ESMAP

ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAM

ANNUAL REPORT 2021

THE WORLD BANK
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ABOUT ESMAP

The Energy Sector Management Assistance Program (ESMAP) is a partnership between the World Bank and 22 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

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TABLE OF CONTENTS

SPECIAL SECTIONS

ABBREVIATIONS

ADELE	Access to Distributed Electricity and Lighting in Ethiopia
AREP	Advancing Regional Energy Transformational Projects
BEIS	UK Department for Business, Energy & Industrial Strategy
BESS	battery energy storage system
CCF	Clean Cooking Fund
CCUS	capture, utilization, and storage
CIF	Climate Investment Fund
CTF	Clean Technology Fund
EAPP	East African Power Pool
EARF	Energy Access Relief Fund
EnDev	Energising Development
ESP	Energy Storage Partnership
ESRF	Energy Subsidy Reform Facility (ESMAP initiative)
FCDO	UK Government Foreign, Commonwealth and Development Office
FDP	forcibly displaced person
FY	fiscal year
GCF	Green Climate Fund
GDU	Geothermal Direct Use
GERI	Global Electricity Regulatory Index
GEP	Global Electrification Platform
GFMG	Global Facility on Mini Grids
GIS	geographic information system
GW	gigawatt
GWEC	Global Wind Energy Council
GWh	gigawatt hours
HDF	Hydropower Development Facility
HEPA	Health and Energy Platform of Action
HLDE	High-Level Dialogue on Energy (United Nations)
IDA	International Development Association
IEA	International Energy Agency
IFC	International Finance Corporation
ILHC	Improving Livelihoods and Human Capital
IRENA	International Renewable Energy Agency
km	kilometer
MARCOT	Electricity Markets, Grid Connectivity and Regional Trade
MDTF	multi-donor trust fund
Mtce	million tons of coal equivalent
MTF	Multi-tier Framework
NEGU	National Electric Grid of Uzbekistan
NEP	Nigeria Electrification Project
PV	photovoltaics (solar)
RBF	Results-based Financing
RISE	Regulatory Indicators for Sustainable Energy
ROGEP	Regional Off-Grid Electrification Project
SAPP	South African Power Pool
SDG	Sustainable Energy Goals
SEforALL	Sustainable Development for All (ESMAP initiative)
SIDS	Small Island Developing States
SRMI	Sustainable Renewables Risk Mitigation Initiative
STEM	Science, Technology, Engineering, and Mathematics
TW	terawatt
UN	United Nations
UNHCR	United Nations Refugee Agency
VRE	variable renewable energy
WB / WBG	World Bank / World Bank Group
WePOWER	Women in Power Sector Network in South Asia
WHO	World Health Organization

All currency in United States dollars ($, USD), unless otherwise indicated.

WORLD BANK REGIONS

AFR	Sub-Saharan Africa
EAP	East Asia and Pacific
ECA	Europe and Central Asia
LCR	Latin American and the Caribbean
MNA	Middle East and North Africa
SAR	South Asia

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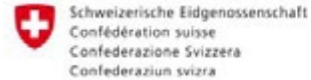
Education and Research EAER
State Secretariat for Economic Affairs SECO


Schweizerische Eidgenossenschaft
Confédération suisse
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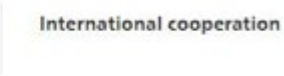
Confederaziun svizra


International cooperation


UKaid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SECTION I

ESMAP AT A GLANCE

Photo © lovelyday12 / Getty Images

ESMAP AT A GLANCE

WHAT

The Energy Sector Management Assistance Program (ESMAP) is a partnership between the World Bank and 22 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 World Bank Group strategies and programs to achieve the World Bank Group Climate Change Action Plan targets.

HOW

- Provides grants and technical support to countries through World Bank Group operational units
- Maintains an active portfolio of about $176.3 million, with FY2019–21 average annual disbursements about $39.6 million
- Delivers key global knowledge products deployed for country engagements
- Develops external partnerships with international organizations, research & development institutions, and industry associations
- Collaborates across World Bank Group regional Energy units and sectors, such as Transport, Urban, Water, Health, and Gender
- Mobilizes donor resources for Bank-Executed Activities (co-financing IBRD and IDA operations). ESMAP raised $330 million for Business Plan FY17-20

ESMAP Business Plan FY2021-24 Structure

Achieving Universal Access by 2030 (SDG 7)

Achieving decarbonization across the energy sector in support of international commitments on climate change

Clean Cooking Fund	Electricity Access	Renewable Energy	Accelerating Decarbonization
Country/Regional Investment Program	Integrated Electrification Strategies and Planning	Energizing Renewables	Zero Carbon Public Sector
Knowledge, Innovation and Policy Coordination	Global Mini-Grids Facility	Energy Storage	Industrial Decarbonization
	Off-grid Solar	Innovative Solar	Efficient and Clean Cooling
	Leave No One Behind	Offshore Wind	Geothermal Direct Use
	Improve Livelihoods and Human Capital	Hydropower Development Facility	Green Hydrogen
	Financial Innovation for Energy Access		

Foundations for the Energy Transition	Utilities for the Energy Transition • Energy Markets, Connectivity and Regional Trade • Energy Subsidy Reform Facility Closing Gender Gaps in Energy • Supporting Coal Regions in Transition
Energy Data Analytics	Tracking SDG7 • Regulatory Indicators for Sustainable Energy • Multi-Tier Energy Access Tracking Framework Regulatory Benchmarking Project • Global Electrification Platform • Demand Estimation

ESMAP BUSINESS PLAN FOR FY2021–24

The ESMAP Business Plan for FY2021–24 lays out our programs and our progress toward the overarching twin objectives of 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. Pursuant to these objectives, ESMAP works within four overarching interlinked programs, which focus on Clean Cooking, Electricity Access, Renewable Energy, and Decarbonization and are underpinned by two cross-cutting programs: Foundations for the Energy Transition and Energy Data and Analytics. Developed during the COVID-19 crisis, the ESMAP Business Plan also draws on the conclusions and recommendations of the External Evaluation.

The overall budget target for the ESMAP Business Plan FY2021-24 was initially set for $1.3 billion, of which $540 million would be for Bank-executed activities (primarily advisory services and analytics) and $740 million for recipient-executive grants (primarily co-financing IBRD/IDA operations). The largest components of the $740 million are $450 million for the Clean Cooking Fund; and about $100 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.

In Section I, this annual report articulates how ESMAP worked toward implementing its business plan in FY2021 (July 1, 2020–June 30, 2021), during global challenges of great magnitude, including the COVID-19 pandemic, the growing need for action to limit global warming to 1.5° Celsius, and the need to scale up efforts significantly to meet the UN Sustainable Development Goal 7 (SDG 7) targets by 2030. Section II follows the structure of the new 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.

CONTEXT

This year has provided an extraordinary set of challenges for the start of ESMAP's four-year business plan. The unrelenting persistence of the COVID-19 crisis has produced repetitive cycles of life/work disruption, devastating health impacts, and major economic distress. Developing countries have been especially impacted and face the prospect of tragic reversals. Concurrently, there has continued to be an urgent need to decarbonize our energy systems, to limit the global temperature rise to 1.5° Celsius, and to achieve universal access to basic services—2.6 billion people still live without clean cooking and nearly 760 million people live without access to electricity. These issues remain critical for people's lives and the future of our planet.

Governments in developing countries, understandably, have been under immense pressure to steer their countries toward economic recovery from the COVID-19 crisis. This crisis has amplified the criticality that recovery and growth are sustainable, resilient, affordable, and equitable. These competing priorities are extremely challenging to manage, and developing economies are struggling to find the balance. The year 2021 saw an average 6 percent growth across emerging markets and developing economies; however, only a fraction of spending in these economies has directly supported a sustainable recovery. Consequently, despite the widespread consensus to "build back better," the world is in the midst of uneven and unsustainable economic recovery, with emissions set for the second largest rebound in history.

It is clear that a dramatic shift will be required to get the world on track to meet the global climate commitments established under the Paris Agreement and to meet SDG 7—universal access to affordable, reliable, and modern energy services (see Box 1.1). For example, the International Energy Agency (IEA) estimated that for the world to reach net-zero emissions by 2050, global annual investments in clean energy will need to more than triple by 2030 to around $4 trillion. Given this huge financing requirement, it is imperative that public funds are deployed wisely to catalyze the vast sums of private co-financing that will need to be mobilized.


Photo © Kamyar Adl

To help address these challenges, the World Bank Group has revamped its efforts to support client governments. Since the start of the COVID-19 crisis, the World Bank Group has committed over $125 billion to fight the health, economic, and social impacts of the pandemic. This financing is helping more than 100 countries strengthen pandemic preparedness, protect the poor and jobs, and jumpstart a climate-friendly recovery. The World Bank Group's new Climate Change Action Plan (see Box 1.2) establishes fresh objectives to help countries meet the goals of the Paris Agreement by fully integrating climate and development, and maximizing the deployment and impact of climate finance.

ESMAP's role and structure meant that it was uniquely positioned to provide support to overcome the unprecedented challenges of FY2021. The team's international energy experts enable ESMAP to provide ahead-of-the-curve thinking on global development topics, effectively delivering strategic upstream support and financing where and when it is most needed. These activities inform the World Bank's energy sector policy dialogue and provide solutions to major development challenges. In turn, ESMAP's leading initiatives directly deploy critical investment from concessional and climate finance, and help to catalyze private sector investment.

In FY2021, ESMAP focused on supporting governments to address the three aforementioned, compounded challenges. To assist clients with their COVID-19 response and recovery, ESMAP's support has concentrated on the sustainable electrification of health facilities and provision of climate-friendly cold chains, and the establishment of the Energy Access Relief Fund (EARF; see ESMAP's COVID-19 Response, p. 8). ESMAP's support efforts for the global transition to low-carbon energy and securing universal access to energy have centered on the mobilization of climate finance through initiatives such as the **Cooling Facility** and the **Sustainable Renewables Risk Mitigation Initiative** (SRMI), which led to $280 million being unlocked in FY2021. In addition to the dynamic response to these critical global issues, ESMAP has also continued its fundamental role in implementing the business plan based on client demand.

ESMAP's positive impact in FY2021, presented in Section II of this annual report, demonstrate that ESMAP's new business plan—approved before the impact of the pandemic became apparent—is fit for purpose and has provided the flexibility needed to respond to urgent, critical demands. This year has also underscored the magnitude of the climate and access challenges facing the world and the need to step up our ambition and efforts.

BY THE NUMBERS FY2021

Fiscal year 2021 was the first year of implementation of ESMAP's four-year business plan for FY2021-24, which focuses on four thematic programs—**Electricity Access, Clean Cooking Fund, Renewable Energy,** and **Accelerating Decarbonization**—hinged upon cross-cutting areas of **Foundations for the Energy Transition** and **Energy Data and Analytics.**

With an active portfolio of $176.3 million, as of the end of June 2021, encompassing more than 267 activities across more than 75 countries, ESMAP is helping to shape global energy policies while underpinning significant World Bank development financing. Concrete program results are illustrated throughout the report.

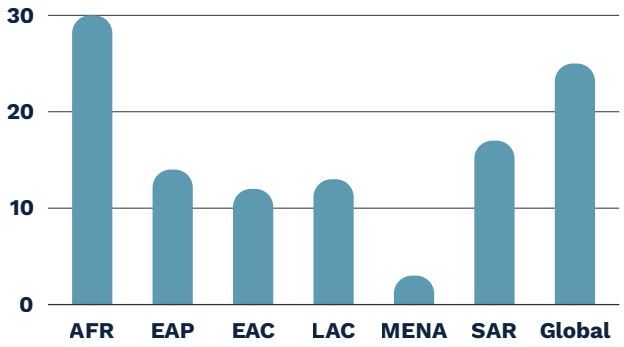
$49.8 million in new activities approved in FY2021

A total of **100 activities** were supported by ESMAP in FY2021

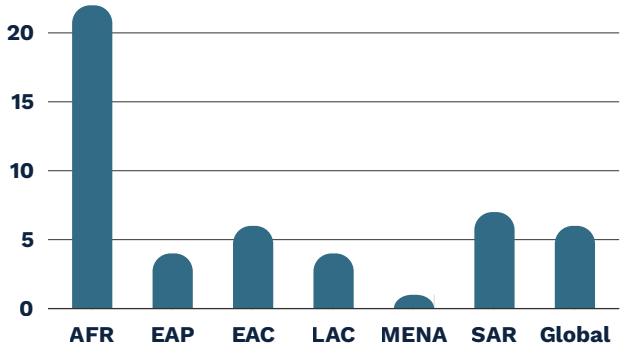
75 activities in 44 countries (excluding regional activities)

25 activities with a global focus

Number of Activities by Region, FY2021



Grant Amount by Region, FY2021 (US$ Million)



Grant Amount by Thematic/Cross Cutting Areas, FY2021 (US$ million)

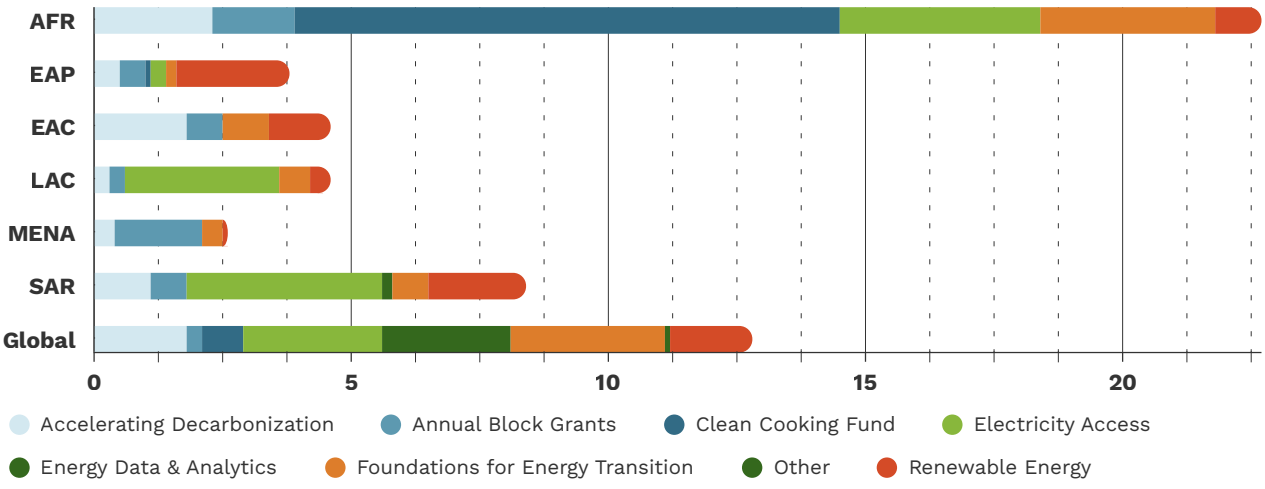


Photo © Jean-Marc Ferre / UN Photo

UNITED NATIONS HIGH-LEVEL DIALOGUE ON ENERGY (HLDE)

The High-level Dialogue on Energy, held in September 2021, was the first global gathering on energy under the auspices of the General Assembly since the UN Conference on New and Renewable Sources of Energy, held in Nairobi in 1981. The overarching goals of the dialogue were to promote the implementation of the energy-related goals and targets of the 2030 Agenda for Sustainable Development and to accelerate action toward the achievement of the SDG 7 targets by catalyzing innovative solutions, investments, and multi-stakeholder partnerships. World Bank/ESMAP co-led the Working Group on Energy Access, one of five groups that informed the deliberations of the High-Level Dialogue on Energy, and took an active role in drafting the accompanying report on *Energy Access: Towards the Achievement of SDG 7 and Net-Zero Emissions*. The report included recommendations on how to accomplish universal access to electricity and clean cooking by 2030 and listed intermediate targets by 2025.

WORLD BANK AND ESMAP CLIMATE CHANGE ACTION

The latest *Assessment Report (AR6)* of the Intergovernmental Panel on Climate Change (IPCC) has emphasized that the risks of inaction—resulting from continued unabated coal-fired generation and use—are untenable and existential.

The World Bank Climate Change Action Plan (2021–25) or CCAP emphasizes the need to support countries planning a transition away from coal, helping them develop clear roadmaps for a just energy transition that focus on governance structures, the welfare of people and communities, and the remediation and repurposing of former mining lands and coal-fired power plants.

In addition to the power sector, coal use in other areas such as industries, transport, and home heating, which are hard to abate, also need special attention. Significant upstream support of identifying clean energy options, including electrification options, is critical.

ESMAP support to countries is already fully aligned with these objectives, but there will be an increasing need for support in this area in the coming years. Countries look on one hand to a clean energy future maximizing the socioeconomic benefits of green energy supply chains, but on the other hand also need to contend with technical challenges as well as the socioeconomic realities of reducing coal dependency.

A significant challenge to a transition away from coal—both for mines and power plants—pertains to its workforce and the associated communities who are dependent on coal for their livelihoods. These workers have spent a considerable period of their lives carrying out specialized functions at these facilities and/or depending on economic activities as a result of their proximate location. Women may be affected more, not just through direct job loss, but also through household tension and gender-based violence that can be created by job loss by the men in the household. Impacts on the transportation sector, including trucking and railways that are associated with coal transport, also need consideration. It is critical to identify and support relevant institutions, stakeholders, and decision making structures, both at the local and regional levels, in order to ensure effective implementation. A comprehensive effort by countries to retire and repurpose coal assets—power generation, mines, and workers—faces several economic and political barriers, is exceedingly ambitious in terms of scale and pace, and has true transformational potential at the national and global level.

ESMAP is already supporting technical, governance, and socioeconomic aspects of the coal transition efforts in India, South Africa, and the Western Balkans. Industrial decarbonization efforts are also being supported in India, Kazakhstan, and Vietnam, but need to be expanded in scope and regional focus.

TABLE 1.1: ESMAP Support to Climate Change Action Plan Implementation

CCAP Priority	ESMAP Key Inputs
Scale Up Clean Energy Systems	ESMAP supports an increasing renewables portfolio in all aspects of solar, wind, hydropower, and geothermal, offshore wind technology, and green hydrogen; as well as energy storage technologies, including with the Energy Storage Partnership. Rooftop solar, mini grids and off-grid solar are a key contribution to distributed renewables.
Power System Planning	ESMAP knowledge helps reduce demand—through improved energy efficiency, demand management tools such as smart metering, and reduced transmission losses—and improve supply— through more reliable and resilient solutions for the power grid, including analytic support to utilities, electrification strategies and planning, and demand estimation. ESMAP plays a catalytic role in facilitating regional trade and building regional markets, including testing innovative market incentives and trading mechanisms in sub-Saharan Africa.
Fossil Fuel Subsidy Reform	Advance fossil fuel reforms to eliminate or reduce energy subsidies through the ESMAP Energy Subsidy Reform Facility.
Energy Efficiency	Tracking SDG 7: Energy Progress Report is a comprehensive tool to track energy data, including efficiency. The new program Energy Markets, Connectivity and Regional Trade and the AREP multi-donor trust fund inform efficiency in regional electricity trade. The Efficient and Clean Cooling initiative accelerates the uptake of sustainable cooling technologies and policies. ESMAP's Zero Carbon Public Sector initiative focuses on retrofitting public buildings. The Clean Cooking Fund supports modern energy cooking services that are clean and efficient. Small Island Developing States (SIDS) DOCK supports the transition to improved energy efficiency.
A Just Transition Away from Coal	Leadership from the Supporting Coal Regions in Transition pioneers supply side pilots and solutions around the closure and repurposing of coal mines and coal-fired power plants on the demand side, solutions in the switch to low-carbon energy sources, and scaling up of renewable energy investments.

