the Russian invasion of Ukraine.

The program’s overarching goal is to restore livelihoods, create jobs, and generate income to improve the development impacts of energy access programs. The team conducts activities that support local initiatives and grassroots entrepreneurship by harnessing renewable energy for productive uses.

ILHC provides support for operational work and advocates solutions for productive uses in close collaboration with WHO, FAO, IRENA, SEforALL, and EnDev, as well as the World Bank Global Practices on agriculture, water, health, or education.

During FY2023, the ILHC team worked with Village Data Analytics (VIDA) and Odyssey Analytics to leverage data analytics to inform project design while

ensuring efficient implementation and evaluation. The initiative’s pilot was rolled out in parts of Nigeria and enabled project teams to identify a cohort of microfinance institutions, appliance providers, and mini grid developers to catalyze business development for productive uses. A learning event held in Nairobi, Kenya, in March 2023 led to the formation of early-stage partnerships, which will stimulate demand and strengthen the viability of dozens of newly developed mini grids in Nigeria. The country’s Rural Electrification Agency will expand the effort forward in collaboration with the World Bank, the Global Energy Alliance for People and Planet (GEAPP), and the Rocky Mountain Institute. The initiative has also been introduced to the Access to Distributed Electricity and Lighting in Ethiopia (ADELE) project.

A \$1.4 million Rockefeller Foundation grant has supported preparatory studies on the productive use of electricity and demand stimulation in the Democratic Republic of Congo, Ethiopia, Kenya, Nigeria, and Rwanda. In addition, assessments are being conducted on the viability of the co-location of agricultural value chains with solar-powered mini grids. The study in Nigeria is finding exceptionally high potential for co-locating mini grid investments in communities cultivating rice and cassava, and where investments in medium voltage lines are not required to accommodate the agricultural loads.

In Tanzania, ESMAP provided additional financing for the country’s rural electrification expansion program, leading to an additional one million last-mile grid connections, which covered 8,500 education facilities and 2,500 health care facilities. The ILHC team provided technical support for designing and implementing mainstream productive uses and electrifying public facilities.

During FY2023, the ILHC program continued to build on the knowledge developed during previous fiscal years and focused on the electrification of public facilities and the stimulation of productive use. The team produced an evidence-based toolkit

to synthesize the lessons learned from the design and implementation of 65 solar electrification programs. The Sustainable Business Models for the Electrification of Public Facilities Toolkit guides the business models with strong potential and maps their implementation. The toolkit is underpinned by a significant number of case studies examining the

promotion of PUE across grid, mini grid, and off-grid solar technologies.

The ILHC team also completed the report [*Accelerating the Productive Use of Electricity: Enabling Energy Access to Power Economic Growth*](#), which proposes a systematic way to operationalize PUE through an ecosystem approach.

BOX 2.16

ENHANCING COVID-19 HEALTH OUTCOMES: EXAMPLES FROM COMOROS, HAITI, AND SOUTH SUDAN

ESMAP's [*Improving Livelihoods and Human Capital \(ILHC\)*](#) activities during FY2023 were integral to supporting the COVID-19 pandemic response. The program's intervention in the Comoros led to the procurement of vaccines, which along with additional interventions helped the island nation reach its 60 percent vaccination coverage goal. ESMAP provided \$1 million in grant funding to support the improvement of the electricity supply in health facilities, including the installation of equipment for 22 health facilities, electrical rehabilitation, and relevant training sessions and maintenance for the solar panels.

In Haiti, ILHC worked with teams from the World Bank's Energy and Health, Nutrition & Population Global Practices on a COVID-19 pandemic response that covered emergency investments in distributed solar PV and battery storage solutions. This included two technical assistance contracts to focus on the electrification of rural health centers and address issues related to technical, economic, policy, and regulatory components of the implementation of the hospital and water pumping investments.

The program supported health service delivery systems in three states in South Sudan to increase access to an essential package of health and nutrition services as part of the COVID-19 pandemic response activities. ILHC funding has facilitated the procurement of eight solar direct drive refrigerator spare parts sets, 72 refrigerator loggers, and 805 cold boxes and vaccine carriers. As a result of the cold chain infrastructure expansion, the country has one of the highest COVID-19 vaccination rates in the East Africa region. This is also expected to improve basic childhood immunization rates in the country.



FINANCIAL INNOVATION FOR ENERGY ACCESS

Innovation in financing for electrification is important for increasing the pace of electrification and providing services to the hardest-to-reach segments. In addition, financing to achieve universal electricity access will be needed across the entire spectrum of the value chain. End-users require credit or flexible payment methods to afford the connection costs and upfront investments in systems and appliances. Service providers also need access to low-cost working capital to finance the systems over long repayment periods. The capital needs to be made available in the right currency to limit exposure to foreign exchange fluctuation, as is evident from the economic consequences of the COVID-19 pandemic and other past external shocks.

Innovative financing is also required to reach the most vulnerable and disadvantaged segments of society, which in many developing countries are the highest percentage of the population. However, it is not often clear which new financing instruments need to be applied in which context to achieve set objectives. Existing market incentives without more targeted interventions are insufficient for the private sector to extend their solutions to these segments.

ESMAP's [Financial Innovation for Energy Access](#) (FIEA) program develops and tests financing instruments and implementation modes to drive energy access acceleration, inclusion, and impact across all electricity systems and solutions. The FIEA team focuses on core areas such as facilitating access to debt finance, results-based and impact-linked finance, digital financial solutions, and value chains.

The program's activities cut across other ESMAP access windows such as the Global Facility on Mini Grids, the Utilities for the Energy Transition, and Off-Grid Solar/Lighting Global. This enables FIEA

to determine how it can help operational projects accelerate access to finance for electrification.

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 and digital measurement, reporting, and verification (MRV) tools for tracking connections and streamlining payments for results-based financing (RBF) programs.

In FY2023, the program produced guidance for operational teams on debt financing for small and medium enterprises in the off-grid solar sector. It includes lessons learned from applying innovative risk mitigation instruments to unlock local debt finance for working capital.

FIEA also worked on an End-User Subsidy Toolkit that deepens the knowledge of end-user subsidies with the most up-to-date expertise and resources. The toolkit provides a user-friendly design framework for governments and development agencies looking at designing and implementing end-user subsidies. It is expected to guide the design of subsidies in different contexts and according to best practices.

The window has supported the preparation of the Accelerated Sustainable & Clean Energy Transformation (ASCENT) program in Eastern and Southern Africa using a multiphase programmatic approach (MPA) in two key areas:

1. Thinking through design options for the risk mitigation, equity, and RBF aspects of the initiative for implementation by the Trade and Development Bank (TDB) and the Trade and Development Fund (TDF)
2. Determining the architecture and digital MRV tools for tracking and verifying electricity connections for payments under the upcoming RBF program of ASCENT

The FIEA program has supported the Uganda Electricity Access Scale-Up Project (EASP) and informed the design of the project's credit facility for access as well as the customization and adoption of [Prospect Energy](#)—an open-source digital

data platform for tracking access connections to streamline verification and payments for the RBF component, supporting off-grid solar, clean cooking, and productive use appliances.

ESMAP AT THE HEART OF NIGERIA'S EXPONENTIAL MINI GRID DEVELOPMENT

Could solar hybrid mini grids be the solution to bring electricity to the 568 million people in Africa who remain without access?

Solar hybrid mini grids are solar-powered electricity networks that function separately from the grid. They are aggregated solar panels operating as one, linked to batteries often backed up by diesel generators, that store and supply the electricity.

The deployment of solar mini grids in Sub-Saharan Africa has markedly accelerated in the past decade. In 2010, 500 mini grids were installed in the region, compared to 3,000 installed today, with an additional 9,000 planned. This remarkable acceleration is the result of four main factors: (1) the falling costs of key components; (2) the introduction of new digital solutions; (3) a large and expanding cohort of highly capable mini grid developers; and (4) growing economies of scale.

Nigeria—a country where more than 80 million people, or nearly 40 percent of the population, lack access to electricity—is one of the countries in Africa that, thanks to the support of ESMAP and World Bank energy operations, has witnessed a fast deployment of mini grids.

The Nigeria Electrification Project

In June 2018, the World Bank and the government of Nigeria launched the Nigeria Electrification Project (NEP). The \$350 million project aimed to provide electricity to 2.5 million people and 70,000 micro, small, and medium enterprises, health centers, and universities by attracting private sector investment in

solar hybrid mini grids and standalone solar systems. The NEP was the first performance-based grant program of its kind.

ESMAP, through its [Global Facility on Mini Grids](#), played a key role in the conceptualization and implementation of the NEP, from its earliest inception states. Steps included:

- ESMAP mini grid specialists led the preparation and implementation of the project, as part of its core task team.
- ESMAP mobilized a significant number of senior mini grid experts to provide targeted, just-in-time advisory support to the project management unit in the Nigerian Rural Electrification Agency (REA).
- ESMAP provided financial and technical support to procure and oversee a wide range of key studies—from geospatial analysis for mini grid portfolio preparation to customization of the Odyssey eProcurement platform, from cost benchmarking to development of minimum technical standards, and from matchmaking of developers and appliance suppliers to many other analytics critical to the project design and implementation.
- In 2018, ESMAP organized a Mini Grid Action Learning Event in Nigeria, which put the spotlight on the NEP and served as a key early matchmaking and networking platform for market building in the country.
- The ESMAP [Mini Grid for Half a Billion People](#) handbook and the [Mini Grids for Underserved Customers](#) report include frontier knowledge on the mini grid sector in Nigeria.

The project has been transformational for the mini grid sector in Nigeria. It has brought scale and financing, catalyzed the market, and bred innovation for both local and international developers. To date, the NEP has supported the establishment of 125 mini grids and the sale of over a million solar home systems, through which more than 5.5 million Nigerians have gained access to electricity. The NEP has also resulted in the creation of over 5,000 private sector local green jobs in Nigeria.