ESMAP'S COVID-19 RESPONSE

To help developing countries contain the spread and impact of COVID-19, the World Bank Group mounted the largest crisis response in its history, helping over 100 developing countries address the health emergency, protect the poor and vulnerable, support businesses, and jump- start a green, resilient, and inclusive recovery. As part of the World Bank Group's response, ESMAP developed a three-prong approach targeted at addressing key energy challenges exacerbated by the health crisis:

- The acute lack of access to sufficient and reliable electricity in many health facilities, with an estimated 1 billion people relying on health facilities without electricity
- Significant gaps in the cold chains needed to deploy vaccines safely and efficiently
- Severe financial stress on the off-grid and mini-grid energy access sector supporting more than 500 million people

From March 2020 onward, the ESMAP COVID-19 response team consolidated its expertise and developed strong collaboration with the Bank's Health Global Practice and global partners to rapidly deliver a climate-informed COVID-19 response activity focused on three key pillars:

1. Electrification of health facilities with renewable energy
2. Reliable and climate-friendly cold chains
3. Energy Access Relief Fund (EARF) in collaboration with 12 partners

The ESMAP response, centered on these three pillars, was grounded in two main ESMAP programs: **Improving Livelihoods and Human Capital**, under the ESMAP Electricity Access program; and the **Efficient, Clean Cooling** program, under the ESMAP Accelerating Decarbonization program. Other ESMAP programs also contributed, including **Off-Grid Solar**, which led on the Energy Access Relief Fund (EARF) initiative, **Mini Grid Facility**, **Battery Storage**, **Zero Carbon Public Sector**, and **Leave No One Behind**.

1 ELECTRIFICATION OF HEALTH FACILITIES WITH RENEWABLE ENERGY AND SUSTAINABLE OPERATIONAL MODELS

ESMAP provided grants to Afghanistan, Haiti, and Liberia, small and fragile countries, to electrify priority healthcare facilities and vaccine cold storage facilities deemed necessary for the COVID-19 response. The grants were processed as part of new or restructuring of energy and health projects. In Nigeria, the ESMAP team helped the Rural Electrification Agency to restructure the Nigeria Electrification Project and allocate more than $70 million from the mini grid budget to rapidly deploy solar hybrid systems for 400 healthcare facilities on potential and likely mini-grid sites.

Photo © Dominic Chavez / World Bank

ELECTRIFICATION OF HEALTH FACILITIES IN LIBERIA

An estimated 95 percent of healthcare facilities in Liberia either have no electricity or they rely on costly diesel generators. For the few that are connected to the grid, the service is intermittent and of poor quality. When the COVID-19 pandemic hit, it exacerbated the urgent need to bring electricity to these facilities. In March 2021, the World Bank's Liberia Electricity Sector Strengthening and Access Project received additional support from a $2.5 million ESMAP grant and a $2.7 million grant from Japan. The additional funding was provided for the electrification of healthcare and vaccine cold storage facilities through standalone solar systems. With ESMAP technical assistance to its design and implementation, the project focuses on urgent provision of solar PV services to (1) selected health facilities to enhance the delivery of healthcare services and improve their resilience during epidemics; and (2) identified vaccine storage facilities to support the COVID-19 vaccine cold chain.

2 DEPLOYMENT OF RELIABLE AND CLIMATE-FRIENDLY COLD CHAINS TO DELIVER VACCINES

ESMAP was a part of the World Bank's COVID-19 Vaccine Delivery Taskforce, where it collaborated with key internal and external stakeholders, including WHO, UNICEF, and Gavi on the deployment of reliable and climate-friendly cold chains. In addition to its technical and advisory support, ESMAP allocated a total of $9 million to COVID-19 response projects in Cabo Verde, Comoros, Eswatini, Ethiopia, Malawi, Niger, São Tomé, Somalia, South Sudan, Sudan, Zambia, and Zimbabwe to support activities strengthening vaccine cold chains and health facilities.

Leveraging its various knowledge products and sector expertise, the ESMAP team also provided in-kind technical cross-support to several World Bank Health operational teams to support COVID-19 response projects focused on reliable and climate-friendly cold chains and health facilities in the following countries: Burkina Faso, Mongolia, Philippines, and Tunisia.

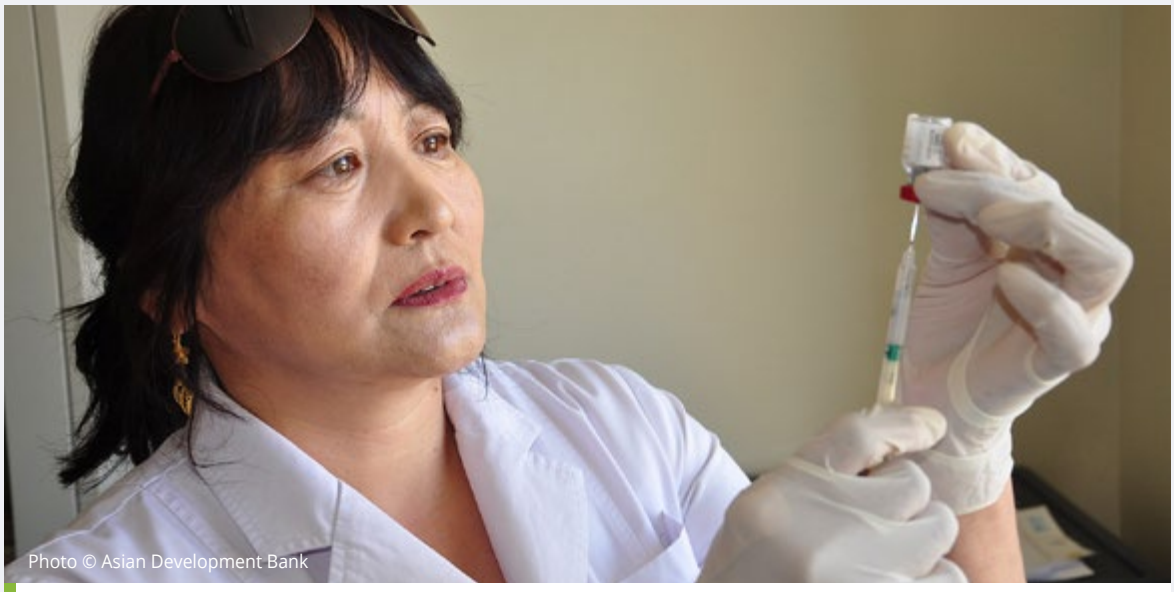


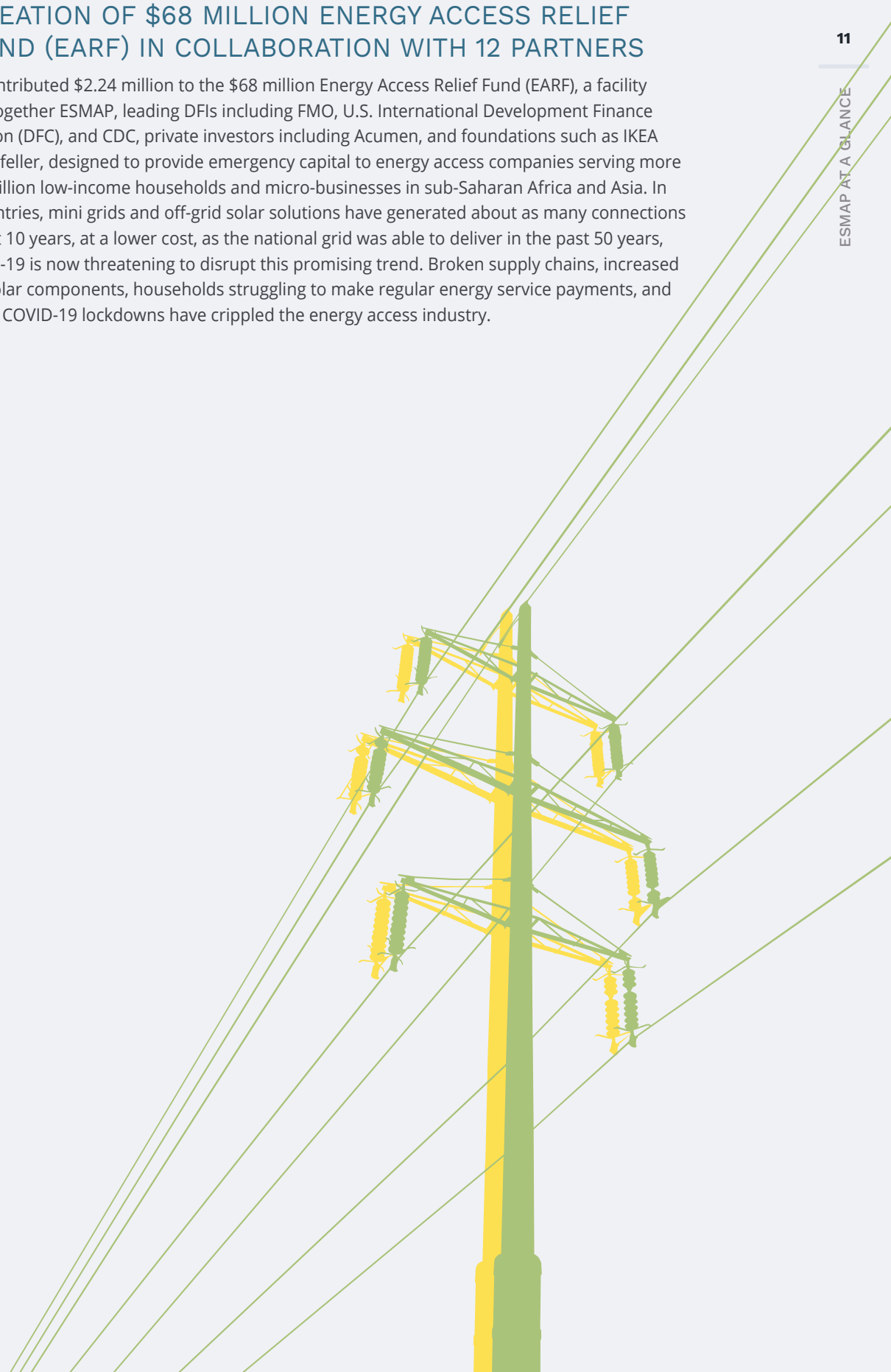
Photo © Asian Development Bank

NEW ENERGY-EFFICIENT VACCINE STORAGE IN MONGOLIA

In Mongolia, ESMAP provided in-kind support for the design of a new energy-efficient central vaccine storage facility, which was financed by the World Bank, working with UNICEF as the implementing agency. The vaccine facility, constructed in just over three months and inaugurated in August 2021, is equipped with over 10,000 pieces of energy-efficient, advanced equipment. This includes cold rooms ranging from 20-40 m^2, voltage stabilizers for cold and freezer rooms, and different capacity refrigerators and freezers complete with full sets of parts and supplies. The new Mongolia central vaccine storage facility was inaugurated by the Prime Minister and constitutes a good example of World Bank-ESMAP-UNICEF collaboration, working effectively and efficiently together in support of the country's COVID-19 response, and making a real difference for the health and wellbeing of the Mongolian people during the COVID-19 crisis.

3 CREATION OF $68 MILLION ENERGY ACCESS RELIEF FUND (EARF) IN COLLABORATION WITH 12 PARTNERS

ESMAP contributed $2.24 million to the $68 million Energy Access Relief Fund (EARF), a facility bringing together ESMAP, leading DFIs including FMO, U.S. International Development Finance Corporation (DFC), and CDC, private investors including Acumen, and foundations such as IKEA and Rockefeller, designed to provide emergency capital to energy access companies serving more than 20 million low-income households and micro-businesses in sub-Saharan Africa and Asia. In some countries, mini grids and off-grid solar solutions have generated about as many connections in the past 10 years, at a lower cost, as the national grid was able to deliver in the past 50 years, but COVID-19 is now threatening to disrupt this promising trend. Broken supply chains, increased costs of solar components, households struggling to make regular energy service payments, and continued COVID-19 lockdowns have crippled the energy access industry.



SECTION II

OUR IMPACT IN FY2021

Photo © Hannah Blair / CLASP

OUR IMPACT FY2021

$10.4 BILLION
in World Bank development financing informed

$3.6 BILLION
external financing mobilized, including private sector[1]

$5 BILLION
climate finance informed

3 GW
of renewable energy expected to be installed

39.8 MILLION MT of CO_2
emissions expected to be reduced

1 MILLION MWh
projected lifetime energy and fuel savings to be achieved

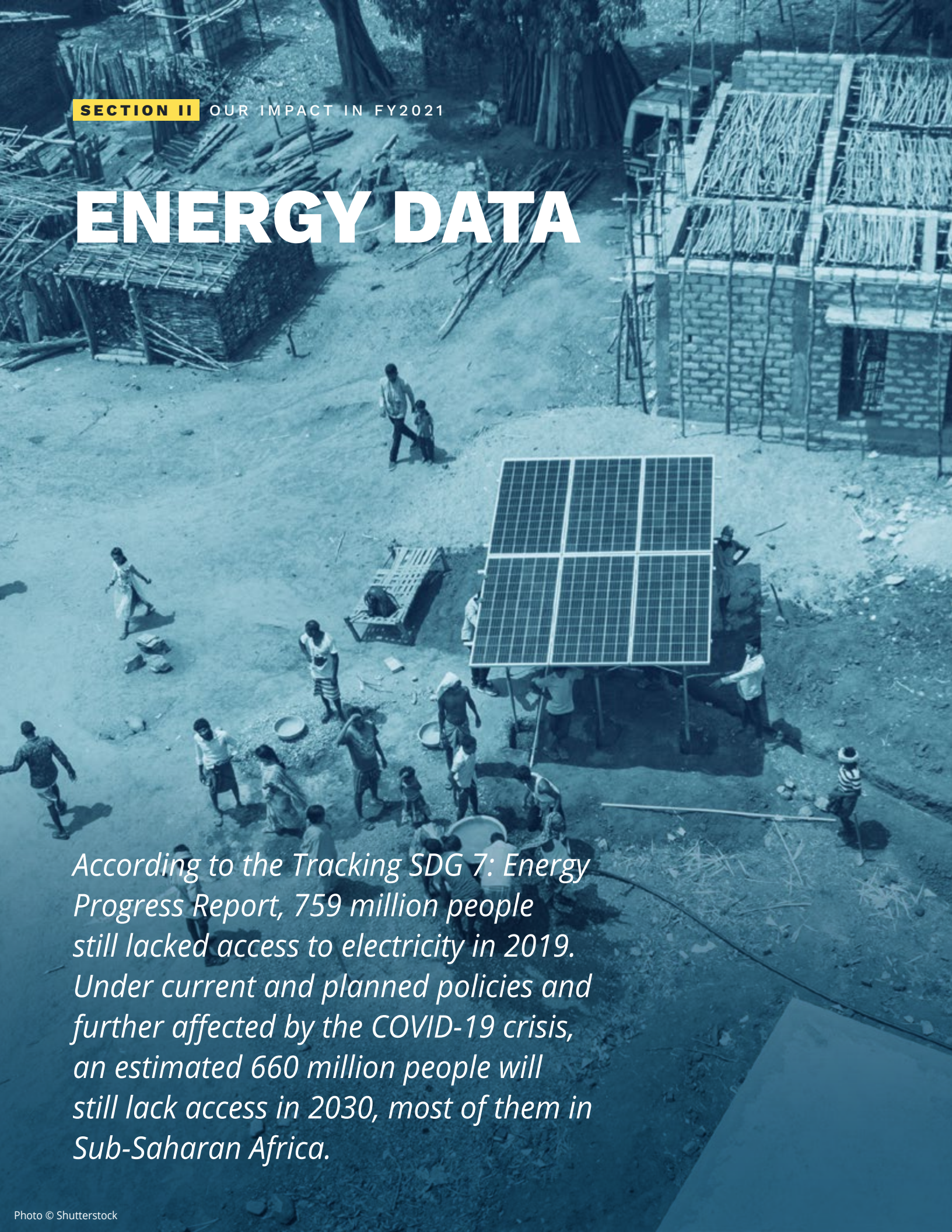
18 MILLION
people expected to gain access to electricity, of which 15.3 MILLION people will gain access to renewable energy

5.2 MILLION
people have gained access to electricity

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

1 In addition, under the **Electricity Access** program $261 million private investments are expected to be mobilized during project implementation as part of projects' results framework; $498.4 million private investments were raised during project implementation of previously informed projects; and $87.3 million other co-financing (MDBs, DFIs, governments) was raised during project implementation, is part of parallel financing or expected to be mobilized as part of the project's results framework. Under the **Energizing Renewables** program additional $1.5 billion of private financing is expected to be mobilized as part of projects' results framework.

ENERGY DATA



According to the Tracking SDG 7: Energy Progress Report, 759 million people still lacked access to electricity in 2019. Under current and planned policies and further affected by the COVID-19 crisis, an estimated 660 million people will still lack access in 2030, most of them in Sub-Saharan Africa.

Photo © Shutterstock

Although the world has made important gains toward SDG 7, efforts have been falling well short of the scale required to reach the SDG 7 targets (see Box 2.1) by 2030. This has only been exacerbated by the COVID-19 crisis, which is having a serious effect on SDG 7 progress. At the same time, the pandemic has pointed to the urgent need for access to reliable, affordable, sustainable, and modern energy—for hospitals and health facilities to treat patients, for schools to prepare children for the digital economy, for communities to pump clean water, and for people to gain access to information. The full impact of the crisis is yet to become clear. Over the coming years, more data on the crisis impact to progress toward SDG 7 will become available.

The core work of ESMAP's Data and Analytics Hub is now more relevant than ever, as the hub has the capacity to assess the impact of COVID-19 on energy access, renewables, and energy efficiency. The hub also assesses energy-related needs in the pandemic response and rebuilding efforts. Analytic support to assess the current and potential electricity demand will help clients and World Bank teams to respond to end-user needs and push productive use efforts successfully.

The Data and Analytics Hub draws from lessons learned over time with the implementation of ESMAP's programs, including the importance of: (1) engaging operational energy teams, governments, and development partners in the countries where data are collected; (2) enhancing capacity building to collect data sustainably and apply findings more effectively to policymaking; (3) making methodology more transparent, critical to ensure credibility of the data; and (4) fostering collaboration between agencies to enable more effective dissemination.