Among the thousands reached by the project are hospitals that previously faced frequent power outages from the national grid. In the State Specialist Hospital in Gombe, for example, frequent power outages meant that doctors had to refer patients to other hospitals, which was especially difficult for low-income individuals who could not afford the services at these other facilities. Inadequate lighting led to the death of women during pregnancy or after delivery, and significant infant mortality. Having benefited from solar energy installation, these hospitals now have clean and reliable electricity, which enables them to provide lifesaving medical care to patients.

The project has also played a pioneering role for performance-based programs throughout Sub-Saharan Africa. These programs have inspired the launch across Western and Eastern Africa of a wide range of similar projects—led by the World Bank and other bilateral and multilateral partners—supported by lessons, best practices, tools, and templates developed for the NEP.

DARES Nigeria

Building on the achievements of the NEP and aiming to further accelerate electrification in Nigeria, in late 2023, the World Bank and the government of Nigeria launched the Nigeria Distributed Access through the Renewable Energy Scale-up (DARES) project. DARES is financed by an International Development Association (IDA) credit of \$750 million. It includes significant parallel financing from development partners, including \$100 million from

the Global Energy Alliance for People and Planet (GEAPP), and aims to leverage over \$1 billion of private capital. Other development partners collaborating on the program include the Foreign, Commonwealth & Development Office (FCDO), the United States Agency for International Development (USAID), GIZ, SEforALL, and the African Development Bank (AfDB).

DARES will double down on the best practices and successful models established through the NEP, with the goal of delivering access to electricity to over 17.5 million people and over 230,000 micro, small, and medium enterprises (MSMEs). It will enable the government of Nigeria to coordinate and finance all off-grid electrification efforts and will help states access technical assistance to develop institutional capacity and policy frameworks for rooftop solar. The program will prioritize gender and inclusion by building on the NEP's gender-related actions to facilitate access to electricity for disadvantaged female-headed households and women-led MSMEs, as well as actions to increase the employment of women in the energy sector.

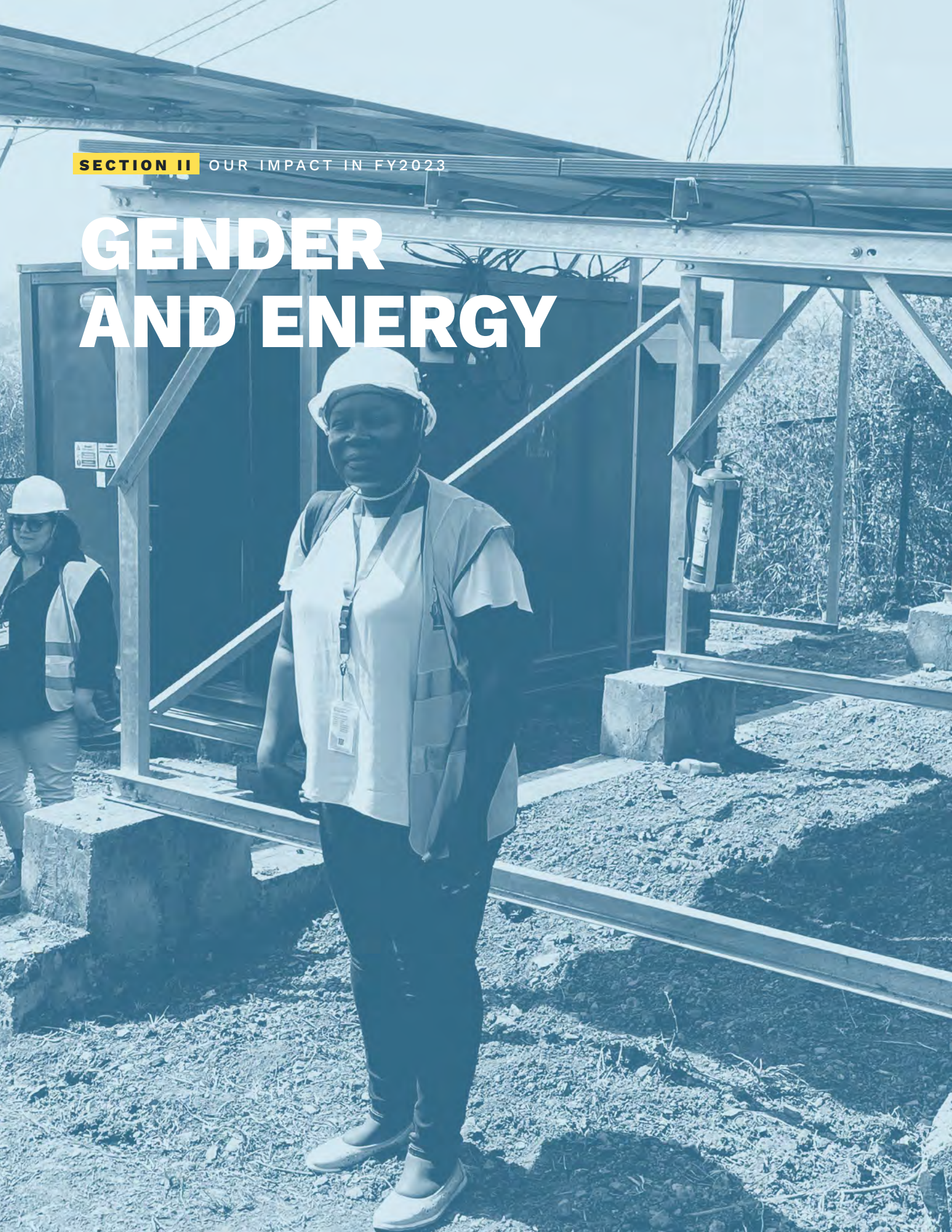
ESMAP in DARES Nigeria

A team headed by ESMAP staff has led the preparation and implementation of the project, supported by ESMAP's contribution of a \$3.25 million grant. ESMAP is again mobilizing senior mini grid experts to provide targeted, just-in-time advisory support to the project. In addition, ESMAP is currently working on the following analyses for the Nigeria DARES project:

- Analysis of systems' architectures
- Review and update of minimum technical service standards
- Cost benchmarking
- Financial modeling and calibration of subsidies
- Upstream support for preparation of mini grid project pipelines
- Analytical work on scaling local currency financing for mini grids

SECTION II OUR IMPACT IN FY2023

GENDER AND ENERGY



Around the world, the energy sector employs over 65 million people. According to the IEA, only 16 percent of them are women while the share of women among the global workforce is close to 40 percent. The energy sector is one of the least gender diverse, and women and girls are disproportionately affected by energy poverty. Lack of access to modern energy or to clean cooking fuels impacts women more than men, limiting women's work options by making their domestic duties harder and more time consuming, exposing them to health risks, and forcing them to forage for wood or other combustible materials.

A variety of pervasive factors interact at the individual, institutional, and societal levels that directly limit women's inclusion in the sector. For example:

- **Gender and social norms** influence dynamics inside individual households and across societies, inhibiting women's access to energy technologies and limiting economic opportunities. In addition, men are the main purchasers of energy products, even when women are the primary end users.
- **Rooted gender biases** that prevent women from accessing employment and leadership opportunities in the sector.
- **Lack of market data and knowledge** about women's inclusion in the sector.

- **Inequity in ownership and assets.** Historically, female-headed households tend to be poorer because long-term assets are unequally distributed.
- **Lack of access to electricity that is reliable, sustainable, and affordable**—necessary for income-generating activities.
- **Lack of business and technical skills.** Women have less exposure to formal business training than men and are subject to gender stereotypes about their financial abilities. Women also tend to own informal businesses with little or no recordkeeping, making it difficult to demonstrate viability or due diligence when seeking financing and using traditional assessment methods.
- **Little investment** on the part of the energy industry to develop electric products geared to women's demand—even though women perform many of the household activities associated with electricity demand.
- **Lack of policies that address gender inequality in the energy sector.** Gender discrimination in laws, policies, and regulations prohibit and inhibit women from accessing the benefits of energy services and from actively participating in the sector.

Different energy sectors face distinct but also similar challenges.

25%

A recent ESMAP study estimates that the hydropower sector will employ 3.7 million people in 2050, 25% of them women. While this is greater than the energy sector average, it is lower than the overall renewables sector.

According to a recent ESMAP study, [Power with Full Force: Getting to Gender Equality in the Hydropower Sector](#), the hydropower sector is expected to employ 3.7 million people in 2050. The study found that the share of women in the sector's labor force is 25 percent, which is greater than the average in the energy sector but lower than the overall renewables sector. The hydropower sector presents unique barriers for women; due to its established nature and aging workforce, it is often perceived as less dynamic and has a conservative corporate culture. Moreover, gender biases often lead to the misconception that women are incapable of handling labor-intensive and technical aspects of hydropower, preventing them from obtaining core jobs and decision-making roles. Additionally, following social norms results in a lower representation of women; for example, hydropower sector jobs require frequent travel to remote sites, and this can pose challenges for women balancing work and family-imposed responsibilities. Consequently, the hydropower sector does not leverage the talents and skills of diverse individuals, even though studies have shown that building an inclusive and balanced workforce that offers equal opportunities for both men and women is economically and socially beneficial.

In the off-grid solar sector, the Global Off-Grid Lighting Association (GOGLA), estimates that approximately 27 percent of jobs are held by women, and this percentage is expected to rise as the market evolves. This is almost 20 percent higher than female employment in other energy sectors, such as oil and gas, but still less than a third of the total off-grid workforce. This is despite experience and evidence that increasing the number of women workers in these energy sectors could lead to market growth, better product uptake, and greater consumer satisfaction.