ENERGY DATA AND ANALYTICS HUB

Data and analytics are key elements for evidence-based decision making on policies and investments necessary for achieving SDG 7. However, comprehensive, detailed data at the global, national, and regional levels for energy access (electricity and cooking solutions) is lacking. Geospatial information gaps are a barrier to electrification planning, and more efficient ways to collect data on energy access are required to support scaled-up investment.

The ESMAP Energy Data and Analytics Hub aims to be an all-inclusive data and knowledge platform that offers a free, unique breadth of energy-related information to use. The hub manages several energy data platforms, as well as four synergetic products—Tracking SDG 7, the Multi-Tier Framework, RISE, and Energy Demand Estimation—that track SDG 7.

150 million

The electricity access rate, in access-deficit countries, must increase from 82% in 2019 to 94% by 2025 to achieve 100% access by 2030. This means a yearly gain of two percentage points, or electrification being brought to about 150 million people between now and 2025. This represents a 33% increase: an extra 0.5 percentage points or additional 40 million people per year over the current rate of progress.

BOX 2.1

SUSTAINABLE DEVELOPMENT GOAL 7

SDG 7 is one of the 17 Sustainable Development Goals established by the United Nations General Assembly in 2015. It aims to "[e]nsure access to affordable, reliable, sustainable and modern energy for all." The goal has five targets, to be achieved by 2030:

Target 7.1: Universal access to modern energy. This target has two indicators:

- Indicator 7.1.1: Proportion of population with access to electricity.
- Indicator 7.1.2: Proportion of population with primary reliance on clean fuels and technology.

Target 7.2: Increase global percentage of renewable energy.

Target 7.3: Double the improvement in energy efficiency.

- Target 7.A: Promote access to research, technology and investments in clean energy.
- Target 7.B: Expand and upgrade energy services for developing countries.

EnergyData.info. EnergyData.info is an open data platform providing easy, free access to data and analytics relevant to the energy sector. This platform serves as a public good available to governments, development organizations, the private sector, nongovernmental organizations, academia, civil society organizations, and individuals to share data and analytics that can complement ESMAP data to help achieve SDG 7 targets. ESMAP is also developing web-based GIS visualization applications hosted on the EnergyData.info platform that are used by Bank teams and external stakeholders for making informed decisions and developing effective projects.

Tracking SDG 7: Energy Progress Report. The report is a comprehensive tool that tracks 220 countries' progress toward achieving the SDG 7 energy pillars on access to electricity, clean cooking, renewables, and efficiency. It is jointly produced every year by the five SDG 7 custodian agencies, namely the World Bank/ESMAP, the International Energy Agency (IEA), the International Renewable Energy Agency (IRENA), the United Nations Statistics Division (UNSD), and WHO, with the support of the SDG 7 Technical Advisory Group at the UN. As the custodian agency for SDG 7.1.1, the World Bank/ESMAP is responsible for the electrification data and the chapter on access to electricity. In FY2021, the ESMAP team introduced the notions of affordability, availability, and reliability to the tracking. The seventh edition of the report was published in June 2021; it found that a greater share of the global population gained access to electricity than ever before, but the number of people without electricity in Sub-Saharan Africa increased. According to the report, the number of people without access to electricity declined globally from 1.2 billion in 2010 to 759 million in 2019. However, under current and planned policies, plus the effects of the COVID-19 crisis, an estimated 660 million people would still lack access in 2030, most of them in Sub-Saharan Africa.

Multi-Tier Energy Access Tracking Framework. The Multi-Tier Framework (MTF) is a tool that identifies and analyzes on a country level the main reasons that households are not using electricity, or that their use is limited, and then recommends a set of measures to remove the identified constraints. By going beyond the traditional binary measure of "connected or not connected"

for electricity access and "solid versus nonsolid fuels" for cooking, the framework provides more accurate data on the actual services households received. The MTF is a complementary source for tracking SDG 7, helping inform policy and investment decisions concerning access. Since its creation in 2015, the MTF has collected data from 21 countries. In FY2021, MTF country reports on Nigeria and Liberia were published.

Regulatory Indicators for Sustainable Energy (RISE). RISE is the first global scorecard that captures the policies and regulations in place to facilitate progress on SDG 7. RISE is published biannually and is available free on an online data platform (rise.esmap.org) that enables users to customize the information they need on each country's power sector and regulatory and policy framework. RISE indicators are included in the outputs of several well-established global initiatives, including the REN21 Renewables Global Status Report, Clean Cooking Alliance Communication Corps, and SDG 7 policy briefs compiled by the multi-stakeholder SDG 7 Technical Advisory Group. The third edition of RISE "RISE 2020: Sustaining the Momentum" was launched in December 2020 and includes 138 countries, 32 indicators and more than 160 questions. This edition tracks for the first-time clean cooking policy and regulations pillar in more than fifty countries. RISE indicators informed countries on policy best practices and provided framework to sustainable energy policy pathways. RISE outputs were used to track progress of several ESMAP grants and World Bank projects, including, among other, the ECA Sustainable Heating Program, Western Balkans Energy Transition Program, Haiti Electricity Access and Sustainable Resilient and Inclusive Development of the Energy Sector, Haiti Renewable Energy for All Project.

The Global Electricity Regulatory Index (GERI). The index is a companion piece to the RISE scorecard and is jointly produced by the African Development Bank and the World Bank. GERI collects data from over 100 developing countries to track the gaps between regulation and actual implementation. This enables users to identify gaps in their country's regulatory framework and benchmark their performance against global peers.

Electricity Demand Estimation. The Electricity Demand Estimation program supports World Bank operations in using reliable and transparent estimation tools and data for the residential and agricultural customer segments of electrification strategy.


Photo © Volkovslava/Shutterstock

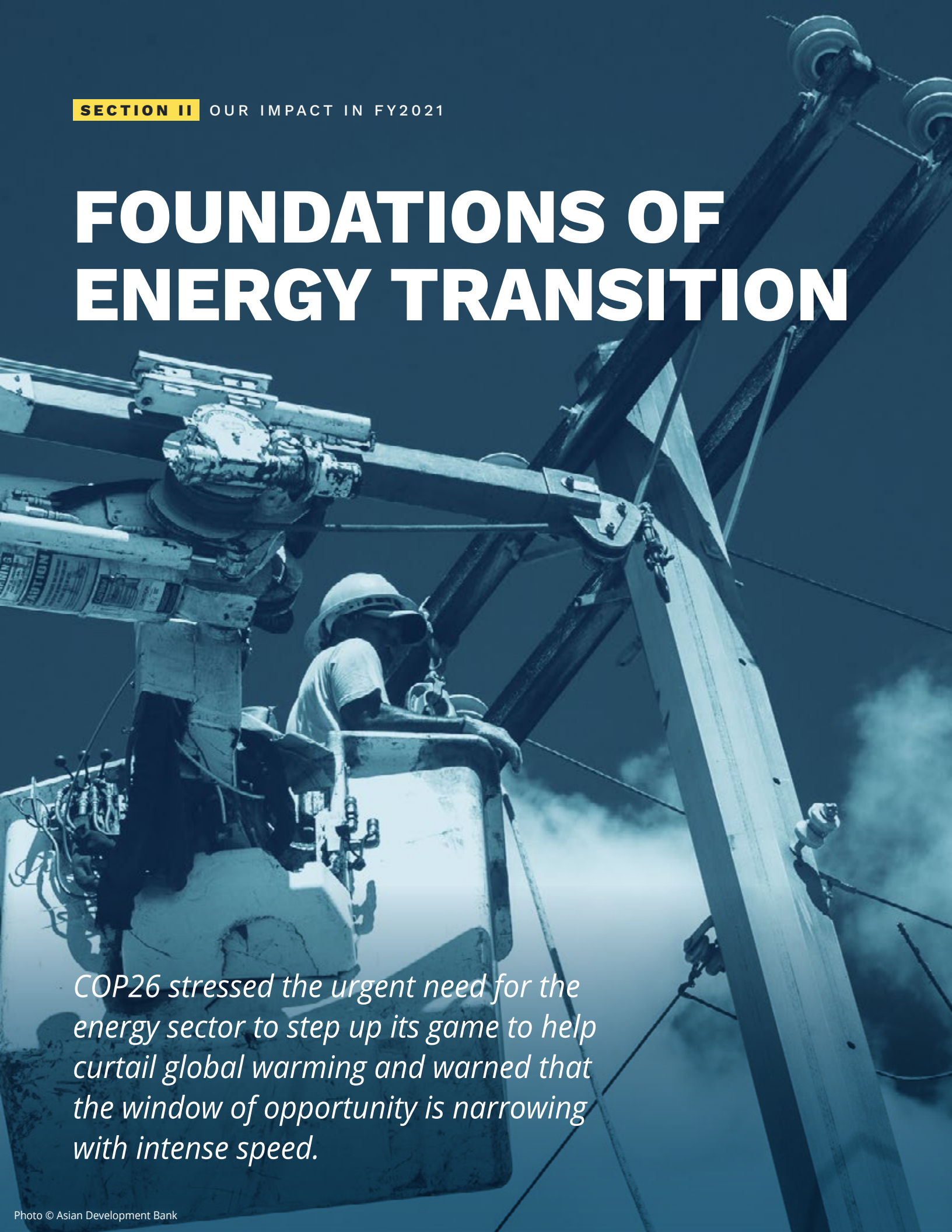
In FY2021, the Energy Data and Analytics Hub's products and database informed more than 30 lending or research projects. Out of the 33 energy and extractives operations approved in that fiscal year, 11 of them used the hub as an informative resource; all grant proposals submitted to ESMAP in FY2021 indicated that they have used the Knowledge Hub products to inform the advisory and analytical products.

For example, in its project on promoting access and transition to clean energy in the Sahel, the World Bank team used ***Tracking SDG 7*** data extensively to engage client countries in dialogue on how to push the SDG 7 agenda forward in the region.

Similarly, the **MTF** informed the implementation of the World Bank project on solar energy in local communities in Burundi. The project seeks to expand access to energy services in rural areas of the country, and the MTF provided detailed information on the energy access situation of households, including quantity and quality of services.

In Mozambique, the **Electricity Demand Estimation** program supported the preparation of an energy access project, helping to illuminate the potential demand from the irrigation sector and the optimal energy solutions.

FOUNDATIONS OF ENERGY TRANSITION



COP26 stressed the urgent need for the energy sector to step up its game to help curtail global warming and warned that the window of opportunity is narrowing with intense speed.

Photo © Asian Development Bank

The world must use the opportunity today to move rapidly to a decarbonized energy sector taking advantage of the plummeting cost of renewable sources of energy; technological advances in demand management, storage, and digitalization; and new decentralized business models for service delivery. The energy transition will need to be based on renewables and efficient technologies as the breakdown of electricity generation by source (see Figure 2.1) in a Paris Agreement-compatible scenario (IRENA 2019).

However, achieving these targets by using existing ways of doing business is not an option, and new, innovative regulations, policies, and markets need to be deployed. The energy transition should also ensure that its socioeconomic impacts are positive and equitable, such as improved gender balance in the energy sector.

A foundation for energy transition lies in a well-functioning, financially sound power sector. Therefore, ESMAP—through its overarching **Foundation for Energy Transition** program—takes on the challenge of gluing together various ESMAP programs and providing a comprehensive policy framework for the energy transition by employing innovative solutions in five interlinked areas:

1. Designing new business and regulatory models for utilities for the future, able to maintain financial viability and service standards (**Utilities for the Energy Transition** program)

2. Developing competitive markets, connecting regions, and deploying power trade mechanisms that provide the price signals and incentives needed to induce the investment in the right technologies and behaviors (**Markets, Connectivity and Trade** program)

3. Helping countries to stop subsidizing fossil fuels and remove subsidies and other distortions (**Energy Subsidy Reform Facility**)

4. Supporting transitioning from coal and least-cost planning (**Supporting Coal Regions in Transition**)

5. Promoting gender equality in the energy sector (**Closing Gender Gaps in Energy**)

UTILITIES FOR ENERGY TRANSITION

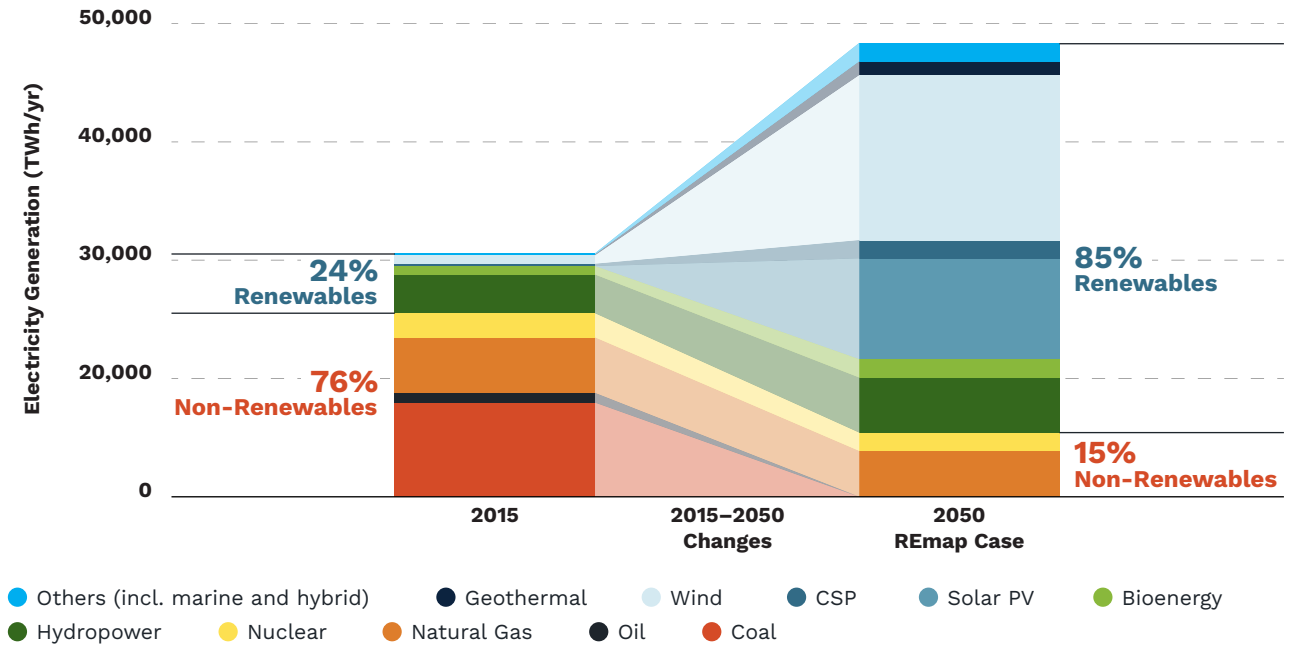
The energy sector is under transformation, driven by decarbonization goals and technological advancements that are challenging the traditional modus operandi of utilities and the adequacy of existing regulations. The increasing availability of cost-effective digital technologies is opening new opportunities for enhanced data-driven decision making, automation, and new business models that can help improve the flexibility and reliability of the grid. This is critical for the higher penetration of variable renewable energy, distributed energy resources, and the clean energy transition.

The **Utilities for Energy Transition** program supports utilities that are grappling with this changing landscape. The program provides technical assistance and pilot programs to guide utilities' investments in digital and decentralized technologies, such as advanced metering infrastructure, and grid-connected distributed energy resources. In FY2021, the program focused on bolstering an enabling environment, including regulatory frameworks to put in place appropriate incentives for the investment in

34%

Coal is still the world's most dominant energy source, generating 34 percent of global electricity in 2020. There is approximately 2,000 GW of coal-based generation capacity remaining worldwide, despite widespread recognition of coal's strong negative impact on climate change.

Figure 2.1. Electricity Generation by Source, 2019



Source: Innovation landscape for a renewable-powered future: Solutions to integrate variable renewables, IRENA, 2019.

such technologies, the emergence of decentralized energy resources, and associated business models.

In Kenya, for example, which implemented an expansive electrification project, as well as in Niger, the **Utilities for Energy Transition** program provided support with studies on electricity demand. The program leveraged utility data and piloted options for appliance finance and distribution to make demand-stimulating appliances affordable to consumers, in collaboration with ESMAP's Innovative Financing for Access program.

ELECTRICITY MARKETS, GRID CONNECTIVITY, AND REGIONAL TRADE

Well-functioning electricity markets—able to provide efficient price signals to guide dispatch and inform investment—are needed to stimulate the appropriate and timely investment required to achieve low-carbon and electricity security goals at least cost and, as such, facilitate and support achievement of the SDG 7 targets.

The situation is becoming especially acute at the time when the world is undergoing an accelerated energy transition, driven by rapidly changing technological, environmental, and economic factors. These include falling costs of renewables, leading to their progressive adoption; the decentralization of generation, propelled by the growing availability and reduced costs of distributed energy resources; and changes in the responsiveness of demand, enabled by the advancement of information and communication technologies (electric vehicles, smart metering, digitalization) and socioeconomic transformation (urbanization, industrialization).

The **Electricity Markets, Grid Connectivity and Regional Trade** (MARCOT) program is one of the newest windows of ESMAP. Establishing the MARCOT program reflects the desire, from several angles—from the client countries, from the Bank management, and from the ESMAP donors—to systematize vast knowledge of the Bank's engagement in the area of power market reforms, set up a consolidated center of expertise on power market solutions tailored to the changing environment and client countries' evolving needs, and provide a practical platform

for implementing recommendations from the Bank's 2019 flagship report *Rethinking Power Sector Reforms in the Developing World*.

In FY2021, the MARCOT program allocated technical assistance grants to a total of 16 activities in all the regions the World Bank serves (except EAP), focusing on strategic objectives of increasing the number of countries with: (1) established or improved markets for energy services; (2) interconnected grids and increased regional trade; and (3) increased financing from the public and private sources.

The program teamed up with the RISE team to establish a comprehensive, regularly updated database of power markets globally. The database holds information about the electricity sector/market characteristics and development over time, presenting a completely new and unique offering for benchmarking the performance of developing markets.

The MARCOT program also launched a series of formal training courses on the "Fundamentals of Energy Markets."

ENERGY SUBSIDY REFORM FACILITY

Established in 2013, ESMAP's **Energy Subsidy Reform Facility (ESRF)** supports governments in the design and implementation of energy subsidy reform programs. The facility supports analytic work on various aspects of the complex energy subsidy reform agenda, including poverty, social protection, fiscal management, macroeconomics, political economy, communication, and climate change mitigation.

There is growing recognition of the need to reform fossil fuel subsidies in view of their climate impact, significant fiscal cost, and the economic distortions they create. With global cumulative subsidy spending in 2020 estimated at $180 billion, per IEA figures, energy subsidies impose a heavy burden on governments and taxpayers, and divert limited government resources away from critical priorities. These priorities include recovery from the global pandemic, investments in green infrastructure, and strengthening service delivery in health and education.