Fortunately, the issue has received considerable attention, and across the globe there are initiatives to accelerate gender equality, diversity, and inclusion in the energy sector, including ESMAP's [Closing Gender Gaps in Energy Program](#).

CLOSING THE GENDER GAP

Energy poverty affects almost half of the world's population, and women and girls disproportionately bear that burden both in their domestic and business activities. Equally, the energy sector remains male dominated, with fewer women working in the sector and women earning lower wages than men. More efforts are needed to close the energy access gap and open economic and leadership opportunities in energy for women.

ESMAP's [Closing Gender Gaps in Energy](#) Program uses its six regional programs to facilitate the design and implementation of interventions that aim to achieve gender equality and reduce poverty.

The six regional programs are:

1. Africa Gender and Energy Program
2. East Asia and the Pacific Gender and Energy Facility, Energy
3. Gender and Social Inclusion in the Europe and Central Asia Region
4. Latin America and the Caribbean Energy and Gender Program
5. Middle East and North Africa Energy and Gender Program
6. South Asia Gender and Energy Facility

The programs have helped strengthen women's roles as consumers, employees, leaders, and entrepreneurs in the energy sector.

Since its inception, the ESMAP Gender Program has been successful at increasing attention to gender issues in World Bank energy projects' design. The program has, however, been met with several constraints in the implementation phases of these projects. These constraints include the limited

number of World Bank task team leaders and government counterparts with relevant knowledge on how to tackle gender equality issues effectively, in different contexts; limited incentive and time for these task team leaders and counterparts to participate in available training; limited availability of gender technical experts in the field; and little recognition for task team leaders and counterparts who promote the implementation of gender actions in their projects.

During FY2023, ESMAP's Closing Gender Gaps in Energy Program continued to catalyze resources to reduce gender inequalities and increase women's empowerment at the global, regional, and country levels.

Among regional initiatives, the Africa Gender and Energy Program supported the design of 11 projects with a strong focus on enhancing women's employment in utility companies and improving the productive use of energy for female farmers and women-led businesses. The projects have also increased access to electricity for female-headed households and advanced female entrepreneurship in the off-grid market. In East Africa, a Regional Network for Women in the Energy Sector was conceptualized to conduct a regional mapping assessment to identify initiatives and actors in the energy sector. This will lead to the development of a roadmap to guide future activities and the consolidation of a regional network.

In the East Asia and Pacific region, two World Bank projects were approved, with operations in Indonesia, Lao PDR, Papua New Guinea, and the Philippines. The projects include activities to improve women's access to modern energy sources and bolster the employment opportunities for women in the energy sector. ESMAP also developed two briefing notes for internal and external audiences: Gender and Energy Portfolio Review and Women's Employment in Renewable Energy in the EAP Region: Overview Note.

In the Europe and Central Asia region, the team provided technical assistance to four new lending projects focusing on gender, energy, and social inclusion. These projects were designed to help improve women's access to finance and enhance their participation in technical roles in the energy sector. In addition, ESMAP published a [report assessing gender gaps in the mining and energy sector in Serbia](#). The launch of a new regional gender and energy network, Women's Empowerment in Sustainable Energy in Europe and Central Asia (WESEE), was prepared in collaboration with local stakeholders, including regional utility companies.

In the Middle East and North Africa region, the Gender team and ESMAP supported the first regional conference of the Regional Network in Energy for Women in the Middle East and North Africa Region (RENEW MNA—see Special Section on Gender). This is a women's network in the energy sector designed to accelerate female recruitment and professional development across the region. The ESMAP team built on the momentum from last year's launch of the RENEW MNA initiative by conducting activities such as a first conference held in Tunisia. The conference featured a facilitated dialogue among representatives of various stakeholders, as well as knowledge sharing and collaboration, with the goal of improving the job outlook for women. In addition, a new lending operation in Tunisia was approved and included gender actions to boost the participation of women in the country's electric utility.

In South Asia, the third Women in the Power Sector Network (WePOWER) Regional Conference was held in Bangkok, attracting more than 180 women professionals from power utilities and energy sector organizations across several regions. Two out of three new World Bank energy projects in the region achieved the [Gender Tag](#). Also in South Asia, a regional gender training for expert young women in the energy sector was conducted to improve women's access to STEM (science, technology, engineering, and mathematics) education.

The gender program in Latin America and the Caribbean supported projects in Argentina, Chile, Ecuador, and Panama, focusing on an innovative approach that includes the design of interventions at the policy level. These aim to close gender gaps in energy access and improve women's participation in the sector.

The ESMAP Gender Program also championed women's empowerment in the energy sector by leading the implementation of the [Women in Energy Storage \(WES\) Mentorship Program](#) for young female professionals. In addition, in collaboration with ESMAP's Hydropower Development Facility, the program is promoting gender equality in hydropower through a new global knowledge product—[Power with Full Force: Getting to Gender Equality in the Hydropower Sector](#).

Also, the team developed, completed, and implemented an [Operational Handbook for Gender Equality in the Off-Grid Solar Sector](#). The handbook describes a variety of ways to close gaps within the off-grid solar sector through entrepreneurship, jobs, and at the consumer level. The report distills findings from an extensive literature review, a global stock-taking exercise, key informant interviews, and case study reviews. This handbook was presented at the GOGLA Global Off-Grid Solar Forum and Expo 2022 (October 2022), in Kigali, Rwanda. Another example

of the report's influence on work on the ground is a recent workshop focused on gender and leadership for off-grid solar companies hosted by the Malawian Ministry of Energy, with support from ESMAP. The handbook was included in the dissemination materials to ensure its conclusions reach a wider audience. The workshop provided practical case studies and examples to help the 20 attendees amplify the potential of women as entrepreneurs and their role in the sector's value chains. The workshop also included a panel discussion on how best solutions to address gender inequalities. The workshop equipped energy experts with the tools to promote gender equality in the sector.

[Closing Gaps in Women's Employment in the Energy Sector toolkit](#) Finally, in coordination with the Utilities for Energy Transition Program, the gender team produced a [Women's Employment in Energy Utilities Sector toolkit](#), which will help project teams address women's employment in the energy sector through the exchange of lessons learned and good practices (drawing on, for example, how women's employment issues have been advanced in the energy sector in Ethiopia and exploring how applicable best practices from the private sector are for the public sector). This product was published online in December 2022 and had a launch event during the 67th Commission of the Status of Women at United Nations headquarters on March 14, 2023.



HARNESSING NEW OPPORTUNITIES TO INCREASE WOMEN'S PARTICIPATION IN THE ENERGY SECTOR IN THE MIDDLE EAST AND NORTH AFRICA

The energy sector is known to be male dominated. Globally, women only account for 16 percent of the workforce in energy-related positions. In Middle East and North Africa (MNA) countries, women generally have a low participation rate in the labor force: only 20 percent of women are employed or seeking employment. That figure is even lower in the energy sector. Even though 50 percent of graduates in STEM in MNA countries are women, less than 10 percent of the energy workforce is female.

ESMAP and MNA Gender and Energy Program are committed to closing gender gaps in the energy sector, in alignment with the World Bank Group's New Gender Strategy. Over the years, both teams have collaborated closely to seek solutions for women's participation in the energy sector.

Evidence of the energy gender gap in MNA

The MNA region, with support from ESMAP, published in 2022 the assessment [Toward More and Better Jobs for Women in Energy](#). The report shows that in most MNA countries, women represent less than 10 percent of the energy workforce and an average of 5 percent in technical fields or in management. In Tunisia, for example, where 27 percent of the national workforce are female (according to the 2014 Tunisia Labor

Market Panel Survey), further research reveals that all are in clerical positions or in low-skilled services. This could be due to a combination of factors, such as restrictive norms, legal barriers that reinforce gender stereotypes, and occupation segregation.

The exclusion of women comes at a cost to the overall economy. The IMF estimates that addressing gender gaps could add up to over 20 percent to the region's gross domestic product. It is also good for business. Companies with gender-diverse boards are more productive and more profitable: reports indicate that companies with women comprising 30 percent of leadership are much more likely to succeed in STEM-related sectors than companies without female representation.

Global energy trends are an opportunity to considerably increase gender balance in the energy sector. It is estimated that the global energy market will grow 44 percent by 2050. In Egypt alone, according to the World Bank 2022 study [The Employment Benefits of an Energy Transition in Egypt](#), this will likely mean the creation of 1.4 million to 3.8 million jobs in the energy sector over the period 2020-50. The drive for an energy transition and clean energy development in MNA countries will likely create more and different types of jobs with the majority in the renewable market.

How do we harness the opportunity?

ESMAP is a supporter, sponsor, and advisor of Regional Network in Energy for Women in the Middle East and North Africa Region (RENEW MNA). The initiative was launched in Tunis in June 2022. RENEW MNA is supported by three pillars:

1. Address the issues around employment challenges following women's education in STEM
2. Examine the recruitment, retainment, and advancement policies and practices in the energy workplace
3. Enhance women's entrepreneurship in the renewable and clean energy technology sector

The RENEW MNA network intends to increase women's economic participation in clean energy jobs and enterprise ownership and leadership. It will also create better workplace conditions and combat widespread gender stereotypes about women in STEM.

Following the launch of the initiative, ESMAP has focused on activities to establish the institutional foundation of the network, raise funds, and build partnerships. The first RENEW MNA conference brought together about 100 representatives from government agencies, academia, international

financial institutions, nongovernmental organizations, and the private sector from more than 20 countries. The conference's primary objective was to facilitate dialogue, share experiences, and foster collaboration among diverse stakeholders. During the event, participants discussed best practices, successful case studies, and innovative approaches to create more and better job opportunities for women and promote women in the energy sector. The event showcased the transformative potential of a regional women's network.