Reflecting the global recognition of the importance of subsidy reform and the complex challenges that need to

BOX 2.2

UZBEKISTAN

FINANCIAL ANALYSIS OF THE NATIONAL GRID

In Uzbekistan, an in-depth study of the National Electric Grid of Uzbekistan (NEGU), sponsored by ESRF, provided a comprehensive analysis of NEGU's financial performance and of key risks to the company's financial sustainability. The study contributed to the government of Uzbekistan's decision to initiate action to improve NEGU's financial sustainability. The study also promoted the design of the World Bank's Electricity Sector Transformation and Resilient Transmission project, a $472 million operation approved in FY2021 that will improve the performance of NEGU and supply reliable energy to millions of households and businesses across the country.

BOX 2.3

Photo © Eugene Kim

SUDAN

ELIMINATING FUEL SUBSIDIES

In Sudan, the Energy Sector Recovery Technical Assistance program, a $2 million multi-donor program, was established in 2019 to support the government with energy subsidy reform, clean energy transition, and increasing access to energy. An ESMAP-funded policy paper prepared as a part of the program identified energy subsidies as a major driver of the local economic crisis and showed that savings from successful reforms can deliver positive impacts for the public and improve the fiscal sustainability of Sudan. Since October 2020, the government of Sudan carried out several reforms to eliminate subsidies for gasoline and diesel products, which effectively ended all subsidies for these products by June 2021. These favorable reforms have also contributed to Sudan's clearing its arrears to the International Development Association (IDA), enabling its full reengagement with the World Bank Group after nearly three decades and paving the way for the country to access nearly $2 billion in IDA grants for poverty reduction and sustainable economic recovery.

be tackled by client countries, ESRF has seen strong and growing demand from World Bank teams supporting client countries in their efforts for energy subsidy reform. Between FY14, when the first grants were made, and FY2021, the facility allocated $24.6 million for technical assistance that aided client governments in the design and delivery of energy subsidy reform in 65 countries.

In FY2021, ESRF provided $2.5 million in country grants toward reforming energy subsidies, bringing the total to 35 active grants under implementation. In addition to informing policy on the ground, ESRF-funded grants informed the design of several World Bank projects approved in FY2021, totaling $4.2 billion.

The outcomes achieved under the country grants were complemented by the facility's own knowledge work. In December 2020, ESRF hosted its first virtual **knowledge forum** for World Bank staff. The forum included a comprehensive debate on the challenges of energy subsidy reforms during and after the pandemic, as well as knowledge exchange among diverse stakeholders, including subject experts and government representatives.

SUPPORTING COAL REGIONS IN TRANSITION

Coal is the world's most dominant energy source, generating 34 percent of global electricity in 2020. Although the pandemic drove a drop in coal demand of 220 million tons of coal equivalent (Mtce), or 4 percent, in many countries, coal consumption is on the rise and coal remains the cheapest and most profitable energy source.

The World Bank Group stopped the direct financing of new utility-scale coal-fired power projects in 2010. The World Bank supports national, regional, and local authorities in developing clear roadmaps for the transition, focusing on governance structures, the welfare of people and communities, and the remediation and repurposing of former mining lands and coal-fired power plants.

Following the World Bank's seminal report *Managing Coal Mine Closure: Achieving a Just Transition for All* in 2018, with lessons from 11 former World Bank investment projects on coal sector transition alongside new evidence from four coal transitioning countries (China, the Netherlands, the UK, and the US), the World Bank is now finalizing a comprehensive set of global coal mine closure good practice technical standards. These standards will enable the transition from "physical closure" to a more "sustainable closure" in the context of achieving a "just transition for all."

A key priority is to support countries and communities most affected by the phasing out of coal as they transition to cleaner energy sources. ESMAP supports coal mine closure and coal plant repurposing, particularly through partnerships like the Platform Initiative in Support of Coal Regions in Transition for Western Balkans and Ukraine, which was launched in December 2020. As part of this effort, the new program on **Supporting Coal Regions in Transition** also assists client countries that have made the decision to transition from coal in developing roadmaps for transition. Technical assistance to support a just energy transition has commenced in Bosnia and Herzegovina and Ukraine. In the two countries, ESMAP is supporting the development of roadmaps for transition using the 3*3 Assessment Framework, developed by the World Bank team.

The program also designed twinning activities between Polish and Ukrainian coal regions, and the first study tour took place in early March 2021 in virtual mode due to COVID-19-related restrictions. Formal trainings are delivered via the Coal Regions in Transition Learning Academy, which is led by the College of Europe in Natolin, Warsaw, and the World Bank, with support from the European Commission. An online virtual delivery of a first set of learning modules was finalized in September 2021.

South Africa is the largest producer of coal in Africa and one of the largest coal producers in the world. Its state power utility produces 95 percent of the nation's electricity, the bulk of this coming from coal-fired capacity. Five million dollars in Technical Assistance was mobilized by ESMAP for the coal retirement and repurposing agenda from the UK Department for Business, Energy & Industrial Strategy's (BEIS) International Climate Finance. Preparatory work started in March 2021 to support the retirement and repurposing of four coal-fired power stations, totaling about a 6 gigawatt (GW) capacity.

The report *Coal Plant Repurposing for Ageing Coal Fleets in Developing Countries* was prepared, and published later, in August 2021. The report presents a detailed cost-benefit framework for examining the value proposition of repurposing for three applications—solar energy generation, battery energy storage, and synchronous condenser (that produces fast reactive power essential for maintaining system security)—and applies it to a representative 1,000 megawatt (MW) coal plant in India, finding a strong economic rationale for repurposing as part of India's just energy transition.

GENDER FOCUS IN ESMAP

ESMAP has built considerable momentum for closing gender gaps through its global Gender and Energy program and its six regional gender programs. These have helped strengthen women's roles as consumers, employees, and entrepreneurs in the energy sector. Aligned with the World Bank Group Gender Strategy and lessons learned during its implementation, ESMAP works with countries to design interventions and generate crucial knowledge of actions needed to close gender gaps in the sector and improve development outcomes.

ESMAP gender activities address gender inequalities in the following areas:

- Improving female workforce participation in the energy sector
- Improving women's productivity and livelihoods
- Improving women's access to modern energy services that meet needs

SIX REGIONAL GENDER AND ENERGY PROGRAMS

Each World Bank region hosts a gender program:

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

Throughout FY2021, the **Gender and Energy** program continued to work closely with ESMAP's other programs to generate and disseminate knowledge on gender and energy and with the regional Energy and Gender teams to address gender gaps in World Bank energy projects. The support provided by regional Energy Gender Experts made a difference: in FY2021, 91 percent of all Energy and Extractives Practice operations were gender-tagged, a substantial increase from 79 percent in FY20. The Gender Tag identifies operations that seek to close gender gaps in human endowments, more and better jobs, ownership and control of assets, and women's voice and agency.

GETTING TO GENDER EQUALITY IN HYDROPOWER

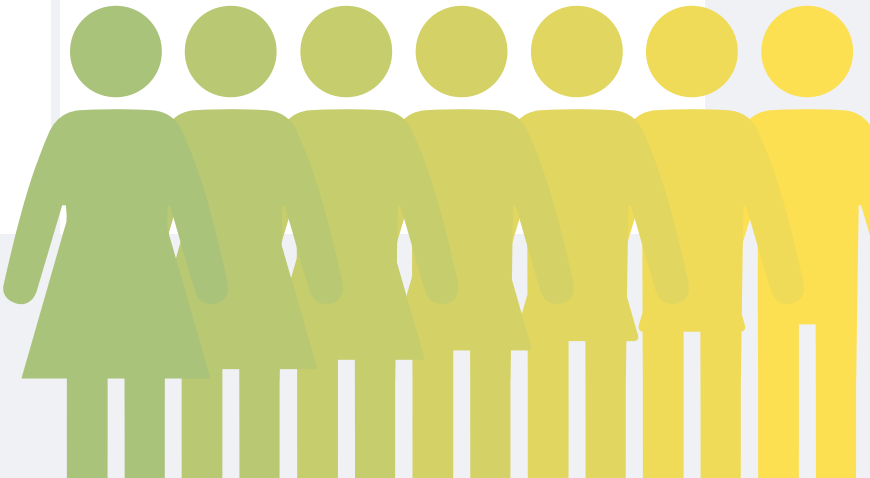
In collaboration with the Gender team, ESMAP's **Hydropower Development Facility** is developing a gender and hydropower global baseline and a report on women's employment in hydropower—including a survey launched in the beginning of FY2022. This report will provide tools and evidence for practitioners to close employment gender gaps in the hydropower sector.

WEST AFRICA: CAPACITY BUILDING FOR WOMEN ENTREPRENEURS IN THE OFF-GRID SOLAR SECTOR

In West Africa, ESMAP's **Off-Grid Solar Scale-Up** initiative is financing activities to close gender gaps in accessing economic opportunity in the off-grid solar sector. These activities are part of the *Regional Off-Grid Electricity Access* project and they include (1) engaging with women entrepreneurs and providing them training and capacity building support; (2) improving women entrepreneurs' access to credit; and (3) increasing women's awareness of employment opportunities in the standalone solar systems market.

ENERGY STORAGE WOMEN'S MENTORSHIP PROGRAM

The **Energy Storage Program (ESP)** fosters gender equality in the energy storage sector through its Women in Energy Storage (WES) Mentoring Program in collaboration with the Global Women's Network for the Energy Transition (GWNET). The mentoring program focuses on career development and improving technical knowledge on thermal energy storage and battery storage for the grids, batteries for renewable energy hybrids, and mini-grids. In 2020, the program received over 240 applications from more than 50 countries. The first cohort of the WES Mentoring Program included 25 mid-career women from 17 countries, working in energy utilities, public sector, private sector, consulting, and academia. Following the success of the first edition, the ESP and GWNET plan on opening applications for the second cohort of mentees, thus continuing to work together towards closing gender gaps in the energy sector.



ETHIOPIA: ADDRESSING GENDER GAPS IN THE MINI GRIDS AND OFF-GRID VALUE CHAIN

Gender has been mainstreamed into the ESMAP-funded activities supporting the design of the *Access to Distributed Electricity and Lighting* project in Ethiopia. This includes the production of analytical evidence on gender equality and design of possible actions to address gender gaps. As a result, specific actions have been included in the project design to increase the number of women in the mini grids and off-grid technology value chain and narrow the gender gap in productive uses of energy and entrepreneurship, and technical assistance to help commercial banks think through alternative credit risk assessment approaches to support female-led and female-owned companies and adopting diverse business practices.

MALAWI: HOW COOLING CAN HELP WOMEN FARMERS

As part of the *Malawi—Financial Inclusion and Entrepreneurship Scaling* project, the ESMAP **Cooling** team is financing an analysis on how to improve farmers' productivity by investing in cold storage. That assessment includes sex-disaggregated data and information and their analysis, and looks at how cooling can help women farmers in particular.

MALDIVES: INCREASING FEMALE LABOR FORCE IN RENEWABLE ENERGY

ESMAP's **SRMI** supported a Gender Action Plan in the *Maldives Accelerating Renewable Energy Integration and Sustainable Energy* project, focusing on increasing women's participation in the Maldives utility. The team is also working with WePOWER, a regional practitioners' network to improve female labor force participation, concentrating on the South Asia Power sector, and to leverage WePOWER's expertise on gender aspects for the project in Maldives.

AZERBAIJAN AND THE PHILIPPINES: MAXIMIZING WOMEN'S EMPLOYMENT IN OFFSHORE WIND

In Azerbaijan and the Philippines, ESMAP's **Offshore Wind** program has commissioned roadmap studies that explore the actions needed to create a viable offshore wind market in these countries, and the market's benefits (for example, economic value added, jobs created, cost of energy reduced, carbon emissions avoided). The roadmaps also detail steps to maximize women's skills development and employment and to address gender challenges.

MIDDLE EAST AND NORTH AFRICA: THE GENDER BENEFITS OF ELECTRIC MOBILITY

Countries in the MNA region are at different stages of deploying electric mobility. ESMAP's Zero Carbon Public Sector team is providing technical assistance to unlock the development potential of electric mobility. This activity aims to identify the most effective interventions that will pave the way for country-specific loans to finance bus corridor electrification. The activity also includes an assessment of the potential gender benefits of electric mobility, examining, for example, gender differences in thermal comfort in the design and procurement of electric buses, and opportunities for women in the transformation of the workforce, sparked by technological change and the disruption of value chains.

RWANDA: DATA TO QUANTIFY GENDER GAPS

Data from ESMAP's Multi-Tier Framework (MTF) helped prepare the *Access and Quality Improvement in Rwanda* project. This included quantifying gender gaps in access to energy, as well as gaps in time management, willingness to pay for energy, and agency in the household—that is, the decision making process for the purchase of electric appliances.

PAKISTAN: INCREASING THE FEMALE LABOR FORCE IN RENEWABLE ENERGY

With the *Khyber Pakhtunkhwa Hydropower and Renewable Energy Development* project, the World Bank, including ESMAP's **Energy Storage** team, is helping Pakistan shift its national energy mix to domestic clean resources by investing in renewable energy generation, including hydropower and solar. As part of this project, the Pakhtunkhwa Energy Development Organization (PEDO) has committed to a target of 15 percent total female staff by FY2023. PEDO will also become a partner of WePOWER and develop a list of gender commitments under the five pillars of WePOWER.

BANGLADESH: EMPLOYMENT OPPORTUNITIES FOR WOMEN IN THE CLEAN COOKING VALUE CHAIN

In Bangladesh, the ESMAP **Clean Cooking Fund** is supporting the implementation of the *Bangladesh Clean Cooking* program, which plans to mobilize $82 million in investments to sell 4 million improved cookstoves and help 17.6 million beneficiaries. As part of this project, with funding from the Green Climate Fund, ESMAP is also supporting the development and implementation of the Gender Action Plan to integrate women into the clean cooking value chain (for example, cookstove production, marketing, and distribution).

ACCELERATING DECARBONIZATION

COP26 stressed the urgency of broadening ambition and strengthening action for climate change. Decisive decarbonization steps are critical when expanding world population, rising average income, and accelerating urbanization are pushing greenhouse gas emissions upward—while millions remain without access to electricity.

Meeting simultaneously sustainable development goals and international climate change objectives requires an integrated approach to decarbonization to avoid locking in inefficient, high-emitting, and expensive development trajectories.

The **Accelerating Decarbonization** pillar is a main component of ESMAP's support to both development and decarbonization. Recognizing that supply side interventions to scale up renewable energy generation is essential but not sufficient to reach net-zero goals by mid-century, and that a large share of emissions (about 75 percent) come outside the power sector, ESMAP's Accelerating Decarbonization complements other ESMAP pillars and builds on the foundation and experience developed in ESMAP's previous business plan (FY2017–20). Further, the pillar seeks to support integrated approaches with strategies and actions that accelerate: (1) the shift to electrification; (2) increased access to different forms of clean energy; (3) systematic integration of energy efficiency improvements across multiple end-uses; and (4) the generation of benefits for communities and the economy, including addressing gender inequality.

While barriers to countries' decarbonization (for example, first cost bias, high development and transaction cost, lack of awareness and information, split incentives, behavioral inertia, and the like) may be common, there is no single path for all. Accelerating Decarbonization supports countries in critical areas, with three sectoral-focused yet complementary programs to cater to each country's needs. The programs include: (1) the Zero Carbon Public Sector program; (2) the Efficient, Clean Cooling program; and (3) the Industrial Decarbonization program, along with two technology-focused programs: (1) the Geothermal Direct Use program; and (2) the Green Hydrogen program.

EFFICIENT AND CLEAN COOLING

By 2030, over half of the world's population will live in hot climates with increasing exposure to potentially dangerous heat conditions. As extreme heatwaves become more frequent, widespread installation of air conditioning will increase energy demand and exacerbate climate impacts. Efficient, clean cooling is essential for climate resilience of populations, workplace productivity, food security, and healthcare delivery.

There is a window of opportunity to meet the growing need and demand for cooling—from cold chains and refrigeration to ensure the safety of foods, medicine, and vaccines to space cooling to ensure comfortable, healthy, and productive homes, institutions, and workplaces—while avoiding the threat of runaway energy demand and GHG emissions and simultaneously help meet multiple SDGs.

ESMAP's **Efficient and Clean Cooling** program helps accelerate the uptake of sustainable and reliable cooling solutions across sectors such as health, agriculture, fisheries, buildings, and transportation. The program seeks to help countries develop the necessary market infrastructure, financing mechanisms, and policies and regulations to deploy sustainable and reliable, as well as affordable, cooling at scale, focusing on space cooling (energy-efficient buildings and air conditioning), refrigeration and cold chain, cooling needs in transport, and the mitigation of urban heat island effects. It takes advantage of windows of opportunities and synergies offered in relevant World Bank country operations (both IBRD and IDA), where sustainable cooling can be integrated in support of relevant sectoral priorities.

The program provides technical assistance—through grants and technical in-kind support—for the inclusion of efficient,

1.1 billion

There are globally more than 1.1 billion people lacking proper access to cooling – from cold chains and refrigeration to ensure the safety of foods, medicine, and vaccines, to space cooling to ensure comfortable, healthy, and productive homes, institutions, and workplaces. At 1.5°C of warming, experts warn that 2.3 billion people could be both exposed and vulnerable to heatwave events – a threshold that could be reached as early as 2030.

Photo © istockphoto / Jörg Henninger

BANGLADESH

LIVESTOCK AND DAIRY COLD CHAIN

Meat and dairy that spoil or arrive at market in a condition consumers reject are a missed opportunity for Bangladesh to reduce its food insecurity and increase the profits of its small farmers. Multiple barriers to cold chain development persist in Bangladesh, including limited access to energy in rural areas; poor and congested transport infrastructure; and lack of incentive for private sector investment. ESMAP's **Clean Cooling** program contributed a $350,000 grant to the World Bank's lending operation *Clean and Energy Efficient Cooling for Livestock Supply Chains in Bangladesh* to undertake technical and analytical work related to cold chain technology and logistics. The expected outputs are a comprehensive diagnostic of the needs for refrigeration in the livestock value chain and the identification of climate-friendly solutions and business models.

AFGHANISTAN

SOLARIZATION OF THE VACCINE COLD CHAIN

In Afghanistan, the solarization of vaccine cold chain facilities was made possible by additional financing of $113 million, including $3 million from ESMAP. The intervention was a key factor in deploying COVID-19 vaccines donated through COVAX, the COVID-19 Vaccines Global Access initiative, for an estimated 16 percent coverage of the entire population and the purchase of additional vaccines for a further 13 percent coverage. *For more information on ESMAP's COVID-19 Response (see p. 8).*

clean cooling in World Bank Group policy dialogues, including in the context of countries' climate change Nationally Determined Contributions. In collaboration with partner organizations like the Clean Cooling Collaborative, the Cool Coalition, the Basel Agency for Sustainable Energy (BASE) and SE4All, the program works to raise awareness on the urgency of the cooling issue and to develop knowledge on clean cooling solutions.