Testimonials from Participants at the 2023 RENEW MNA Conference

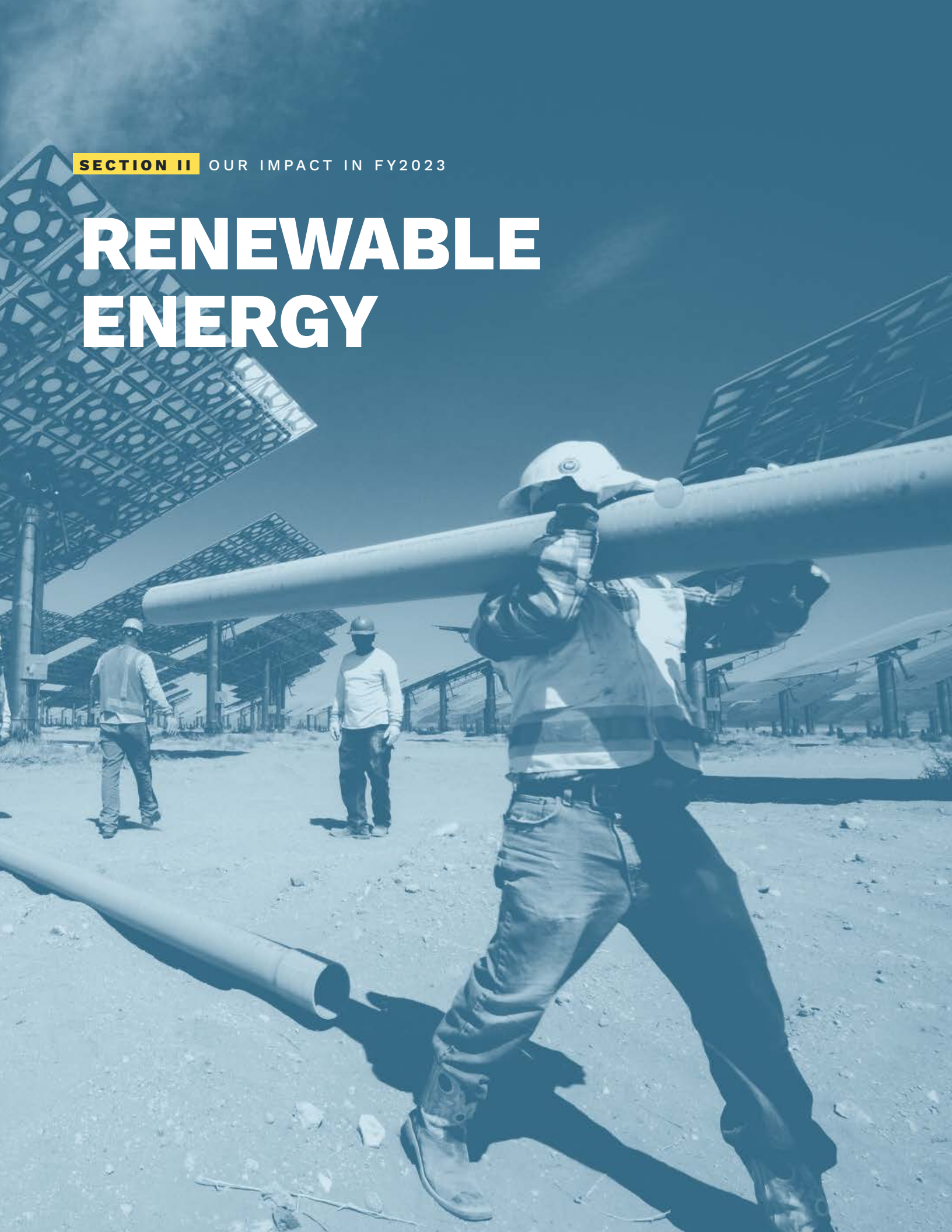
"Our region is home to immense female talent that remains untapped. I welcome RENEW as an opportunity to bring countries together, share lessons, and work collectively toward clean energy goals." Amani Mohammad Hassan Al-Azzam, Jordan's General Secretary of the Ministry of Energy and Mineral Resources

"Women are playing an important role in clean energy, and we need networks like RENEW MNA to not only support women as they advance in the sector but amplify regional and global recognition of their many contributions." Sabah M Mashaly, CEO and Managing Director, Egyptian Electricity Transmission Company



SECTION II OUR IMPACT IN FY2023

RENEWABLE ENERGY



Growth in renewable power surged in 2022-23, driven by the global energy crisis and policymakers pushing for alternatives to fossil fuels. By the end of 2023, the world had added 50 percent more renewable capacity compared with the previous year, according to the [International Energy Agency](#) (IEA). In response to higher electricity prices following disrupted energy supply caused by Russia's invasion of Ukraine, policymakers, particularly in Europe, have looked to alternatives to importing fossil fuels to keep prices in check and improve energy security. The shift in focus away from imported fossil fuels pushed solar PV to the fore, accounting for three quarters of this year's increase in global renewable capacity.

And yet, even though growth is now so robust that renewables will likely overtake coal as the largest source of electricity generation in 2025, significantly more needs to be done to triple renewable capacity by 2030, as countries agreed at COP28 in December 2023. Much of the recent unprecedented growth came from China, with many other emerging and developing countries left behind in the new energy economy. Per the IEA's net zero scenarios, a staggering 7,000 GW of new renewable energy capacity must be deployed by 2030 globally to align with the climate objectives of the Paris Agreement. About one-third of this target, 2,100 GW, must be implemented in emerging and developing economies (excluding China). To do so, the financing and deployment of renewables must be scaled up in those countries.

The number of renewable energy projects getting financed and operating in emerging and developing markets today falls significantly short of the required scale. The total installed capacity in those markets is about 780 GW (excluding China), which must triple

within six years. In Sub-Saharan Africa alone, the installed capacity for solar and wind generation is 11 GW, far from the 250 GW needed by 2030 to align with the Sustainable Development Goals.

Between 2015 and 2022, clean energy investments have seen a clear upswing, with a 40 percent increase in financing mobilized in emerging and developing countries. But there is an important caveat: a staggering three-quarters of these investments in 2022 was concentrated in just three countries, China, India, and Brazil, with 170 GW, 22 GW, and 16 GW of new renewable energy capacity financed, respectively. It is key to unbundle emerging and developing markets as a group to assess why some countries struggle to create the right enabling environment to attract private investments while others succeed.

Mobilizing the private sector at scale and pace will require the accelerated development of pipelines of bankable clean energy projects. Lowering the real and perceived risks by investors is critical. In advanced emerging economies, this may mean creating certainty around policies, investing in grid infrastructure to accommodate greater shares of renewables, and reducing red tape and delays. Other emerging and developing economies may need to ensure access to finance, strengthen governance, and create robust regulatory frameworks.

ESMAP works on all these issues, whether regulatory, technical, or market transformation support to mitigate country, sector, and project risks. We complement such advisory work with hands-on support in optimally allocating public and concessional funds for the greatest environmental and social impacts.

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A staggering 7,000 GW of new renewable energy must be deployed by 2030 globally to reach the Paris Agreement's climate objectives. About a third of this, 2,100 GW, must be implemented in emerging and developing economies (excl. China), requiring a tripling of those markets' current capacity.

SUSTAINABLE RENEWABLES RISK MITIGATION INITIATIVE

While the transition to sustainable energy sources is a significant opportunity for emerging markets, the deployment of renewable energy is lagging. One of the key challenges for many developing markets is the lack of bankable projects ready for private sector investments. In response, ESMAP launched the [Sustainable Renewables Risk Mitigation Initiative](#) (SRMI) in 2018 to support countries in developing and implementing sustainable and resilient renewable energy programs that can attract private investors while maximizing benefits for their citizens. SRMI assists countries in the integration of variable renewable energy sources, such as solar and wind, into the electricity grid, enhances the planning process beyond World Bank support, helps to ensure project bankability, and supports securing adequate public funding—particularly concessional and climate financing. Addressing these issues requires a multifaceted approach, combining more mobilization of private funds and financial innovation to complete the energy transition and meet global climate objectives.

SRMI is a partnership between ESMAP and Agence Française de Développement (AFD), International IRENA, International Solar Alliance (ISA), and SEforALL. In FY2023, the Asian Development Bank (ADB), European Bank for Reconstruction and Development (EBRD), AfDB, and GIZ's program GET. transform also joined. The enhanced partnership will strengthen collaboration and bolster knowledge sharing and capacity building.

During FY2023, funding from SRMI helped complete several projects in Sub-Saharan Africa. Botswana and Namibia finalized their Renewable Energy Deployment Strategies used as technical baselines to support two new World Bank investments for the integration of large renewable energy deployments.

Ghana completed its Energy Transition Program which includes a socioeconomic assessment of proposed transition scenarios. Mali completed a variable renewable energy integration study and a strategic study to support the tendering of 300 MW of solar projects. Zimbabwe finalized its solar PV procurement framework and variable renewable energy integration analysis, which led to the decision to launch a tender with World Bank support. Burundi completed the update of their Transmission and Generation Master Plan which addresses key issues centered around country-wide access to electricity in 2030 and facilitates engagements with private sector developers and investors. This is a step in the right direction as the government builds the capacity of its team working on the financial recovery of REGIDESO, the public utility responsible for water and electricity distribution in the country. To strengthen the Ministry of Energy's and REGIDESO's ownership of this process, the World Bank/ESMAP team held a 4-week capacity building training and tightly monitored progress.

In the Central African Republic, pre-feasibility studies for solar and battery storage mini grid development and for the socio-economic development strategy in the renewable energy sector were completed.

The World Bank approved the Mali Electricity System Reinforcement and Access Expansion Project (MESRAEP) with \$43 million of co-financing from the [Green Climate Fund](#) under the first SRMI-Green Climate Fund Program. MESRAEP aims to support the deployment of 135 MWp of solar generation, 90 MWh of battery storage, leverage \$150 million of private investments and connect around 3.5 million people to the grid.

In Asia, the World Bank approved a new program for results—ISLE-1—with support of SRMI and ESMAP's Energy Storage Program. The Philippines completed

its Energy Transition Policy Note, providing a robust analysis of the pathways to decarbonize the power sector, and Georgia's solar and wind tender was completed in late June 2023 with support from SRMI.

SRMI-supported least-cost generation expansion planning and a variable renewable energy integration analysis informed the World Bank dialogues about

investments in regional energy integration across six countries: Serbia, Montenegro, FYR Macedonia, Albania, Kosovo, and Bosnia and Herzegovina.

In FY2023, ESMAP-SRMI also began work on a position paper identifying the main bottlenecks to be tackled to build a pipeline of bankable renewable energy projects.

BOX 2.17

THE SRMI RESILIENCE FACILITY

SRMI works with the Green Climate Fund (GCF) to accelerate renewable energy deployment by financing targeted public investments and mitigating critical risks holding back renewable energy investments, such as the lack of clear programs to guide the transition to renewable energy or unclear procurement processes. The ultimate goal is to crowd-in private investments for future renewable energy infrastructure. A first program with GCF (\$280 million for seven countries) was approved in FY2021. The the second program, the [SRMI Resilience Facility](#), was approved in FY2023. Here, ESMAP's SRMI blends \$160 million funds from the CGF with \$960 million in World Bank financing to leverage \$1.8 billion in private investments. The facility is designed to support Ethiopia, Guinea Bissau, Indonesia, Kyrgyz Republic, Mongolia, Seychelles, Somalia, Tajikistan, and Tunisia in formulating their energy transition strategies and establishing robust procurement processes to attract private investments for renewable energy infrastructure. The main targets are the deployment of 2.2 GW of new renewable energy projects, 570 MWh of battery storage, and access to electricity for 3.2 million people. During FY2023, projects in two of the nine countries included in the SRMI-Resilience Facility were approved by the World Bank.

In the Kyrgyz Republic, the support for the first phase of the Kyrgyz Renewable Energy Development Project will help enable renewable energy integration by strengthening the country's transmission systems.

In Tunisia, the support for the Tunisia-Italy interconnector (ELMED) project will help link energy grids between Tunisia and Europe and support renewable energy trade that is essential to Tunisia's sustainable development and climate change strategy.

ENERGY STORAGE PROGRAM

“What do we do when the sun doesn’t shine, and the wind doesn’t blow?” This has become the main concern as ever more countries look to transition to renewable energy sources. The fundamental question has held back the expansion of clean energy use, and as a result, too many countries are still exposed to vulnerabilities associated with using fossil fuels for electricity generation.

The answer to the variability of renewable energy generation is energy storage systems, often batteries, that store energy and dispatch it to meet demand at any given time, ensuring uninterrupted energy supply. In this way, governments can take advantage of favorable solar and wind energy prices while relieving fiscal budgets of expensive, often imported, fossil fuel-based energy.

To bolster the adoption of such systems, ESMAP’s Energy Storage Program supports developing countries in deploying energy storage by providing access to concessional finance and technical assistance. Since 2018, the program has mobilized \$850 million in concessional climate funding for battery storage projects. These funds are channeled to countries through development partners such as the [Climate Investment Funds \(CIF\)](#), [Green Climate Fund \(GCF\)](#), and [Canada-World Bank Clean Energy and Forests Climate Finance Facility](#). Moreover, through World Bank-financed projects, the Energy Storage Program has mobilized 5.5 GWh of battery storage capacity commitments in active projects (including mini grids) and has identified 3.7 GWh of capacity in its pipeline.

In 2019, ESMAP also convened the [Energy Storage Partnership \(ESP\)](#) to complement financial support by connecting stakeholders and sharing experiences in deploying energy storage across developing countries. Bringing together now as many as 55 partners worldwide—ranging from research institutions and industry bodies to multilateral development banks,

development groups, and power companies—the ESP helps introduce technological and regulatory solutions to countries and develop business models that leverage the full range of services that storage provides. As part of its mission to smooth the path toward adoption of storage systems, the ESP began work on the report [Unlocking the Energy Transition: Guidelines for Planning Solar-Plus-Storage Projects](#). Launched at COP28 in December 2023, it features a toolkit and framework for planning and implementing utility-scale solar-plus-storage projects while leveraging private investments.

Another ESP focus during FY2023 was to provide clients with training and capacity-building opportunities for energy storage to enhance their institutional capacity. The ESP inaugurated the Virtual Energy Storage Academy (VESA) in June 2023 during the ninth Partners Meeting in Leicestershire, UK. VESA aims to provide an Open Online Course platform for all energy storage practitioners. Three modules were presented: (1) e-mobility integration into mini grids; (2) energy storage for solar mini grids; and (3) policy and regulatory considerations to deploy battery energy storage systems (BESS) in developing countries. The program is currently working with the Indian Energy Storage Alliance (IESA) on two additional modules on Long Duration Energy Storage (LDES) and BESS Safety Guidelines.

ESP is also committed to closing gender gaps in the energy storage sector. A second cohort of mentees participated in the [Women in Energy Storage \(WES\) Mentoring Program](#) during FY2023, focusing on career development and improving knowledge of thermal energy as well as various battery storage applications.

The number of countries with which the World Bank engaged on battery storage increased significantly during FY2023, from 27 to 39. Also, during the fiscal year, the Central African Republic, India, South Africa, and West Africa started work on World Bank-funded BESS projects (for details on West Africa, see Box 2.18).

The Energy Storage Program directly and indirectly informed six projects in FY2023. In Indonesia, the program worked to improve access to sustainable and lower-cost electricity in the country's Maluku and Nusa Tenggara regions and enhance the operational capacity of the national electricity utility. This will lead to an additional installed capacity of 600 MW in renewable energy and 320 MWh of battery storage capacity.

In Kenya, the program is supporting the country's battery storage assessment, which has identified the requirement for 400 MWh of battery energy storage systems in multiple sites, primarily for load shifting (reducing venting of geothermal energy during off-peak) and for ancillary services.

BOX 2.18

REGIONAL EMERGENCY SOLAR POWER INTERVENTION PROJECT

The \$311 million Regional Emergency Solar Power Intervention Project (RESPITE), approved in December 2022, seeks to rapidly boost grid-connected renewable energy capacity in Chad, Liberia, Sierra Leone, and Togo to mitigate the impact of high electricity costs and strengthen regional integration.

ESMAP's [Energy Storage Program](#) is supporting RESPITE's implementation by facilitating knowledge sharing between the four participating countries and the West African Power Pool (WAPP). The exchange is on enabling private sector participation and solar and BESS projects procurement that can lead to rapid market regional development, attracting international players.

Progress on RESPITE is promising, with the Regional Coordination Unit established; ongoing bid processes for solar PV and BESS in Chad, Liberia, and Sierra Leone; and BESS assessments moving forward in Chad, Sierra Leone, and Togo. These assessments will inform the preparation of operation and maintenance procedures for plant construction.

Looking ahead, the work program for the next fiscal year remains on track, supporting contract awards in Chad, Liberia, and Sierra Leone, along with procuring supervisory engineers and preparing essential documents. RESPITE has the potential to pave the way for a more sustainable and affordable energy sector, contributing to the ambitious expansion of clean energy generation in West Africa.

INNOVATIVE SOLAR

Harnessing the sun's power can be one of the easiest ways to connect people and businesses to renewable energy in low-income countries with inadequate electricity access. However, a combination of cost and lack of appropriate technology often inhibits the deployment of solar energy, depriving individuals, households, and businesses of its transformative impact.

ESMAP's [Innovative Solar](#) Program was designed to broaden the scope of solar energy deployment by improving the awareness and adoption of innovative grid-connected solar concepts and business models. The program extends beyond the regular large-scale, ground-mounted solar PV projects and explores innovative solutions such as distributed solar either installed on rooftops or floating on water. It also supports combining solar power with other technologies like hydropower, solar-based water pumping for agricultural purposes, solarization of water utilities, solar charging for electric vehicles, agrivoltaics, and solar-based desalination.

ESMAP provides technical assistance for conducting economic assessments based on data analytics and tools or pilot business models. It builds capacity around policy and regulatory frameworks and mobilizes financing, such as lending, investment, and concessional climate finance.

In Cameroon in FY2023, the Innovative Solar team provided technical assistance to explore developing floating or ground-mounted solar PV at the Lom Pangar and Memve'ele hydropower plants. These pre-feasibility studies will also inform additional components of the larger hydropower project on the country's Sananga River.

In Tanzania, ESMAP continued to support the country's two power supply utilities—the Tanzania Electric Supply Company Limited and Zanzibar Electric Corporation—in examining opportunities

to introduce distributed PV across different customer segments.

In Timor Leste, the Innovative Solar Program provided a grant to support the country's health care facilities and enhance cold chain storage by using solar energy. The grant funds an energy audit of primary health care facilities with the goal of introducing rooftop solar PV and climate-resilient construction practices for new municipal hospitals.