Since the onset of the COVID-19 pandemic, a particular focus of the program has been to contribute to the Bank's COVID-19 response efforts and the rollout of vaccines by supporting the deployment of reliable and climate-friendly vaccine cold chains and strengthening of client countries' health systems and enhancing their sustainability. The program also seeks to mobilize additional financing for technical assistance and investments to support the scale-up of affordable, sustainable, and reliable cooling solutions. Throughout FY2021, ESMAP helped mobilize over $150 million from the Green Climate Fund (GCF) to support a multi-country **Cooling Facility**, which was approved by the GCF in October 2021.

INDUSTRIAL DECARBONIZATION

Three industries—iron and steel, non-metallic minerals (cement, glass, lime), and chemical industries—are responsible for 70 percent of all direct industrial CO_2 emissions today. With the rapid industrialization taking place in low- and middle-income countries, this is a key challenge and an opportunity to shape a low-carbon future, a challenge for which ESMAP is uniquely positioned.

The aim of the initiative on **Industrial Decarbonization**, which is fully funded with £17.23m from the UK's Department for Business, Energy & Industrial Strategy, is precisely that of supporting World Bank Group teams and client countries on interventions targeted at decarbonizing the industrial sector. The initiative pursues a strategy of reduction of the demand for carbon-intensive products and deployment of innovative decarbonization technologies.

In FY2021, 10 grants were approved, with a total of $7.66 million to financial and technical support to World Bank Group task teams across global practices and IFC. In India, for example, the ESMAP grant supports the government of India in developing a holistic understanding of hydrogen-linked low-carbon pathways and in contributing toward informed decision making on sustainable deployment of solutions based on hydrogen produced through green hydrogen. In Vietnam, the ESMAP grant promotes innovative technologies and circular manufacturing processes at industrial parks and their tenants to upscale energy efficiency and create eco-industrial parks.

In Turkey, ESMAP supports the Ministry of Industry and Technology of Turkey in transforming conventional organized industrial zones into efficient, competitive,


Photo © ThinkGeoEnergy

and sustainable green zones by promoting innovative technologies and introducing the concepts of industrial symbiosis, and green organized industrial zones.

In Morocco, the ESMAP grant supported the government in planning for decarbonization of the industrial sector and the introduction of green hydrogen. Two assessments were produced, providing a snapshot of the value chain for hydrogen and hydrogen products in Morocco and preliminary estimates of the local production costs of green hydrogen and hydrogen-based synthetic fuels, including green metallic iron or crude steel.

GEOTHERMAL DIRECT USE

Geothermal aquifers are widespread and suitable for a range of geothermal direct use (GDU) applications. Direct use can increase the efficiency and commercial viability of existing geothermal operations. It has applications in agriculture, for example, food drying; in commerce, such as cement drying; and industry, for example, space heating.

"Direct use" refers to the use of heat energy from geothermal resources without an intervening medium, as opposed to its conversion to electrical energy. Even though geothermal energy has been used directly for centuries, currently it is mainly used in space heating and balneology applications in China, North America, and Northern Europe. At the end of 2019, it was estimated that installed thermal power capacity for direct use was a modest 107 gigawatts thermal (GWt). GDU projects can support economic activity, create jobs, promote gender equality, and displace greenhouse gas-intensive fuels currently used for heating, contributing to global decarbonization efforts.

ESMAP's **Geothermal Direct Use** program was created as part of the new FY2021–24 business plan to raise awareness of the value of direct use geothermal in creating and decarbonizing economic activity and to build the enabling environment necessary to scale up its use.

In FY2021, the program initiated technical assistance activities in Kazakhstan and Turkey to assess the potential of geothermal direct use.

KAZAKHSTAN

GEOTHERMAL RESOURCES

Kazakhstan holds significant geothermal resources. With the support of Iceland, ESMAP in FY2021 contributed to two studies that explored the potential of geothermal direct use in district heating in Kazakhstan. The first study, *Legal, Regulatory, and Institutional Review of Kazakhstan's Geothermal Sector*, found that the market environment for geothermal heat is not encouraging for private investment in GDU or public demand for GDU heating services, due to the prevalence of fuel subsidies. This study also found that the geothermal permitting and licensing process is rather unclear, as it is in the hands of many institutions. The second study is a prefeasibility analysis for two locations, Almaty and Turkistan. This report will be published in FY2022.

GREEN HYDROGEN SUPPORT PROGRAM

In the future, green hydrogen—hydrogen produced with renewable energy resources—could provide developing countries with a zero-carbon energy carrier to support national sustainable energy objectives. Moreover, green hydrogen solutions could decarbonize hard-to-abate sectors such as heavy industry, buildings, and transport.

In FY2021, the **Green Hydrogen Support** program was created as a standalone initiative in the new FY2021–24 business plan. Its aim is to raise awareness about the opportunities and challenges of green hydrogen and to build the enabling environment necessary to sustainably scale up green hydrogen in developing countries, and contributions and collaborations with IFC.

In August 2020, the program produced a report on *Green Hydrogen in Developing Countries*, which illustrates current and potential areas of deployment for green hydrogen production and fuel cell technologies in developing countries. The report is targeted at organizations that work with investors and governments on developing national roadmaps in order to highlight areas of national focus and to assess the applications in which green hydrogen can deliver gains.

During FY2021, ESMAP supported Costa Rica's the *First Fiscal and Decarbonization Management Development Policy Financing* project with ESMAP funds, which helped in the design, public consultation process, and presentation of the National Strategy for Smart Grids and Green Hydrogen. Further, in India, ESMAP carried out an assessment that will contribute toward strengthening the country's National Hydrogen Energy Roadmap. The roadmap is aimed at promoting green hydrogen and identifying early entry points through demonstrations, pilot projects, and capacity-building opportunities to facilitate a green hydrogen transition. In addition to country-level work, the group is co-funding a global green hydrogen report with IFC's upstream department, to create an opportunity analysis framework and identify private sector opportunities.

ZERO CARBON PUBLIC SECTOR

The public sector is a large energy consumer, and in some countries, it accounts for 10–20 percent of total energy consumption. Major consumers are public buildings, public utilities, and transport. In addition, public procurement is commonly 10–20 percent of a country's gross domestic product (GDP). In public buildings alone, energy savings of 20–50 percent can often be achieved through cost-effective retrofits in existing buildings, and new public buildings can be constructed to meet higher efficiency standards.

Overall, the public sector can take a leading role in the low-carbon transition by applying green procurement policies in its own procurement to create demand for low-carbon technology supplies. Through policy and regulation, governments also have a major impact on decarbonization in the industrial, commercial, and residential sectors.

Given the importance of the public sector in the transition toward net zero emissions, ESMAP started a new initiative on **Zero Carbon Public Sector**, which aims to accelerate the uptake of energy-efficient and low-carbon solutions by public sector entities in developing countries. The main areas of intervention are within public buildings, such as administrative and office buildings, schools, hospitals/clinics, and social housing schemes; public utilities, such as water utilities, district heating and cooling utilities, and waste management and street lighting services; and transport, such as public transport and publicly owned vehicle fleets (public buses, public fleet such as police vehicles, garbage trucks, and so on).

In FY2021, ESMAP's Zero Carbon Public Sector initiative supported 22 country and regional activities in all six regions of the World Bank.

BOX 2.7

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TURKEY

ENERGY EFFICIENCY IN PUBLIC BUILDINGS

In Turkey, with more than 175,000 public buildings across the country, the energy efficiency potential in the public sector is vast. The **Zero Carbon Public Sector** initiative supported the design and implementation of a $200 million project in Turkey called the *Energy Efficiency in Public Buildings Project*, jointly supported by the Bank and the Clean Technology Fund. The project not only invests in energy efficiency retrofits of public buildings, but also develops and implements performance-based contracts (Energy Services Company, or ESCO, contracts), under which a minimum percentage of energy savings for a building is specified in the tender documents and the bidders offer their most cost-effective approaches to meeting or exceeding the level of savings. In addition, the project pilots retrofitting of buildings to Nearly Zero Carbon Buildings (NZEB) standards.

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MEXICO

MANUALS FOR ENERGY-EFFICIENT DESIGN

In Mexico, the **Zero Carbon Public Sector** initiative supported the development of manuals for energy-efficient design for various housing solutions (for example, energy-efficient lighting, efficient faucets and toilets, energy-efficient heating, roof insulation, and passive design), which were integrated into the government's existing Sustainable Housing Subsidy program. The improved design measures can yield household savings of $90–$323 per year, and if applied to only 40 percent of households eligible for housing support, would contribute to the mitigation of up to 850,000 tons of CO_2 per year.

CLEAN COOKING

With 2.6 billion people globally still relying on pollutant traditional fuels and technologies to cook their meals, cooking poverty remains one of the most urgent development challenges of our time.

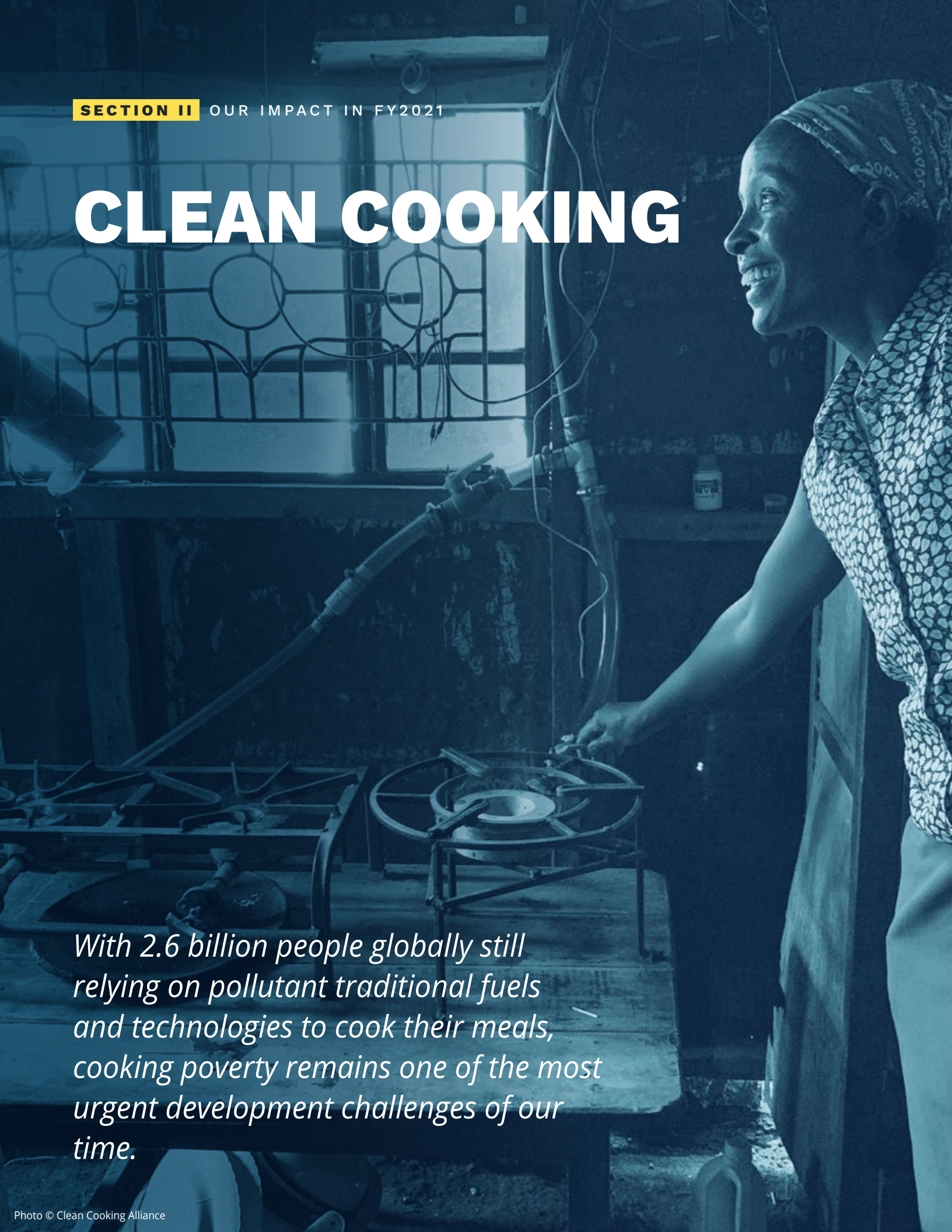


Photo © Clean Cooking Alliance

If trends continue without policy changes, 2.3 billion people will remain without access to clean cooking by 2030, jeopardizing the achievement of SDG 7 and progress across several related SDGs. Market-based and investment-driven transformative solutions are required for a paradigm shift. Breakthroughs are especially needed in three key, interlinked areas: (1) political commitment; (2) investment; and (3) knowledge and innovation.

Progress on access to clean cooking has been stymied because: (1) it cuts across multiple sectors, including energy and health, but is not prioritized in any of the sectors; (2) the most affected groups, women and young children in poor households, have the least voice; and (3) households do not prioritize the public benefits of clean cooking (for example, climate, health, and gender equality) in their decision making, which makes the sector less attractive to private investors.

To help client countries tackle this multi-sector challenge, the World Bank's ESMAP launched the **Clean Cooking Fund (CCF)** at the 2019 UN Climate Action Summit. The CCF has a funding target of $500 million, making it the largest fund dedicated to galvanizing political commitment, scaling up public and private investment, and catalyzing innovation in clean cooking.

The CCF is structured to support the strengthening of the clean cooking ecosystem through: (1) knowledge to advance sector understanding; (2) ramped-up investment in on-the-ground country and regional projects and technical assistance aid; and (3) partnerships, both internal and external, to increase cross-sector synergies and uphold the prioritization of policies and actions at all levels. Results-based financing (RBF) is used to pay for the verified results of interventions to incentivize supply-chain players, spur market development, and pay for the public co-benefits (health, gender equality, and climate) of interventions.

CLEAN COOKING FUND

FY2021 was the first year of operation for the CCF. The fund focused its activities on building awareness of the issue of clean cooking; launching its first operation co-financed with IDA in Rwanda; and mobilizing political commitment in collaboration with partners.

The CCF was prolific in its production of knowledge. In September 2020, the CCF launched the global flagship *The State of Access to Modern Energy Cooking Services Report* at the UN Climate Summit (see Box 2.9). Building on the main findings of the report, ESMAP developed and launched the first energy sector online learning course on clean cooking, "The Hidden Side of Energy Access: Understanding Clean Cooking." Other knowledge products included: eight additional publications, two databases, 14 webinars, six blogs, a video, infographics, a results brief, and an impact story.

$2.4 trillion

2.6 billion people globally still rely on polluting fuels and technologies to cook their meals. The cost to human health, women's productivity, and the environment and climate is conservatively estimated at $2.4 trillion per year.

BOX 2.9


Photo © SNV

THE STATE OF ACCESS TO MODERN ENERGY COOKING SERVICES

In September 2020 at the UN Climate Summit, ESMAP's **Clean Cooking Fund (CCF)** launched the flagship report *The State of Access of Modern Energy Cooking Services*. The report takes a deep dive into the progress, demand, supply, and enabling environment in the sector and charts a path for countries to transition their population to access better outcomes. The report contributes new perspectives and data to the sector: it provides a more comprehensive measurement using the Multi-Tier Framework for Clean Cooking to define "modern energy cooking services" and "improved cooking services" and to calculate global estimates. The report gives new estimates on the cost of inaction on SDG 7, disaggregated by health, climate, and gender impacts. It also includes new projections for the investment needs for progress.

The study has led to the development of several additional tools: a consolidated country database to facilitate country-level assessments; the Players & Initiatives database, which takes stock of cooking players across the globe, as well as cooking initiatives at the national, regional, and global levels; and the e-learning course "The Hidden Side of Energy Access: Clean Cooking," designed to promote a better understanding of the sector. The course has already reached over 1,200 participants. The CCF team is preparing six additional advanced modules on investment, climate, gender, behavior change, health, and policy, which are planned to be launched in early 2022.

RWANDA

CCF'S ENERGY ACCESS AND QUALITY IMPROVEMENT PROJECT

The government of Rwanda has set targets for shifting households from traditional to modern energy cooking solutions by 2024 that are also part of its climate commitments under Rwanda's Nationally Determined Contributions. With ESMAP's technical and grant support, the World Bank is working with the government of Rwanda to achieve its targets on access to clean cooking. The Rwanda Energy Access and Quality Improvement project, approved in July 2020, is the first CCF co-financed project, with a $10 million CCF grant and $10 million in IDA financing. It is the largest World Bank clean cooking operation in Sub-Saharan Africa. The project aims to provide 2.15 million people (500,000 households) with clean cooking solutions through an RBF facility managed by the Rwanda Development Bank and technical assistance activities to improve the enabling environment managed by the Energy Development Corporation Limited. The RBF facility has a pro-poor design with RBF subsidy levels linked to household socioeconomic categories and clean cooking performance tiers. The CCF team is working in coordination with other groups in the World Bank, including on behavioral science, climate change, and social protection, as well as with development partners such as GIZ's Energising Development (EnDev) program and the European Commission.

Under its investment pillar, the CCF's current portfolio includes an active project in Rwanda and seven pipeline projects in Burundi, Ghana, Horn of Africa region, Mozambique, Myanmar, Niger, and Uganda. These projects, once approved and implemented over the next 5-6 years, are expected to leverage $67.5 million in IDA co-financing, and $113 million in private sector financing. The projects will help 12 million people gain access to clean cooking, contributing to a healthier, greener, and more equitable post-COVID-19 recovery. Preliminary projections show that ESMAP support in expanding access to clean cooking will lead to $1.5 billion in health benefits, $193 million in climate benefits, and $523 million in gender equality benefits.

ESMAP has also worked with development partners to elevate the clean cooking agenda and mobilize political commitment. Together with WHO, UNDESA, and UNDP, the World Bank co-convened the Health and Energy Platform of Action (HEPA). As part of HEPA, ESMAP supported the launch of the High-Level Coalition on Health and Energy in May 2021 to create political momentum in the clean cooking sector. The meeting, which kicked off high-level cooperation to identify concrete steps to promote clean cooking and electrification of healthcare facilities, endorsed a Strategic Roadmap on Health and Energy. ESMAP co-led the Technical Working Group on Energy Access of UN High-Level Dialogue on Energy (HLDE) 2021, which prioritized policy and action to accelerate access to clean cooking. The HLDE *Thematic Report on Energy Access*, co-led by the World Bank and launched in June 2021, includes key recommendations to prioritize and coordinate political commitments and financing to accelerate access to clean cooking. The support is helping to build synergies with electrification efforts as well as a primary milestone to provide such access for one billion people by 2025.

ELECTRICITY ACCESS

Universal access to affordable, reliable, and modern energy services by 2030 is a prerequisite for improving the living and working conditions of the currently energy deprived populations. However, 759 million people still lack any access to modern electricity.

Photo Courtesy of Ignite Rwanda / ©IRENA

There has been tremendous progress over the past few years, yet it is projected that some 660 million people will remain unelectrified in 2030. The pace at which access is delivered will have to more than triple between now and 2030 to counter this. The challenge is particularly daunting due to the ongoing COVID-19 crisis, and given that 84 percent of the unconnected population live in rural areas—which are much more difficult to reach with reliable and affordable electricity—and 50 percent live in fragile and conflict-affected settings.

In order to achieve universal access that also delivers the desired socioeconomic impact, a paradigm shift is needed: the "last mile" to be connected must become the "first mile" to be tackled. This will require: doubling down on inclusiveness of energy access; reinforcing enabling policy and regulatory frameworks; leveraging innovations to provide energy services that are reliable yet affordable and that respond to the needs of all, including vulnerable households; and catalyzing pro-poor energy access financing, including end-user subsidies. It will also require measures leading to the development of productive uses and electrification of healthcare, education, and other public institutions, which will improve livelihoods and boost human capital formation.

Through its six workstreams—(1) Integrated Electrification Strategies and Planning; (2) Global Facility on Mini Grids; (3) Off-Grid Solar (Lighting Global); (4) Leave No One Behind; (5) Improving Livelihoods and Human Capital; and (6) Financial Innovation for Electricity Access—the **ESMAP Electricity Access** program places a distinct emphasis on scaling access at this new frontier. For FY2021, four main themes drove the program's work: (1) responding decisively to the COVID-19 crisis, with a focus on electrifying health facilities and the preservation of energy access gains achieved in the past; (2) using multiple workstreams of the program and working across sectors to set up ambitious, strategic interventions, which can significantly impact electrification progress; (3) increasing focus on pro-poor approaches and the Leave No One Behind agenda; and (4) growing the concentration on low-income countries with development challenges, including countries affected by fragility, conflict, and violence (FCV).

INTEGRATED ELECTRIFICATION STRATEGIES AND PLANNING

The **Integrated Electrification Strategies and Planning** program aims to increase adoption and improve implementation of national electrification strategies and least-cost electrification plans that use geospatial electrification modeling to integrate grid, mini-grid, and off-grid technologies.

The activity provides technical assistance and operational support to World Bank projects in all phases, from pipeline to implementation to impact assessment. The overall goal of the program is to have at least 50 client countries officially adopt integrated electrification strategies/least-cost plans, complete with universal access targets, implementation schedules, modalities, and financing plans. The initiative also provides support for geospatial electrification planning and preparation of geospatial-based mini-grid investment portfolios. In addition, the program has developed and is now expanding the **Global Electrification Platform** (see Box 2.11) which is an open-source, open-data platform offering the high-level overview of least-cost solutions—grid, mini-grid, and off-grid—based on location and demand of beneficiaries (https://electrifynow.energydata.info/).

759 million

According to the Tracking SDG 7: Energy Progress Report, 759 million people still lacked access to electricity in 2019. Under current and planned policies and further affected by the COVID-19 crisis, an estimated 660 million people will still lack access in 2030, most of them in Sub-Saharan Africa.

BOX 2.11

GLOBAL ELECTRIFICATION PLATFORM

Launched in 2019, the **Global Electrification Platform (GEP)** is an online, open-access, interactive platform that allows for the overview of electrification investment scenarios for a selection of countries. The scenarios present pathways for achieving universal electricity access, split into an intermediate strategy for 2025 and full electrification by 2030. Users can explore 216 different scenarios to meet the access goals. Users can add layers as well to help illustrate useful contextual information about a selected country, for example, wind potential, electricity networks, and location of health facilities.

In FY2021, as part of the World Bank's COVID-19 response, the Integrated Electrification Strategies and Planning program contributed geospatial analyses, which identified the least-cost and fastest ways to electrify health centers, differentiate facilities in areas with mini-grid potential as opposed to those that should be served with standalone solutions, and address electrification planning requirements to deal with the next public health crisis.

GLOBAL MINI GRIDS FACILITY

Mini grids have the potential to electrify close to half a billion people by 2030. They have demonstrated that they can provide reliable quality electricity for households and productive uses. Moreover, mini-grid capital costs have been declining and are expected to continue a downward trend through 2030. At the same time, the quality of service has increased dramatically. The costs of key mini-grid components, such as solar panels, inverters, batteries, and smart meters, have decreased substantially due to innovations and economies of scale in utility-scale solar projects, the booming rooftop solar industry, and the growing electric vehicle market.

In FY2021, the **Global Mini Grids Facility** (GFMG) launched two new knowledge products:

- Following the launch in FY19 of the flagship report *Mini Grids for Half a Billion People*, the ESMAP's GFMG team launched a comprehensive knowledge package. The package included a handbook, two companion volumes presenting additional analysis, databases, and infographics. This package informed and supported the implementation of the World Bank's growing investments in mini grids.
- In response to a growing interest in the topic from many task teams and clients, the facility launched a report that examines the scope for interconnected mini grids in areas already served by existing distribution companies to produce win-win-win outcomes for consumers, local distribution companies, and private developers.

Along with generating frontier knowledge, the GFMG continues to provide essential support to the expanding number of mini-grid projects in the World Bank's lending envelope. To date, these have reached 35 operations in 32 client countries, representing the largest mini-grid portfolio of a single global financier. In FY2021, the facility provided direct support to 18 of these projects, covering 24 countries (including large-scale regional programs in the Sahel and the Horn of Africa). Working to address the most complex energy access challenges across the globe, the GFMG team has been providing in-depth advisory assistance to a number of projects in the highest access-deficit and fragile countries, such as the Democratic Republic of the Congo, Haiti, and Niger.

Another highlight of the facility's work during the fiscal year is the hands-on engagement of its team in the recently approved Access to Distributed Electricity and Lighting in Ethiopia (ADELE) project. At $500 million, ADELE is the largest access project in Sub-Saharan Africa, with the

largest mini-grid component ($270 million) of any financier. In FY2021, with support from several members of the GFMG team who are leading the deployment of the mini-grid component, the ADELE project reached effectiveness and is now rapidly advancing in its implementation.

Another milestone reached is the implementation of the $350 million Nigeria Electrification Project (NEP), which the GFMG team continues to support extensively. As of the preparation of this report, 375 mini grids were under active preparation under the project's Performance-Based Grant financing window, anticipated to provide over 1 million people with reliable and affordable electricity.

The companies that are expected to deploy these mini grids have raised over $41 million in private funding, leveraging the corresponding IDA financing at a 1.3 ratio. In addition to this ongoing work, in response to the COVID-19 pandemic, the Nigerian Rural Electrification Agency, with support from the GFMG team, rapidly mobilized to provide the Nigerian healthcare sector with much-needed electricity supply and redirected $75 million out of the NEP financing to an urgent health facility electrification program. As a result, at present, construction of reliable solar power systems is in the final stages at 88 rural clinics across the country.

BOX 2.12

Photo © IRENA

MINI GRIDS FOR HALF A BILLION PEOPLE

The report *Mini Grids for Half a Billion People* has become a point of reference for the energy policy community and a second edition is being prepared. The comprehensive study launched in 2019 provided policymakers, investors, and developers with insights on how mini grids can be scaled up. It was also one of ESMAP's most downloaded reports (over 28,000 downloads), and its findings have been used to inform the design of the mini-grid component in a significant number of World Bank projects, including Burkina Faso, Burundi, Chad, the Democratic Republic of Congo, Ethiopia, the G5 Sahel, Mali, Mauritania, and Niger.

OFF-GRID SOLAR

The **Off-Grid Solar Scale-Up** program—also known as Lighting Global—aims to increase access to clean, reliable, and sustainable electricity provided by modern off-grid solar solutions. Lighting Global uses market-driven approaches to scale-up off-grid solar across the African continent and beyond, leveraging World Bank lending and the private sector. The program supports the use of technologies ranging from portable solar lanterns and solar home systems, to solar powered productive use applications, and larger off-grid solar systems for schools or health centers.

In FY2021, the program focused on:

- offsetting the economic risk to the nascent off-grid solar industry and off-grid solar consumers occasioned by the COVID-19 pandemic (see "ESMAP's COVID-19 Response," page 8).
- developing market-compatible solutions for reaching the "last mile" and low-income households in complex business environments such as fragile states.
- promoting technology and business model solutions for the electrification of productive uses and public institutions through off-grid solar solutions, in collaboration with ESMAP's Improved Livelihoods and Human Capital program.

In June 2021, the biyearly *Global Off-Grid Sales Data* report, published by GOGLA, the global association for the off-grid solar energy industry, with support from Lighting Global, found that while the off-grid solar industry had shown tremendous resilience throughout the pandemic, the path to recovery was uneven. Due to consumers' reduced spending and capacity and severe disruptions in global supply chains, the industry was not yet back on a solid growth trajectory.

In FY2021, Lighting Global joined forces with GOGLA and ACE TAF, a program funded by the UK Government Foreign, Commonwealth and Development Office (FCDO), to create the End User Subsidy Lab. The lab is a platform through which stakeholders can jointly design smart and effective end-user subsidies, pooling knowledge, technical expertise, and funding. End-user subsidies, which directly reduce the amount a customer must pay for their purchase of electricity service or products, can accelerate access for millions of low-income and vulnerable households.

BOX 2.13

RWANDA

ENERGY ACCESS

In Rwanda, while the pace of grid electrification has increased, off-grid access expansion has slowed down, mainly because low-income households cannot afford to pay for electricity services or products. The Off-Grid Solar program informed the World Bank *Rwanda Energy Access and Quality Improvement* project, which will provide electricity access through off-grid solar systems to 1.6 million people, including first-time access to 150,000 people in low-income brackets. The project increases affordability of solar products drastically. It provides end-user subsidies to low-income households, which are assigned based on the household poverty level. Support from the Off-Grid Solar program has helped the Rwandan government analyze the lessons from the pilot, plan its scale-up, and implement it.

LEAVE NO ONE BEHIND

Despite COVID-19-related movement restrictions and pleas from the international community for a ceasefire that would facilitate the COVID-19 response, displacement continued to occur—and grow—during the pandemic. As a result, according to the United Nations High Commissioner for Refugees, in 2021 more than 1 percent of the world's population, or 1 in 95 people—nearly 82.4 million—were forcibly displaced.

The precursor to ESMAP's **Leave No One Behind** program, the Energy Access for Host Communities and Refugees initiative, was restructured during FY2017–20. Following the sharp increase in the number of forcibly displaced people (FDPs) and their impact on host communities' electricity infrastructure, the initiative was reoriented to acknowledge these previously unaddressed development challenges, and toward the provision of safe, reliable, and affordable electricity for host communities and FDPs. The program aims to increase the number of World Bank Group operations and national electrification strategies where electricity access for displaced people, refugees, and host communities is mainstreamed.

In FY2021, the publication of the program's *Energy Solutions for Forcibly Displaced Persons and Their Host Communities: Closing the Financing Gap* note provided an overview of how humanitarian agencies and host governments address the energy challenges and how development institutions can tackle the current displacement crisis.

The initiative is working with ESMAP's Multi-Tier Framework (MTF) team (page 17) to adapt the MTF questionnaire to enable governments to better identify displacement settings and address their electrification needs. Currently, governments facing influx of displaced people have a hard time assessing the additional energy strains these displacements occasion on host communities or integrating the energy needs of displaced people in their electrification plans. As part of the World Bank's Horn of Africa Initiative's rapid support for regional integration, the program held several consultations with the World Bank/UNHCR Joint Data Center on developing a MTF survey about displacement, and additional fundraising activities to launch a nationally representative MTF survey on displacement in Somalia, including a module on livelihoods.

In FY2021 in Yemen during the COVID-19 outbreak, the program contributed to efforts to restore the reliable electricity supply and provide affordable electricity access by assessing electricity access expansion, institutional arrangements, and market conditions. For more information about ESMAP's COVID-19 response, see page 8.

IMPROVING LIVELIHOODS AND HUMAN CAPITAL

Significant progress has been made toward achieving universal access to electricity. However, the socioeconomic benefits of electrification have not been fully reaped, as many electrified households and businesses do not use electricity for purposes beyond lighting and phone charging. Moreover, the degree of reliable electricity service to public institutions remains dire, especially in Sub-Saharan Africa, where half of secondary schools and a quarter of health facilities have no power.

The **Improving Livelihoods and Human Capital (ILHC)** initiative aims at promoting the use of electricity to enhance income generation and productivity—also called productive use of electricity (PUE)—and the electrification of public institutions. The initiative is raising awareness on the enabling role of electricity in achieving SDGs beyond SDG 7. ILHC contributes to efforts to advance cleaner, renewable energy for food and water security and health, education services, and efficiency of appliances and equipment.

BOX 2.14

Photo © istockphoto / Juanmonino

HAITI

IMPROVING LIVELIHOODS AND HUMAN CAPITAL DURING THE PANDEMIC

In FY2021, the COVID-19 pandemic called for rapid action to deploy vaccines, restore livelihoods, and strengthen public institutions and the resilience of communities. In Haiti, the ILHC initiative provided solar photovoltaic and battery storage installations for five large hospitals, solar PV-powered water pumps in five piped water systems prioritized for the COVID-19 response, and solar hybrid systems for health and/or water facilities in rural towns. The project, Haiti Renewable Energy for All, benefited from $2.9 million in additional financing from the Swedish International Development Cooperation Agency (SIDA) through ESMAP and $2 million from the Haiti COVID-19 Response Project cross-sector investment in addition to the initial Small Renewable Energy Program (SREP) funding. The intervention strengthened the government's response to the COVID-19 health crisis by enabling healthcare facilities to power life-saving equipment such as oxygen concentrators and to improve hygienic conditions in communities by enabling water pumping.

In FY2021, with support from the Rockefeller Foundation, the program supported the preparation of four pilots in Democratic Republic of Congo, Ethiopia, Kenya, and Nigeria. In Ethiopia, the mainstreaming of the productive use of electricity in the off-grid electrification program included work on the identification of productive loads (horticulture, dairy, poultry, and industrial parks) suitable to serve as anchor customers for the mini grids.

In Burundi, the ILHC team provided grant assistance and technical expertise to evaluate the country's electrification strategy and estimate the demands of health and education infrastructure, as well as design standardized solar-power service packages for up to 400 sites. In Liberia, ILHC provided grants for the electrification of healthcare and vaccine storage facilities through standalone solar systems.

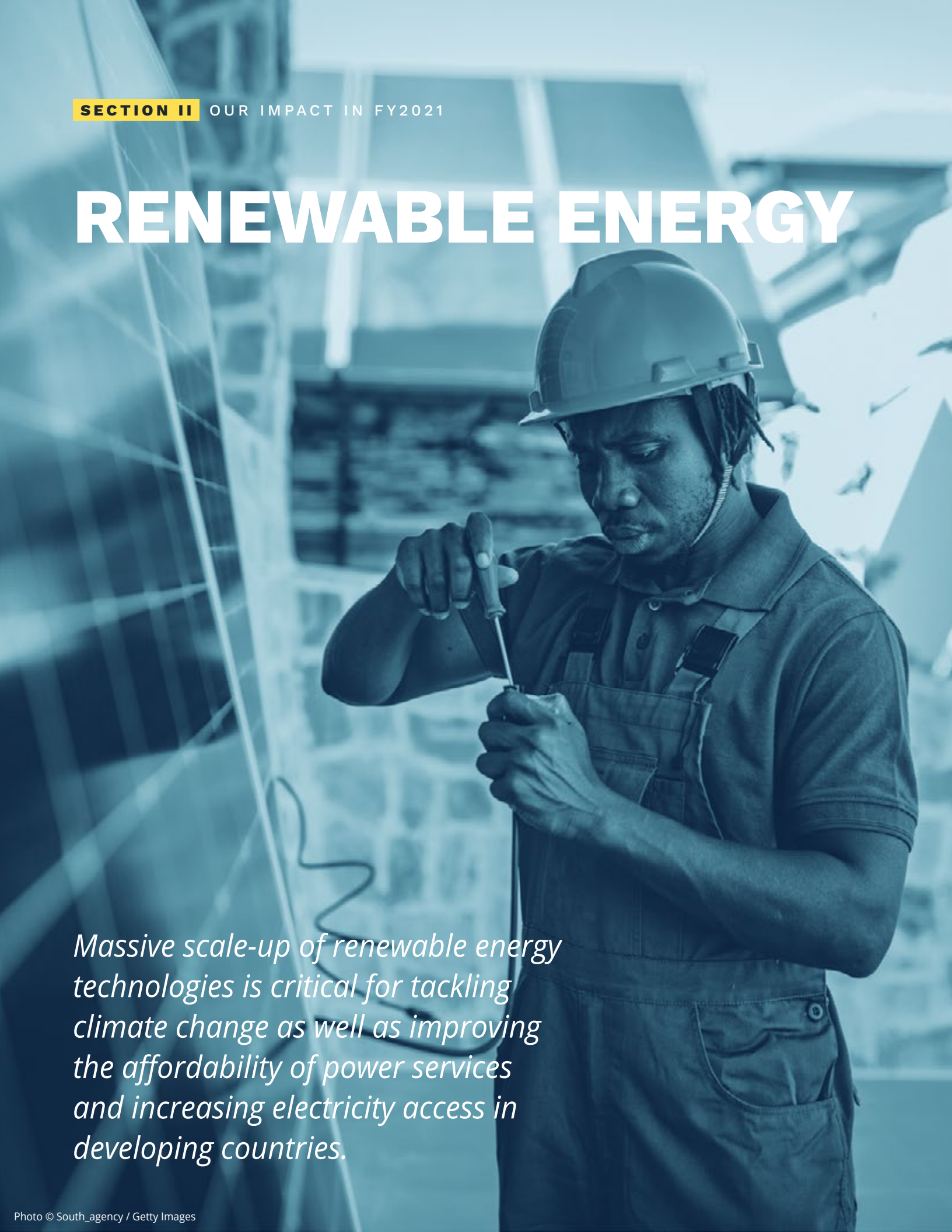
FINANCIAL INNOVATION FOR ENERGY ACCESS

Innovative financing is required in order to reach the most vulnerable and disadvantaged segments of society. Often, we observe that existing market incentives without adequately targeted interventions are insufficient for the private sector to extend solutions to portions of the population that are considered high risk or are otherwise not a top priority, due to location. It is then important to create the right incentives and implementation tools to help deliver electricity services and address affordability constraints for end-users.

The **Financial Innovation for Access** initiative, launched in FY2021, endorses the development and testing of financing instruments and implementation modes to drive energy access acceleration, inclusion, and impact across all electricity systems and solutions. It aims to do so in a way that provides additional financing instead of excluding or competing with private markets. While there is a growing number of structuring options and innovative instruments, it is not always clear how to determine the applicability of the instruments and use these in pursuit of increasing electricity access—a challenge this initiative strives to address.

Since April 2021, the financial innovation team has carried out analysis and drawn design recommendations for impact-linked finance mechanisms for underdeveloped off-grid solar markets such as Liberia and Burundi, in coordination with Acumen Fund.

RENEWABLE ENERGY



Massive scale-up of renewable energy technologies is critical for tackling climate change as well as improving the affordability of power services and increasing electricity access in developing countries.