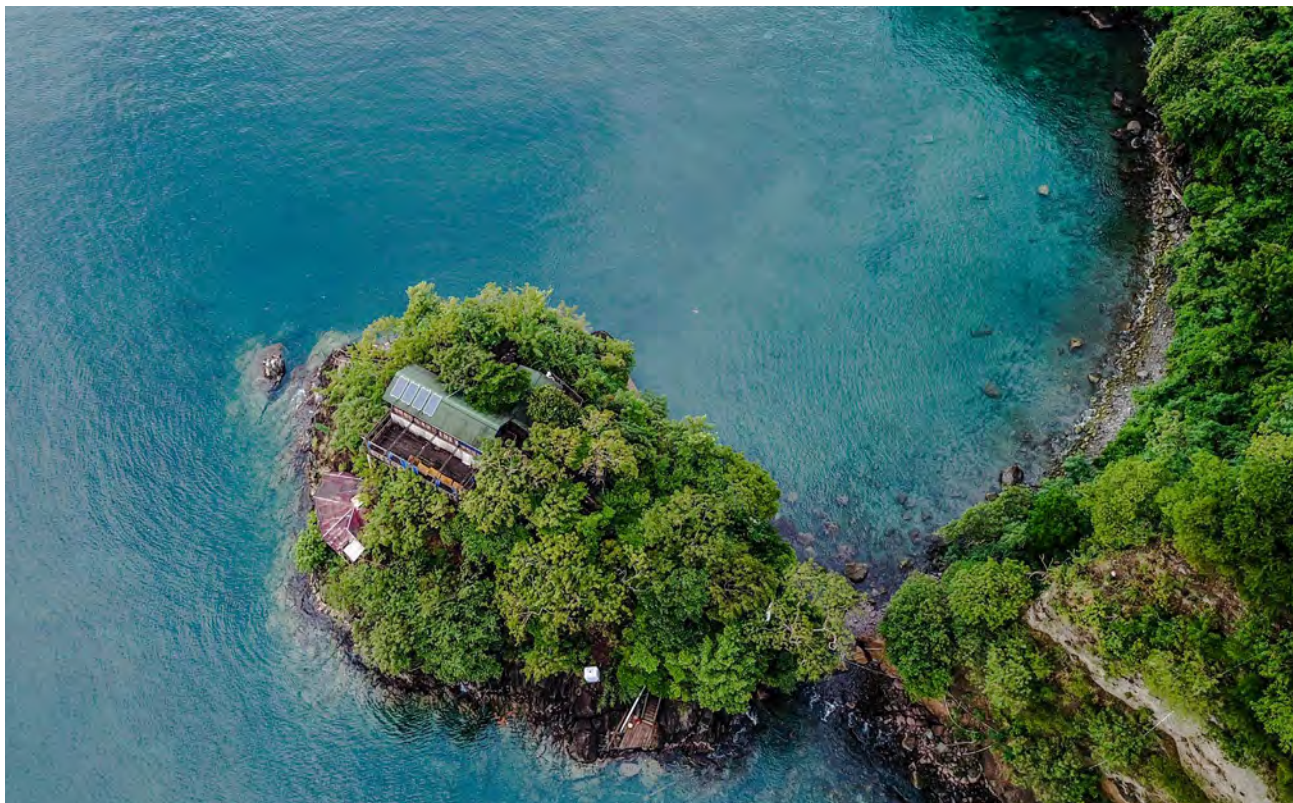
During FY2023, the program continued to produce reports and papers on innovative solar technologies. Two key reports were released to provide information for policymakers, regulators, and utility operators. The [Power Systems and Distributed PV](#) report addresses the technical challenges of integrating high shares of PV to the grid. The [Distributed Photovoltaics Economics and Policy](#) report completes the [From Sun to Roof to Grid](#) report series and highlights the cost-benefit analysis, regulatory issues, and business models of distributed PV.

Also in FY2023, ESMAP launched a new phase of its [Solar Rooftop PV Potential Mapping Tool](#). This powerful mass simulation tool uses satellite imagery and a user-friendly map viewer to chart and calculate the potential electricity generation from rooftop PV installations on individual buildings for entire cities. The tool also helps energy system planners, city authorities, and solar installers/developers calculate the aggregate rooftop PV potential per building type (commercial, industrial, public, or residential). It also computes building-level system sizes, electricity generation potential, roof angles, slopes, and configurations. After a successful pilot phase, a two-phase expansion program has been launched. The first phase, initiated in FY2023, consists of transitioning through cities in small batches and preparing training to decentralize the use of this sophisticated tool to local consultants for a second phase of scaling-up via open access. By the end of FY2023, the tool had been used to map the rooftop PV potential of a total of 20 cities in 17 countries.



WORKING IN TÜRKIYE TO ENHANCE THE GOVERNMENT'S CLIMATE AND AGRICULTURE AGENDA

In FY2023, the [Innovative Solar](#) Program provided a grant for the government in Türkiye to understand the business models required to support the deployment of solar irrigation systems. This includes the effective use of tools and measures to regulate the extraction of water, identifying the role of the private and public sectors and highlighting the range of schemes that can be used to promote the uptake of solar irrigation on a different scale. The information will be an essential component to provide justification for future investment and expansion of the ongoing Türkiye Climate Smart and Competitive Agricultural Growth Project. It will also inform the government's role in expanding future solar irrigation investments. The grant is essential in generating evidence on the important impact that solar irrigation schemes can have on climate mitigation and adaptation and ultimately inform the dialogue with the country's Ministry of Agriculture on the nexus between climate and agriculture.



SUPPORTING ENERGY EFFICIENCY AND RENEWABLE ENERGY ACTIVITIES IN GRENADA

In FY2023, the [Innovative Solar](#) team continued work in Grenada to support the implementation mechanism and time-bound action plan for accelerating energy efficiency and distributed renewable energy in residential, commercial, public, and industrial buildings. The team completed surveys designed to provide an overview of the island nation's energy use and the potential for energy saving with energy efficiency and distributed renewable energy. This generated a list of recommendations to implement energy savings strategies that include the installation of rooftop solar photovoltaics on each building on the island. A new regional initiative was established to provide technical assistance to the Caribbean nations on advancing their national and regional sustainable energy targets. Grenada is the first of the four island nations covered in the initiative to launch activities, and the government is working to prepare new regulations to galvanize action toward recovery and building multi-dimensional resilience, including climate resilience and private and public sector resilience.

OFFSHORE WIND

One-quarter of the world's offshore wind potential is located off the coast of developing countries. However, significant challenges, such as high upfront development costs, have been barriers to realizing this massive potential. Addressing these challenges is critical to harnessing the offshore wind resource and providing cost-competitive, clean, and secure large-scale energy to people in developing countries while also generating significant socioeconomic benefits.

ESMAP's [Offshore Wind Development](#) Program is a unique collaboration with the World Bank's IFC to support emerging market governments and other stakeholders in the deployment of offshore wind. In setting the program's objectives and in executing them, ESMAP and IFC work in lockstep, simultaneously considering both the public and private sectors' implications and needs of all projects. The program also collaborates with the private sector through the Global Wind Energy Council (GWEC), connecting with the international offshore wind industry and providing market insights to client countries. This collaboration has been critical to the program's success, as it has broadened understanding of private sector requirements to catalyze the growth of offshore wind in emerging markets. Activities of the joint ESMAP/IFC program are ongoing in more than 20 countries, from large emerging market economies like India and Vietnam to small island developing states like Fiji and St. Lucia.

During FY2023, the Offshore Wind Development Program's activities continued to help governments with developing strategic country roadmaps and provide technical assistance to support other priority actions. Nine countries—[Azerbaijan](#), Brazil, Colombia, India, [the Philippines](#), South Africa, [Sri Lanka](#), Türkiye, and [Vietnam](#)—have received grants to develop a country roadmap, which is a toolkit of recommendations for governments to unlock their offshore wind potential.

Brazil's offshore wind development activities reached an important milestone, with more than

70 applications submitted to establish the country's first offshore wind site. Achieving this was made possible by ESMAP's assessing the offshore wind potential and a \$300,000 grant for a roadmap study. This laid the groundwork for and galvanized interest in offshore wind as a new potential source of renewable energy in the country and an important new market for the industry.

In Colombia, ESMAP worked with the newly elected government to conduct technical training workshops for all key players involved in building the necessary policies, frameworks, regulations, and infrastructure to deploy offshore wind. ESMAP also led on the baseline activities required to carry out a regulatory study examining the requirements of ports to manage the logistics of offshore wind construction and operation.

In India, the program continued work on the offshore wind roadmap study that began in 2020. This involved providing support to the country's Ministry of New and Renewable Energy for the development of a strategic document to focus on the timeline for deploying offshore wind by 2030, in line with the country's renewable energy targets.

Sri Lanka's recent economic crisis has heightened the urgency to explore renewable energy sources to reduce dependence and costly spending on fuel imports. The government's target is to increase the country's renewable energy uptake by 70 percent by 2030, and offshore wind could play a role in achieving this goal. In FY2023, ESMAP provided a \$350,000 grant to conduct pre-feasibility studies on priority sites identified in an August 2023 roadmap.

Scoping studies began in the Dominican Republic, Namibia, Panama, and Ukraine to identify opportunities for offshore wind development and provide country grants for the development of roadmaps. ESMAP's program also conducted country-level studies and offered technical assistance to support the regulatory reform needed for governments to establish market conditions to plan and upgrade grid networks.

The program has also focused on capacity building and knowledge exchange for policymakers at different stages of emerging markets' offshore wind journey. One key initiative was a 10-day study tour with 32 high-level government officials from 15 client countries. The tour brought participants to the Netherlands, Germany, and Denmark to visit offshore wind manufacturing sites, projects, and ports, as well as engage in meetings and workshops with industry and government representatives in these countries. The study tour was a valuable opportunity to understand firsthand how offshore wind markets and projects develop and to exchange knowledge among client countries on addressing common challenges.

Finally, the ESMAP team continued work on a study examining [the role of concessional climate finance in accelerating the deployment of offshore wind in emerging markets](#). The team also continued its outreach and dissemination activities at global industry events and in trade publications to inform key stakeholders of the importance of deploying offshore wind in emerging markets and best practices.