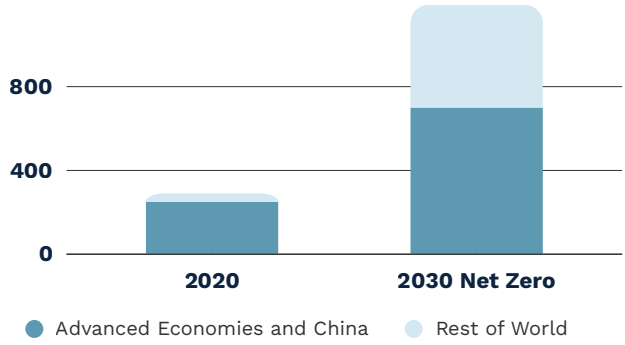
Photo © South_agency / Getty Images

Renewable electricity is poised to play a critical role not only to decarbonize the power sector and increase access, but also to enable the clean electrification of transportation and certain heating and cooling end-uses. For hard-to-decarbonize sectors (for example, certain heavy industries), green hydrogen is expected to be the technology of choice, and its production will necessitate significant renewable energy investment.

According to the World Energy Outlook 2021 of the International Energy Agency, to achieve net-zero emissions by 2050, renewable energy expansion in developing countries needs to accelerate: the share of renewables needs to increase from almost 30 percent of electricity generation globally in 2020 to about 60 percent in 2030 in the IEA Net Zero Scenario (see Figure 2.1). In addition to the need for the rapid ramp-up and modernization of grids, the IEA's outlook suggests that utility-scale battery storage capacity worldwide needs to increase 30 times from 2020 to 2030 in the Net Zero Scenario.

ESMAP is scaling up renewable power technologies in developing countries, using a three-prong approach, to: (1) help countries improve their enabling environments for renewable energy (RE) in order to unlock large-scale investment in mature RE technologies, such as ground-mounted solar, onshore wind, and geothermal, and aid the integration of variable renewables in power systems; (2) broaden the range of RE technologies deployed in developing countries to include new innovations such as battery storage, rooftop and floating solar, and offshore wind; and (3) build a pipeline of sustainable hydropower projects in recognition of their role in power grids for system balancing, flood control, and irrigation.

Figure 2.2. Capacity Additions of Renewables



Source: World Energy Outlook 2021, International Energy Agency.

ENERGIZING RENEWABLES

Solar and wind technologies are revolutionizing the power sector. They can become a game changer for many developing countries: solar and wind power is abundant, among the cheaper sources of electricity, and cost-competitive with fossil fuel in many countries.

But while the proportion of solar and wind generation is rising every year, it is still far from the level needed to reach the SDGs and Paris Agreement climate change targets. To reach these objectives, large amounts of private funding will have to be unlocked to complement the limited public financing available. Yet deployment of private investment at the necessary scale in developing countries is hindered by critical challenges such as grid integration technical constraints, off-taker risk, inadequate regulatory frameworks, and weak procurement and planning capacity.

60%

To achieve net-zero emissions by 2050, developing countries' share of renewable energy in electricity generation globally needs to grow from almost 30 percent in 2020 to about 60 percent in 2030.

BOX 2.15

INDONESIA

TRANSITIONING FROM COAL TO RENEWABLE ENERGY

ESMAP provided support to Indonesia in its efforts to transition from coal to solar energy. This included assistance with the development of least-cost generation plans, a variable renewable energy (VRE) integration analysis, and a reliability analysis. Through this activity, the ESMAP team aided the creation of a new electricity generation plan and was able to demonstrate that switching from the current plan of building 450 MW of new coal projects to building solar plants producing up to 1 GW instead could save the Indonesian government up to $300 million by 2030. The activity also led to a proposed $500 million investment financing by SRMI, the Canada Facility, and the CTF. The resulting project, which will fund the identified grid upgrades for VRE integration, as well as grid resilience and reliability, and a transaction advisor to support the selection of private investors, is scheduled to go to the Board in FY2022.

The Sustainable Renewables Risk Mitigation Initiative (SRMI)—launched in 2018 at COP24 under the leadership of the World Bank in partnership with the Agence Française de Développement, the International Renewable Energy Agency, the International Solar Alliance, and SE4all—helps developing countries take a series of important steps to deflate critical risks perceived by the private sector while also minimizing risks for the public sector. In addition, SRMI helps such countries build a pipeline of bankable solar and wind projects for consideration by the private sector while maximizing socioeconomic benefits. The **Energizing Renewables** program—SRMI's ESMAP implementation window—offers an integrated package of support for geothermal, onshore wind, and solar solutions combined with financing from multilateral development banks and climate funds.

In FY2021, the World Bank Board approved three investment projects—in Burkina Faso, Maldives, and Tanzania—that followed the SRMI methodology; the projects were co-financed by the Clean Technology Fund (CTF).

In March 2021, the Green Climate Fund (GCF) Board approved a $280 million funding proposal for SRMI. It aims to unlock 2.5 GWs of solar and wind projects in seven client countries—Botswana, Central African Republic, Democratic Republic of the Congo, Kenya, Mali, Namibia, and Uzbekistan—by leveraging over $3.3 billion in private investments. These projects are expected to provide access to green and reliable electricity for the poorest households to approximately 4.2 million people. SRMI will help the seven countries shift to low-emission sustainable development pathways and increase access to affordable, reliable, sustainable, and modern energy.

In addition to funding from the CTF and GCF, other donors, including France, the Netherlands, Norway, and the UK, have supported SRMI, with the target to mobilize $1 billion in climate finance and technical assistance funding across 20 developing countries by 2025.

ENERGY STORAGE PROGRAM

The variability of wind and solar energy increases the complexity of the operation of power systems, requiring more flexibility and constraining their upscaling. The Energy Storage program aims at addressing this issue by developing tailored solutions for the sustainable increase of energy storage. The Energy Storage Partnership (ESP), supported

through this program, brings together 34 partners worldwide to foster international cooperation to adapt and develop energy storage solutions for developing countries.

In FY2021, the **Energy Storage** program developed a range of knowledge-sharing products, training, and policy reports as well as an energy-storage sizing app—a tool to provide a preliminary assessment of the energy storage sizing requirements (in terms of both energy and power) and the project cost of hybrid solar PV and energy storage systems (https://storagesizing.energydata.info/).

The report Deploying Storage for Power Systems in Developing Countries: Policy and Regulatory Considerations, published by the ESP, introduces the different ways in which storage can meet policy objectives and overcome technical challenges in the power sector. The report provides guidance on how to determine the value of storage solutions from a system perspective, and discusses relevant aspects of policy, market and regulatory frameworks to facilitate storage deployment.

The report *Reuse and Recycling: Environmental Sustainability of Lithium-Ion Battery Energy Storage Systems* provides an overview of the status of the reuse and recycling of lithium-ion batteries in order to assess whether and to what extent developing countries can and should play a larger role in this burgeoning area. According to the report, since stationary batteries will play a predominant role in providing grid services to integrate variable renewable resources and decarbonizing the transport sector, the reuse and recycling of batteries will be a critical component in helping developing countries to make a rapid and sustainable transition in delivering clean energy. This report provides short-term and long-term recommendations toward building this enabling environment around reuse and recycling in developing countries.

Warranties for Battery Energy Storage Systems in Developing Countries, a third report published by the ESP in FY2021, describes good practices for battery energy storage systems (BESS) warranty design. Warranties provide mechanisms to mitigate the technical and operational risks of battery projects by transferring the risk of defects or performance issues to the manufacturer or the battery vendor. The report offers indispensable insights on responding to the challenges of the conditions found in some developing countries, where BESS must operate in harsh climate conditions in remote locations with poor accessibility and limited internet access and unreliable power supply, often with low availability of skilled local workforce.

BOX 2.16

MALDIVES

SOLAR PV AND BATTERY STORAGE FEASIBILITY

ESMAP support assisted the government of Maldives in assessing the techno-economic feasibility of solar PV and battery storage for selected islands. The objective was to evaluate the potential of deploying renewable energy sources and energy storage in the Maldivian context. The study, which was endorsed by the government, confirmed that solar PV and energy storage is the least-cost option for displacing the conventional diesel generation. It was critical in informing the design of the World Bank's project on accelerating renewable integration and sustainable energy, with a total of 50 MWh battery storage capacity integrated into the project design.

BOX 2.17

MOROCCO

ENERGY STORAGE TESTBED: ACCELERATING FRONTIER ENERGY STORAGE SYSTEMS TO MARKET

The ESP is developing a global "Network of Energy Storage Testbeds" (NESTs) Initiative. Energy Storage Testbeds are proposed in India, Morocco, and South Africa to serve regional needs to address the significant and unique barriers facing developing nations in accessing the benefits of energy storage systems (ESS). A "Testbed" is a facility which enables countries to assess energy storage performance under realistic local grid conditions at low cost and at manageable scale.

Morocco's energy storage testbed is hosted and developed by the Moroccan Agency for Sustainable Energy (MASEN) at its Research and Development testing facility in the Noor Ouarzazate Complex. ESMAP supported by BEIS is preparing a $5 million grant for the Morocco testbed, which is most developed amongst the Global NESTs Initiative. ESMAP's support will increase the testbed's capabilities for testing an expanded range of technologies, strengthen its capacity building approaches and business model for sustained operations, and help implement a testing regime of performance and safety related codes and standards.

The ESP helps bring new technological and regulatory solutions on energy storage to developing countries, as well as helps develop new business models. In South Africa, the ESKOM Renewables Support Project is the largest World Bank and African Development Bank battery storage operation, mostly funded by the CTF. This flagship project could serve as a reference for many subsequent projects, with demonstration effect on procurement in the rest of Africa and other low-income countries.

INNOVATIVE SOLAR

The **Innovative Solar** initiative is a new program that aims to expand the scope of solar deployment beyond typical large-scale, ground-mounted solar photovoltaics (PV) projects, and support client countries' awareness, adoption, and deployment of innovative grid-tied solar concepts and business models.

The program supports the uptake of innovative solar solutions in developing countries through three main workstreams:

- Support for distributed solar deployment (for example, rooftop PV) in developing countries' specific settings through the exploration of "use cases" and business models that alleviate challenges, such as energy security, costs of power production, and quality of service.
- Support for floating solar deployment in places where land is scarce or land acquisition is a major obstacle to solar development. Building on the experience with floating solar on human-made, inland water bodies, the new areas of research include marine-floating solar, in particular, inclusion of floating solar to marine spatial plans and development of environmental and social considerations for deployment of marine-floating solar.

Photo © Getty Images/iStockphoto

SENEGAL

SOLAR ROOFTOPS

In Senegal, an ESMAP grant funded an assessment of the potential for solar rooftop installations on public buildings to help reduce the arrears of public entities to the local utility, SENELEC. The activity identified 25 suitable public buildings that were further assessed for their available rooftop space, solar potential, and electricity consumption. Economic analysis for these potential installations suggests that the rooftop solar installations could save SENELEC approximately €4.5 million over a 20-year period; that the installations could meet 116 percent of their electricity needs of these buildings; and that they would have a five-year payback period. The results of the analysis were presented to the government of Senegal in spring 2021.

- Support for hybridization of solar power with other technologies in order to decrease its variability, improve its dispatchability, and improve the use of grid infrastructure such as power lines and substations. Examples of such work include hybridization of hydropower plants with solar power plants and hybridization of solar power generation with other forms of energy storage.

In FY2021, the Innovative Solar program allocated seven technical assistance grants in aid of development of distributed solar PV in Bangladesh, Grenada, Nigeria, and Peru; a global program on development of policies in agriculture that foster the uptake of distributed solar replacing diesel generators for water pumping in irrigation systems; and development of floating solar installations on hydropower reservoirs in Sri Lanka and Tajikistan.

BOX 2.19

Photo © International Hydropower Association

TAJIKISTAN

FLOATING SOLAR ON HYDROPOWER PLANTS

In Tajikistan, ESMAP is supporting a preliminary techno-economic assessment of the possibility to install floating solar plants on Nurek and Baipaza hydropower plants and Qairokkum reservoirs. The assessment, currently under way, focuses on issues related to construction, anchoring, mooring, and interconnection with the grid network. A high-level environmental and social screening and studies of financing options will be performed once the technical assessment is completed.

Photo © Fred. Olsen Windcarrier

VIETNAM

OFFSHORE WIND ROADMAP

The program led pioneering activities in Vietnam, a country facing rapidly increasing demand, where the power system is expected to double in size by 2030 and near-term energy supply shortfalls could occur. Its footprint of fossil fuels could increase, in fact, as coal accounts for 34 percent of power generation, which could rise by 55 percent unless course correction is carried out in the coming year. The **Offshore Wind Development** program delivered to Vietnam a strategic offshore wind roadmap (the program's first in a series of roadmaps for emerging markets), which explored the role of offshore wind in helping to sustainably meet the country's future energy demands. The roadmap presented the opportunities and challenges that come with developing an offshore wind sector in Vietnam and highlighted the economic benefits that could be created. This information has helped the government make informed, strategic decisions on offshore wind; Vietnam's new power development plan sets the target 8.5 GW of offshore wind to be operational by 2035.

OFFSHORE WIND

Around a quarter of the world's offshore wind potential is within the waters of low- and middle-income countries. Accelerating its uptake in emerging markets has become essential in their transition from fossil fuels. The offshore wind industry has matured rapidly over the past decade and can provide GW-scale generation that is close to matching coastal demand with capacity factors exceeding 50 percent at cost-competitive prices.

The joint ESMAP-IFC **Offshore Wind Development** program's objective is to accelerate the use of offshore wind in low- and middle-income countries. Analysis by the program estimates that there are over 71,000 GW of technically extractable offshore wind resources globally.

During FY2021, largely through financing to ESMAP from BEIS, country grants were provided to the energy programs in Azerbaijan, Colombia, India, the Philippines, and Sri Lanka, adding to the grants delivered to Turkey and Vietnam in FY20, bringing the total number of grants to seven. These grants are all buttressing the development of offshore wind roadmaps. Six country roadmaps are in progress, and one (Vietnam) has already been completed.

ESMAP established its Offshore Wind Development Program in partnership with the International Finance Corporation (IFC), to strategically support both the government and industry in emerging markets. This joined up approach enables the World Bank Group to provide a comprehensive package of support to our clients. The Program also works in close cooperation with the Global Wind Energy Council (GWEC). GWEC provide strong links with the international offshore wind industry and offer market insights in our client countries. For example, in September 2020, the Program collaborated with GWEC to produce an offshore wind virtual study tour which saw over 400 delegates, including representatives from 24 client governments, attend the three-day event.

The Offshore Wind Development program prepared an Offshore Wind Roadmap for Turkey, which has a similar objective to the roadmap for Vietnam. To aid the subsequent delivery of offshore wind in Turkey, the Offshore Wind Development program is also supporting activities under the EU Instrument for Pre-Accession Assistance (IPA) 2019 program. The work is going to include undertaking offshore site surveys and auction design, ahead of a future tender for offshore wind.

HYDROPOWER

Sustainably developed hydropower delivers affordable renewable energy and promotes broader climate objectives, but significant hydropower potential remains untapped. The **Hydropower Development Facility** helps clients identify and build a pipeline of sustainable hydropower projects in their country, supports clients in developing and managing next-generation rehabilitation and greenfield projects, and aims to accelerate the deployment of technology that is critical to integrating variable renewable energy into the grid.

The facility's portfolio supports the development of a total of 2.5 GW of hydropower, mostly in South Asia. This includes the preparation of the Upper Arun Hydroelectric project in Eastern Nepal, the most ambitious among the project grants, which is envisaged to produce 1060 MWs. In FY2021, the Hydropower Development Facility supported several studies related to the feasibility of the project, including economic and financial analyses, a study on vocational training and fisheries, and a dam safety assessment.

The facility also supports the Rusumo Hydroelectric project at the border of Rwanda and Tanzania. The project will generate approximately 80 MWs, to be shared equally among Burundi, Rwanda, and Tanzania. In FY2021, the Hydropower Development Facility continued to provide technical assistance related to tunneling and blasting activities, with the objective of ensuring that blasting is performed within permissible limits and in adherence with international environmental, health, and safety standards.

Photo © 2020 gokturk_06/Shutterstock

INDONESIA

FIRST PUMPED STORAGE HYDROPOWER PROJECT

A pumped storage hydropower is a configuration of two water reservoirs at different elevations that can generate power as water moves down from one to the other, passing through a turbine. In Indonesia, the World Bank is financing the construction of the country's first pumped storage hydroelectric facility, in the West Java province. The Upper Cisokan hydropower project will generate 1 GW and will contribute to Indonesia's transition to a lower- carbon economy. In FY2021, ESMAP's **Hydropower Development Facility** provided technical assistance to the preparation and early implementation of the project. This includes knowledge sharing on: contract negotiations, environmental and social safeguards, implementation arrangements, owner's engineer recruitment, climate risk assessments, and project appraisal.

PARTNERSHIPS

THE POWER OF PARTNERSHIPS

Integral to ESMAP's business model is to actively collaborate with multilateral and bilateral organizations, initiatives and programs, as well as partnering with nongovernmental organizations, think-tanks, research institutions and industry groups to influence the global energy agenda. Over the years, ESMAP has built a strong network of partnerships across sectors. In FY2021, ESMAP created new partnerships and enhanced existing ones. Below are some examples of these collaborations:

CLEAN COOLING COLLABORATIVE (CCC)

ESMAP's Efficient and Clean Cooling program (ECCP) was established in 2019 thanks to an initial $3 million grant to ESMAP from the philanthropic Clean Cooling Collaborative (CCC) - formerly known as the Kigali Cooling Efficiency program or K-CEP. ECCP has also benefitted from the K-CEP cooling network. ECCP has since become an integral part of the FY2021-24 ESMAP Business Plan's Accelerating Decarbonization pillar. In FY2021, CCC recognized ESMAP with the 'High Impact' award at their K-CEP Phase 1 Impact Event.

WHO, UNICEF AND GAVI

As a part of the World Bank's COVID 19 Vaccine Delivery taskforce, ESMAP participates in regular interagency meetings with the World Health Organization (WHO), the United Nations Children's Fund (UNICEF) and the Vaccine Alliance (Gavi) to share recent updates, good practices, as well as experiences with common challenges regarding supply and logistics - especially cold chains - relevant to the COVID 19 vaccine roll-out. ESMAP collaborates closely with the three organizations at global and country level on data sharing, tools, models to assess cold chain gaps and costs, information on the cold chain landscape in low- and middle-income countries along with knowledge dissemination of latest cold chain equipment and technologies, solarization of cold chain, and identification of co-investment opportunities.

GREEN CLIMATE FUND (GCF)

ESMAP and the World Bank's Energy Climate Finance team have worked closely with the Green Climate Fund (GCF) over the past 18 months to develop a multi-country facility dedicated to sustainable cooling. In October 2021, the GCF Board approved the World Bank's Cooling Facility, through which 157 USD million GCF funds will be channeled to nine World Bank projects. It is one of the world's first multi-country financing initiatives to focus on cooling and will help nine identified countries develop the necessary market infrastructure, financing mechanisms, and policies and regulations to deploy clean cooling at scale. It will focus on space cooling (i.e., energy efficient buildings and appliances), as well as refrigeration and cold chains in the health and agriculture sectors.