HYDROPOWER DEVELOPMENT FACILITY

Hydropower—the use of waterpower to generate energy—is today the biggest source of renewable energy and will continue to play a pivotal role in achieving universal access to electricity. It also helps facilitate the transition to renewable energy by complementing the growing use of solar and wind energy. Solar and wind are low carbon energy sources, but due to their nature, only available intermittently. By adding the steady flow of hydropower to the mix, renewable power systems become more reliable and resilient. In fact, the [International Energy Agency](#) estimates that hydropower is needed to deliver flexible services while achieving net-zero emission targets.

The ESMAP [Hydropower Development Facility](#) helps developing countries harness hydropower's energy

in a sustainable manner. It helps build a pipeline of projects, devise implementation strategies, and identify and mitigate risks associated with hydropower development. The program supports upgrading existing hydropower facilities and constructing new plants. It also helps analyze whether and how to integrate hydropower with variable renewable energy into power systems.

During FY2023, ESMAP's Hydropower Development Facility provided a grant to support the Liberia Electricity Corporation in selecting a contractor to oversee the repairs for the Mt. Coffee Hydropower Plant. This was combined with a comprehensive analysis of existing studies to expand this and the St. Paul 2 Hydropower Plant. Based on the analysis, the grant helped develop a strategic plan for the government and the corporation with well-defined milestones to move the project forward.

In Mozambique, ESMAP provided support to evaluate opportunities to add hydropower capacity by bringing the 1,500 MW Mphanda Nkuwa project onstream and rehabilitating the Cahora Bassa plant. Activities included an assessment of the financial, social, environmental, and biodiversity impacts and an evaluation of the hydrology and climate resilience of the newly constructed dam.

In the Solomon Islands, ESMAP supported the Tina River project with a \$50,000 grant and technical support. The project is designed to provide more than half of the Pacific island's power.

In support of Bhutan's hydropower development, the ESMAP Hydropower Development Facility granted \$1.5 million in technical assistance for preparing the Upper Dorjilung project with an expected installed capacity of 1,125 MW. The government of Bhutan has asked the World Bank to finance the project. Large-scale hydropower projects have helped ease government budgetary pressure and allowed more investments in human and physical capital, significantly improving delivery of government services and enhancing educational and health programs.

The facility continues to support an evaluation of ways to increase the Brazil power sector's reliability and flexibility, ensuring availability of power and improving the country's climate resilience. A \$400,000 grant in FY2023 will aid exploring barriers to hydropower rehabilitation and help upgrade and conduct pre-feasibility studies for modernizing different sizes of hydropower plants.

In terms of knowledge products, the team during FY2023 investigated how hybrid hydropower plants—those that combine hydropower with storage as well as solar- and wind-generated energy—can play a crucial role in evolving power systems toward ever more use of renewables (particularly wind power and solar PV) while replacing fossil fuels.

One of the main motivations for hybrid hydropower plants is to provide readily dispatchable energy while using resources in the most optimal way through a capable and flexible power system. The investigation provides insights into the different types of hybrid plants, their capabilities, and how to enhance them to meet the demands of an evolving power system.

The Hydropower Development Facility also financed the analysis of women's employment in the hydropower industry in FY2023. The resultant report, [*Power with Full Force: Getting to Gender Equality in Hydropower*](#), published in FY2024, already has improved the industry's understanding of gender diversity and the barriers women face in the sector.

BOX 2.21

ENHANCING THE MACROECONOMIC ENVIRONMENT IN TAJIKISTAN WITH HYDROPOWER

A \$400,000 grant in Tajikistan has shown how an initially small ESMAP intervention can spur follow-on World Bank financing and advice with outside impact.

The ESMAP grant helped identify gaps in the technical, environmental, social, and commercial framework of the Rogun hydropower project (3340 MW). The closing of these gaps was a prerequisite for international financial institutions and the private sector to consider investing in the project. This analysis led to a \$15 million IDA grant for technical assistance in FY2023 and \$50 million in grant financing for a Development Policy Operation to promote structural reforms aimed at accelerating sustainable economic growth and mitigating economic vulnerabilities.

The reforms supported by the Development Policy Operation will also help improve the macroeconomic environment for the Rogun hydropower plant development. The World Bank is expected to approve \$500 million in IDA funding in addition to mobilizing \$5.6 billion in financing from third parties for the construction of the power plant in FY2024. The total estimated capital expenditure to complete construction is about \$6.1 billion.

SECTION II OUR IMPACT IN FY2023

ASSOCIATED TRUST FUNDS



CARBON CAPTURE AND STORAGE TRUST FUND

Carbon capture, utilization, and storage (CCUS) is a set of technologies that capture carbon dioxide (CO₂) from point sources, such as large manufacturing facilities, or directly from the air and then transports the CO₂ either to a point of use or to permanent geologic storage. The technologies are an integral part of energy transitions to net zero carbon systems and thus can help developing country governments meet their national and international climate change commitments.

Since 2009, the **Carbon Capture and Storage (CCS) Trust Fund**—an associated trust fund under the ESMAP umbrella since FY2021—has been working with governments to develop the enabling environments needed for technology-based carbon management. The trust fund has allocated more than \$30 million to support activities across several regions, and during FY2023, donors extended the trust fund to August 2024.

The importance of carbon management underpinned by carbon capture, utilization, and storage technologies has been increasingly recognized in recent years. The inclusion of CCUS in several World Bank documents reflects this trend. Country Climate and Development Reports and many developing countries' National Determined Contributions are among them. This development also made an extension to the CCS Trust Fund necessary. In FY2023, new support was allocated to work in India and ongoing activities in Egypt, Nigeria, South Africa, and Timor Leste.

In South Africa, the Carbon Capture and Storage Trust Fund activities were restructured and extended to accommodate changes in the site of the planned pilot. Also, the Council for Geosciences, the organization in charge of implementing the pilot activities, conducted an airborne electromagnetic survey and other CO₂ storage site characterization.

In Egypt, the CCS Trust Fund supports work to identify a national carbon capture, utilization, and

storage strategy and scope legal and regulatory considerations. As part of this work, the fund led training activities on technology-based carbon management, including a regional workshop. In April 2023, the *Advancing Industrial CCS Hubs and Developing an Enabling CCS Framework* study was launched. The study is the first in a series and centered around the four industrial hubs in the country. It highlights near-term actions underpinning the development of carbon capture and storage-enabling environments and carbon capture, utilization, and storage hubs, including developing a financing mechanism for technology-based carbon management. This is expected to have a positive impact on plans to unlock the regional potential for greening industrial zones and introduce new lines of revenue streams by creating low carbon products.

The Carbon Capture and Storage Trust Fund also supports an IFC engagement with the government in Timor Leste to explore options for establishing a CO₂ storage hub that will contribute to regional decarbonization efforts. Specific activities include legal and regulatory support and capacity building. A three-day training workshop was held with relevant government stakeholders during which participants discussed carbon capture and storage technologies, upgrade costs, and global project case studies. Additional activities will focus on unlocking investment opportunities for up to \$250 million to fund the capital expenditure program for the Bayu-Undan CCS project. The purpose is to accelerate the deployment of CO₂ storage in the Asia Pacific region and to demonstrate that CO₂ storage resources can provide revenue streams that support economic development.

World Bank analyses have shown that India needs adequate technology-based carbon management to be able to meet its net zero target by 2070. The CCS Trust Fund supports a set of activities focused on scoping a carbon capture, utilization, and storage policy framework, developing an approach for potential hubs and clusters, and qualifying the role of carbon utilization in India's net zero transition. This work will complement other ESMAP-supported

industrial decarbonization work in India. It will also result in a series of reports that the government can use to achieve deep decarbonization of the industrial sector.

The Carbon Capture and Storage Trust Fund also supports the creation of insightful knowledge products that can enhance the development of this

niche sector. In FY2023, a study on [Decarbonizing Natural Gas Using CCUS Technology](#) was released. It focuses on the importance of understanding the need for carbon capture and storage in natural gas production and use to meet global climate mitigation goals. It includes high-level country studies on the potential for carbon capture and storage to be applied to natural gas activities in several regions.

BOX 2.22

CATALYZING INDUSTRIAL CARBON CAPTURE, UTILIZATION, AND STORAGE IN NIGERIA

Since FY2022, the **Carbon Capture and Storage Trust Fund** has supported IFC-implemented work in Nigeria designed to develop an enabling environment for technology-based carbon management in the country. The activity focuses explicitly on carbon capture, utilization, and storage deployment in Nigeria's industrial sector. In FY2023, the program finalized a high-level assessment of the country's CO₂ storage potential and defined two prospective CCUS project concepts. The two concepts, one in cement and one in fertilizer, are projects across the entire chain (including capture, transport, and storage) and of demonstration scale (1-2 Mt CO₂ per year). If developed, they could serve as examples of industrial carbon capture, utilization, and storage projects in Africa. The results of the assessments were compiled in a report and disseminated in a series of workshops to enhance knowledge transfer and capacity development. One key outcome of this activity is the government's recent decision to establish a Carbon Capture, Utilization, and Storage Center of Excellence within the Nigeria Geological Survey Agency. The government shared their plans for the center at the final capstone in-country workshop hosted by IFC. The workshop, in October 2023, convened representatives from Nigeria's public and private sectors and international CCUS experts.

SMALL ISLAND DEVELOPING STATES (SIDS) DOCK

As the world tackles the threats posed by the rapidly changing climate, smaller island nations are most vulnerable to extreme weather. This is compounded

by small island developing states' reliance on imported petroleum products to meet their energy needs. Such dependence is not only problematic from a climate perspective but impacts residents' livelihoods as well, since constant fluctuations in oil and gas prices can destabilize their economies. The

abundance of solar, wind, ocean, geothermal, and biomass resources in these countries enables them to pursue energy efficiency and renewable energy alternatives to fossil fuels.

ESMAP's [Small Island Developing States \(SIDS\) DOCK Support](#) program is a \$22.1 million initiative, launched in 2011, to assist member countries of the Alliance of Small Island States (AOSIS) to transform their energy sectors and efficiently adapt to climate change. The program, funded by the Danish and Japanese governments, is designed to create the 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 potential for scale-up through climate finance and other sources of finance.

The program has mobilized \$309 million of funding for small island developing states such as Comoros,

Dominica, the Maldives, the Marshall Islands, São Tomé and Príncipe, St. Lucia, and Tuvalu. This has led to the generation of 98.1 MW of new renewable energy capacity in these island nations and 75 MWh of new battery energy storage systems.

During FY2023, the program helped the Comoros improve the electricity supply in health care facilities by purchasing and installing equipment, providing relevant training sessions, and coordinating routine maintenance for solar panels.

The team's technical support has been integral to advancing the solar PV agenda in the Maldives. Activities have been conducted under the country's Accelerated Renewable Energy Integration and Sustainable Energy (ARISE) project, which finances battery energy storage installations connected to solar PV. In FY2023, the 40 MWh battery storage project was signed to be installed on the outer islands.

BOX 2.23

REDUCING THE PACIFIC ISLANDS' VULNERABILITY TO EXTREME CLIMATE EVENTS

In FY2023, ESMAP's [Small Island Developing States DOCK](#) program funded the Regional Sustainable Energy Industry Development Project, which operationalized the Pacific Power Disaster Assistance Program, designed to enhance the energy resilience in the eight Pacific Island countries: Marshall Islands, the Federated States of Micronesia, Nauru, Palau, Papua New Guinea, Solomon Islands, Tuvalu, and Vanuatu. The Pacific Power Disaster Assistance Program assessed the islands' energy infrastructure's vulnerability to potential natural disaster risks during extreme weather and climate events. It also prepared investment programs to provide technical guidance on the engineering solutions required to increase the resilience of energy installations. Fourteen utilities in the Pacific Island countries signed memoranda of understanding as part of a purchasing power agreement. Also, a wind resource mapping activity was completed at seven out of nine measurement sites.

A blue-tinted close-up photograph of several people's faces looking towards the camera. The image is a collage of faces, with some looking directly at the viewer and others looking slightly away. The lighting is soft, and the overall mood is professional and collaborative.

SECTION III

FINANCIAL REVIEW

This chapter summarizes the FY2023 financial information of the ESMAP Umbrella Trust Fund Program, anchor, and its associated trustee accounts.

CONTRIBUTIONS

In FY2023, ESMAP received \$98.7 million from 6 donors. Table 3.1 presents actual receipts in FY2023 from individual donors for ESMAP and cumulative receipts during FY2017-23. Table 3.2 indicates cumulative pledges and receipts of associated trust funds to ESMAP.

Table 3.1. Donor Contributions to ESMAP, FY2017-23 (\$ thousands)

Country	FY2023 Contribution Paid-In & Receivables		ESMAP FY2017-23	
	ESMAP	Cumulative Pledges	Cumulative Receipts	Cum. Receipts over Cum. Pledges
Austria		4.154	4.154	100%
Canada				
Department of Foreign Affairs, Trade and Development		2.298	2.298	100%
Department of Environment and Climate Change	18.314	18.264	1.873	10%
ClimateWorks Foundation		3.100	3.100	100%
Denmark		46.456	46.456	100%
EU		14.252	7.298	51%
Finland		144	144	100%
France		1.222	1.222	100%
Germany				
- BMU		19.734	19.734	100%
- BMZ (Federal Ministry for Economic Cooperation and Development)	1.201	7.331	6.136	84%
Global Energy Alliance for People and Planet (GEAPP) LLC	50.000	50.000	15.000	30%
Iceland		4.517	4.517	100%
Italy				
- Ministry of Ecological Transition		10.980	7.720	70%
- Ministry of Foreign Affairs and International Cooperation		6.054	6.054	100%
Japan	15.000	15.000	15.000	100%
Luxembourg		1.124	1.124	100%
Netherlands		75.878	65.878	87%
Norway				

> Continued

> Continuation of Table 3.1

Country	FY2023 Contribution Paid-In & Receivables		ESMAP FY2017-23	
	ESMAP	Cumulative Pledges	Cumulative Receipts	Cum. Receipts over Cum. Pledges
- MFA		4.773	4.773	100%
- Norad		81.925	64.519	79%
Rockefeller Foundation		1.650	1.650	100%
Spain		7.088	7.088	100%
Sweden	12.149	68.785	53.353	78%
Switzerland				
- SDC		3.374	3.374	100%
- SECO		27.749	27.749	100%
United Kingdom				
- BEIS		74.893	68.678	92%
- FCDO	2.074	76.077	68.916	91%
World Bank				
Grand Total	98,7	626.822	507.808	

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

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

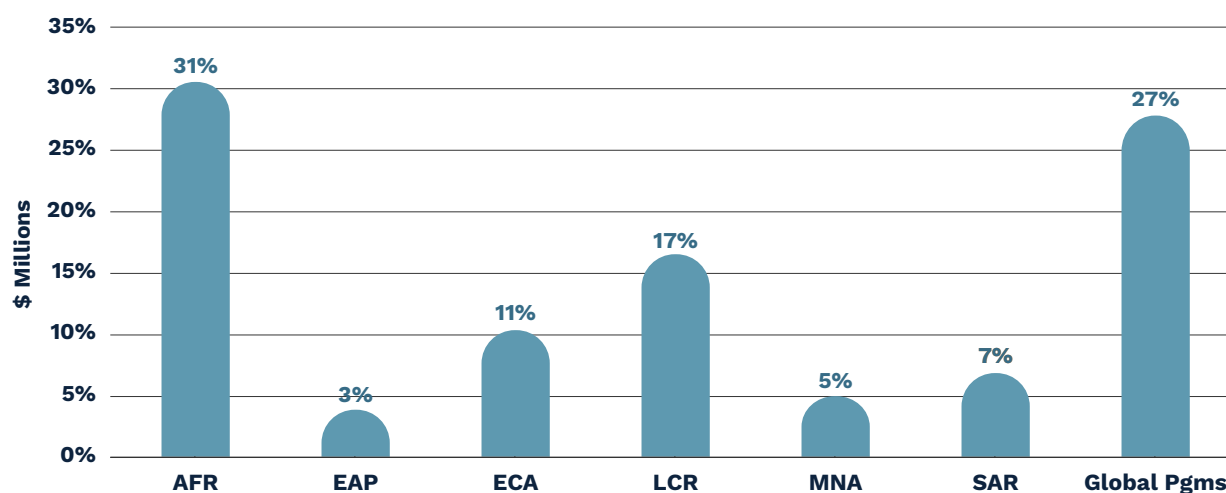
Associated Trust Fund	Donor Country	Cumulative Pledges	Cumulative Receipts	Cum. Received over Cum. Pledges
Advancing Regional Energy Projects (AREP) in Africa	Sweden	17.446	17.446	100%
	Norway	18.313	18.313	100%
	United Kingdom	40.759	40.759	100%
Carbon Capture and Storage (CCUS)	Global Carbon Capture and Storage Institute, Ltd.	2.173	2.173	100%
Support for Small Island Developing States (SIDS DOCK)	Denmark	7.093	7.093	100%
	Japan	15.000	15.000	100%
Support to Regional Off-Grid Electrification Project (ROGEP)	Netherlands	44.000	16.000	36%
Support to Electricity Sector Modernization and Sustainability Project (KEMS) in Kyrgyz Republic Single-Donor Trust Fund	Swiss State Secretariat for Economic Affairs (SECO)	13.160	4.146	32%
Support to Energy Access and Quality Improvement Project (EAQIP) in Rwanda	Denmark	3.796	3.796	100%

DISBURSEMENTS

ESMAP disbursed about \$77.3 million in FY2023, a 45 percent increase compared to the amount disbursed in FY2022. The total disbursements for the associated trust funds, SIDS DOCK, AREP, CCUS,

ROGEP, EAQIP, and KEMS amounted to about \$5.9 million. By the end of 2023, the total cumulative disbursement reached \$185.7 million, increasing by 70 percent compared to FY2022. The following figures and tables present FY2023 breakdown of disbursements by region.

Figure 3.1. ESMAP Disbursements and Percentages, by Region, FY2023 (\$ million)



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), two global RETFs—COVID-19 Energy Access Relief Fund (\$2.2M) and Quality Assurance Capacity Building for the Off-Grid Solar Sector (\$0.6M); China Energy Transition Program (TF0B9540) (0.1M); and St Lucia-Renewable Energy Sector Development FCDO Grant (TF0B5992, \$4.2 M).

Table 3.3. ESMAP Disbursements, by Region and Program Management, FY2023 (\$ thousands)

Region	\$ Thousands
AFR	23,649
EAP	2,304
ECA	8,225
LCR	13,494
MNA	3,482
SAR	5,092
Global Programs	17,829
Total	74,076
Administrative Unit	Sum of FY Thematic Disbursement
Program Management and Administration	3,265
Total	3,265
Grand Total	77,341

**Table 3.4. ESMAP and Associated Trust Funds Disbursements, by Region, FY2023
(\$ thousands) (New)**

Region	ESMAP	AREP	CCS	ROGEP	KEMS	SIDS	Total
AFR	23,649	3,791	804	161			28,405
EAP	2,304		15			610	2,929
ECA	8,225				150		8,375
LCR	13,494		0			24	13,518
MNA	3,482		148				3,630
SAR	5,092		0			16	5,108
Global Pgms	21,094		194			1	21,290
Total	77,341	3,791	1,162	161	150	651	83,255

Figure 3.2. ESMAP and Associated Trust Funds Disbursements, by Program Area, FY2023 (\$ thousands)