COOL COALITION

ESMAP is a member of the Cool Coalition's Steering Committee and engages in Cool Coalition activities and events raising awareness about and promoting a global transition to efficient and climate-friendly cooling. ESMAP supports the Cool Coalition in promoting a "reduce-shift-improve-protect" holistic and cross-sectoral approach to meet growing demands for cooling.

TRACKING SDG7

Along with the International Energy Agency, the International Renewable Energy Agency, the United Nations, and the World Health Organization, the World Bank/ESMAP is a custodian agency in tracking the SDG 7 targets. Every year, the custodian agencies publish Tracking SDG7: The Energy Progress Report. The report provides the most comprehensive look available at the world's progress towards global energy targets on access to electricity, clean cooking, renewable energy, and energy efficiency. The 2021 edition informed the United Nations High Level Dialogue on Energy (see p. 5).

UNICEF

ESMAP is working with UNICEF on electrification of public institutions. The objective of this partnership is to collaborate on market assessments and data sharing for electrification of schools and health centers in low-income client countries. These assessments can subsequently inform investments in electrifying public institutions. Collaboration is underway in Niger and Sudan.

TESLA

The World Bank and TESLA started a collaboration in November 2020 through which Tesla is sharing knowledge and analysis with the World Bank on the cost implications and least cost of energy of different levels of economies of scale, technology optimization (solar, battery, energy management system), and logistics in mini-grid portfolios. TESLA representatives are also presenting innovative solutions to electrify public institutions (schools, health centers) in World Bank webinars and workshops.

HEALTH AND ENERGY PLATFORM FOR ACTION (HEPA)

In 2019, the WHO with the World Bank, the United Nations Development Program (UNDP), the United Nations Department of Economic and Social Affairs (UNDESA) and the support of the International Renewable Energy Agency (IRENA) and other key stakeholders established the Health and Energy Platform of Action (HEPA). This platform aims to strength cooperation between health and energy sectors, with an initial focus on clean cooking and health care facility electrification. In FY2021, as part of the HEPA, ESMAP collaborated with WHO and the Clean Cooking Alliance (CCA) in a series of webinars on Transitioning to Clean Cooking aimed at energy and health decisionmakers.

AFRICA CLEAN ENERGY

Through a partnership with the African Clean Energy (ACE) program of the United Kingdom's Foreign, Commonwealth & Development Office and the Global Off-Grid Lighting Association (GOGLA), ESMAP created in FY2021 the first end-user subsidy lab for off-grid solar products. The lab seeks to enable stakeholders to design smart and effective end-user subsidies that will lower the cost of off-grid solar products without creating market distortions.

VIENNA ENERGY FORUM, EFFICIENCY FOR ACCESS, ENDEV

ESMAP's Improving Livelihoods and Human Capital (ILHC) program has built a number of external partnerships to share knowledge on productive uses of energy. This includes cooperation with the UNIDO Vienna Energy Forum Virtual Series on Food Systems, the Efficiency for Access (EforA) Coalition led by the Collaborative Labelling and Appliance Standards Program (CLASP), and EnDev Learning & Innovation Productive Use of Energy Community of Practice.

UNHCR

ESMAP's Leave No One Behind (LNBH) program collaborate with the data and energy teams from the United Nations Refugee Agency (UNHRC). This collaboration not only allows for a better understanding of the energy situation around the refugee camps, but it also sheds a light on the energy requirements in the surrounding areas.

GLOBAL WIND ENERGY COUNCIL AND IFC

ESMAP established its Offshore Wind Development Program in partnership with the International Finance Corporation (IFC), to strategically support both the government and industry in emerging markets. This joined up approach enables the World Bank Group to provide a comprehensive package of support to our clients. The Program also works in close cooperation with the Global Wind Energy Council (GWEC). GWEC provide strong links with the international offshore wind industry and offer market insights in our client countries. For example, in September 2020, the Program collaborated with GWEC to produce an offshore wind virtual study tour which saw over 400 delegates, including representatives from 24 client governments, attend the three-day event.

ENERGY STORAGE PARTNERSHIP

The World Bank Group convened the Energy Storage Partnership (ESP) in May 2019 to foster international technological cooperation and training that can develop and adapt new energy storage solutions tailored for the needs and conditions of developing countries. The ESP currently has 41 Partners and has built consensus around an agenda for expanding the knowledge base and capacity for developing countries to manage energy storage projects. In the past year, the ESP created online training sessions on energy storage, the production of three reports, and the implementation of testbeds (see p. [Energy Storage]).

GREEN POWERED FUTURE MISSION COALITION

The World Bank/ESMAP is a member of the Green Powered Future Mission Coalition led by Italy, China, and the United Kingdom. The coalition aims to demonstrate that power systems, regardless of geography or climates, can effectively integrate up to 100% VRE in their generation mix by 2030 while ensuring the system is cost-efficient, secure, and resilient. This year the mission developed a Joint Roadmap of Global Innovation Priorities which was released during a dedicated event organized at the UNFCCC Innovation Hub Pavilion at COP26 in November. The next step will be setting out the Mission's Action Plan 2022-2024.

MODERN ENERGY COOKING SERVICES (MECS) PROGRAM

The Modern Energy Cooking Services (MECS) Program, led by Loughborough University and funded by the UK Department for International Development (DFID), aims to create a stronger evidence base for transitioning to modern energy cooking services through socioeconomic and technological innovations to drive the process forward.

HIGH-LEVEL COALITION ON HEALTH AND ENERGY

The High-Level Coalition on Health and Energy, convened by the WHO, aims to strengthen cooperation between health and energy sectors, increase political momentum, spur investments, mobilize public support and drive practical solutions. ESMAP, representing the World Bank, supports and collaborates with the Coalition. It was launched in June 2021 and has issued a strategic roadmap on health and energy.

ASSOCIATED TRUST FUNDS

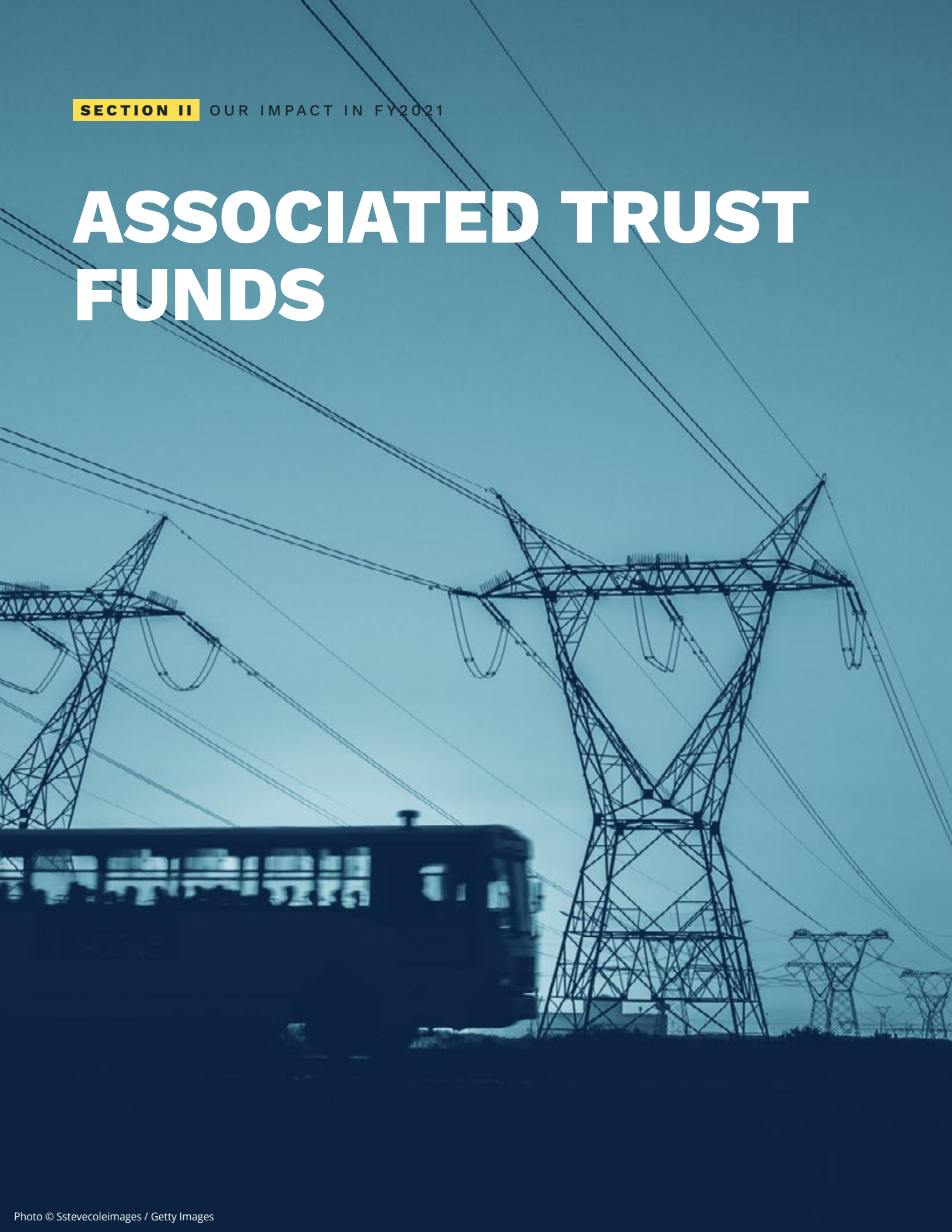


Photo © Sstevecoleimages / Getty Images

ADVANCING REGIONAL ENERGY TRANSFORMATIONAL PROJECTS MULTI-DONOR TRUST FUND

The Advancing Regional Energy Transformational Projects (AREP) multi-donor trust fund was established in 2016 to improve the enabling environment for regional power trade and advancing regional energy projects in the Africa region. It later became an ESMAP-associated trust fund and complements the activities of the ESMAP MARCOT program.

The program supports the Southern African Power Pool (SAPP), a cooperation of the national electricity companies in Southern Africa under the auspices of the Southern African Development Community, in establishing a regional power market and offering various trading instruments that make it the most advanced power pool in Africa.

Key activities assisted by MARCOT/AREP in FY2021 include the development of an SAPP regional master plan, the preparation of feasibility and environmental and social assessment studies for several regional transmission projects, and the training of over a hundred regional and national utilities staff.

The MARCOT program (through AREP) also supported the operationalization of the regional balancing market, which started up in November 2021. Substantial progress was achieved in developing the innovative concept of the Regional Transmission Infrastructure Financing Facility (RTIFF) to attract financing for regional transmission grid leveraging the regional competitive power market mechanisms.

The program also supported the Eastern African Power Pool (EAPP). This included an update of the EAPP short-term action plan (2021–23), framing the key priorities over the next three years, as well as advisory and consultancy activities to establish the regional market, develop the regional system plan, and train EAPP and national utilities staff.

CARBON CAPTURE USE AND STORAGE

The **World Bank CO_2 Capture and Storage Trust Fund** (CCS TF), an associated trust fund under the ESMAP umbrella since FY2021, has been operating since 2009. Its aim is to help client governments assess the potential for CO_2 capture, utilization, and storage (CCUS) in meeting national and international climate change mitigation goals and building the capacity within countries to deliver on this potential. To date, the CCS TF has capitalized countries and regions in Africa, Asia, Central and South America, Europe, and in the Middle East in this effort, including providing ongoing support for the development of CCUS pilot projects in Mexico and South Africa.

CCUS deployment is advancing, with 26 large-scale commercial CCUS projects now in operation globally and a further 39 at various stages of development. FY2021 saw significant developments both within the country support operations as well as with the development of global CCUS analytics.

In South Africa, the World Bank-supported CCUS program has now identified a new location for the pilot CO_2 storage project, with the site being endorsed by an international expert peer review. The national power utility, Eskom, has also agreed to host a CO_2 capture pilot project assessment study at one of its newly built power stations.

The CCS TF is nearing completion of a study looking at the development of a CCUS legal and regulatory framework in Mexico, in partnership with the Ministry of the Environment and Natural Resources. The CCS TF is also working with the ministry to scope a potential pilot CCUS project to be hosted at an industrial facility, with current discussions focusing on CO_2 capture from a cement production facility.

FY2021 also saw the commencement of a program of work on the role of CCUS in the Pan-Arab region, with the first grant approved under the World Bank internal CCUS grant window. The program will undertake a regional assessment of CCUS potential, with a focus on blue hydrogen, as well as looking at developing national CCUS strategies, CCUS legal and regulatory frameworks, and building CCUS capacity and cooperation across the region. Final results for the Pan-Arab CCUS program are due in 2023.

Photo Courtesy of Seychelles Public Utilities Corporation / © IRENA

SMALL ISLAND DEVELOPING STATES (SIDS) DOCK

Small Island Developing States (SIDS) are often extremely dependent on imported petroleum products to meet their energy needs, including electricity generation. As a result, many SIDS experience high and often rising costs for electricity, supply interruptions, as well as vulnerability to oil price shocks. So, many SIDS are now looking to transition to more sustainable energy sources, where improved energy efficiency and renewable energy play an increasing role.

The **SIDS DOCK Support program** is an initiative among member countries of the Alliance of Small Island States (AOSIS). The program helps SIDS transform their energy sectors and address adaptation to climate change.

In FY2021, the SIDS DOCK Support program supported two new ongoing activities, in Maldives and Comoros. In Maldives, the grant will facilitate the power system planning activity, which will inform the nation's decarbonization strategy. The overarching goal of this study is to assess the impact of various technologies, including electric vehicles, on power systems. The study will help formulate possible technology options and indicative scenarios that can be implemented to advance the government of Maldives's 2030 carbon neutrality commitment.

In Comoros, a $0.5 million grant was provided to co-finance a World Bank project furthering COVID-19 vaccine purchase and health system strengthening. The grant is enabling the acquisition and installation of solar power for health facilities to improve their ability to store and safely deliver COVID-19 vaccinations and to treat COVID-19 patients in the absence of consistent, available power.

The SIDS DOCK Support program is also backing three ongoing activities that are co-financing projects in Pacific Islands, Solomon Islands, and Dominica.

In Pacific Islands, the program co-finances a Bank project using a regional approach to improve data availability and the capacity of power utilities of the Pacific Island countries. These efforts are mainly focused on enhancing their ability to incorporate and manage renewable energy technologies and long-term disaster risk planning. It is the first project implemented by the Pacific Power Association.

The grant in Solomon Islands supports the development of five renewable energy-based mini grids. In Dominica, the grant co-funds the drilling in South Laudat of an additional reinjection well and a new production well needed for the development of a geothermal power plant.

SECTION III

FINANCIAL REVIEW

Photo © Jessica Lea / DFID

This chapter outlines the FY2021 financial information for the multi-donor trust funds (MDTFs) that are under ESMAP's management, namely, the ESMAP Umbrella MDTF and its associated trust funds.[2]

CONTRIBUTIONS

In FY2021, ESMAP received $197 million from 11 donors. Trust funds associated with ESMAP, including SIDS DOCK, did not receive new contributions in FY2021. Table 3.1 presents actual receipts in FY2021 from individual donors for ESMAP, as well as cumulative receipts during FY2017-21. Table 3.2 presents cumulative pledges and receipts of associated trust funds to ESMAP.

Table 3.1. Donor Contributions to ESMAP, FY2017-21 ($ thousands)

Donor Contributions to ESMAP and SIDS DOCK MDTFs, FY2017-21 ($ '000)

	FY2021 Contribution Paid-In & Receivables	ESMAP FY2017-21		
Country	ESMAP	Cumulative Pledges	Cumulative Receipts	Cum. Receipts over Cum. Pledges
Austria	2,423	4,132	4,132	100.0%
Canada		2,298	2,298	100.0%
ClimateWorks		3,000	2,250	75.0%
Denmark	21,212	30,248	28,480	94.2%
EU		14,750	7,298	49.5%
Finland		144	144	100.0%
France	1,209	1,209		
Germany				
- BMU		8,465	8,465	100.0%
- BMZ	2,374	6,368	7,395	116.1%
Iceland	1,778	4,511	3,933	87.2%
Italy		6,054	6,054	100.0%
Japan				
Luxembourg		1,124	1,124	100.0%
Netherlands	40,500	119,878	81,378	67.9%
Norway				
- MFA		4,773	4,773	100.0%
- Norad	56,651	86,988	74,476	85.6%

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2 As set out in the Administration Agreement with ESMAP donors, the current financial information relating to multi-donor and associated trust funds under ESMAP management can be accessed via the Bank's Trust Funds Donor Center. The Bank's Financial Statements, as well as the Single Audit Report on Trust Funds, can be accessed on the Bank's public website on World Bank Group Finances. Consistent with the Bank's Trust Fund Reform, the ESMAP has an Umbrella "Anchor" MDTF TF073553 and the older TF071389 and TF072490. ESMAP's Umbrella structure includes four trust funds associated to ESMAP: (1) TF071728: Support for Small Island Developing States (SIDS DOCK); (2) TF071379: Carbon Capture, Utilization and Storage (CCUS); (3) TF072636: Advancing Regional Energy Projects (AREP) in Africa; and (4) TF073420: Support to Regional Off-Grid Electrification Project (ROGEP).

Country	FY2021 Contribution Paid-In & Receivables ESMAP	ESMAP FY2017-21 Cumulative Pledges	ESMAP FY2017-21 Cumulative Receipts	ESMAP FY2017-21 Cum. Receipts over Cum. Pledges
Rockefeller Foundation		1,650	1,350	81.8%
Spain	6,887	6,887		
Sweden	34,428	58,714	44,952	76.6%
Switzerland				
- SDC	3,336	3,336		
- SECO		14,050	14,050	100.0%
United Kingdom				
- BEIS*	26,289	82,235	44,572	54.2%
- FCDO		44,389	43,050	97.0%
World Bank				
Grand Total	**197,086**	**505,204**	**380,173**	

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

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

ASSOCIATED TRUST FUND	DONOR COUNTRY	CUMULATIVE PLEDGES	CUMULATIVE RECEIPTS	CUM. RECEIPTS OVER CUM. PLEDGES
Advancing Regional Energy Projects (AREP) in Africa	Sweden	17,446	17,446	100%
Carbon Capture, Utilization	Norway	18,313	18,313	100%
& Storage (CCUS)	United Kingdom	40,759	40,759	100%
	Global Carbon Capture and Storage Institute, Ltd.	2,173	2,173	100%
Small Island Developing States (SIDS DOCK)	Denmark	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%

DISBURSEMENTS

ESMAP disbursed about $39.0 million in FY2021, a decrease of over 9 percent from the amount disbursed in FY2020. Total disbursements for the associated trust funds SIDS DOCK, AREP, and CCUS amounted to about $5.1 million. The following figures and tables present the breakdown of disbursements for FY2021.

Regional and global program activities accounted for about 95 percent of disbursements in FY2021, with the balance spent on activities for Program Management & Administration, Knowledge Management, and Communications. It should be noted that the global programs include technical support by the central ESMAP unit to World Bank country/regional activities.

Figure 3.1: ESMAP Disbursements, by Region, FY2021 (in $ thousands)

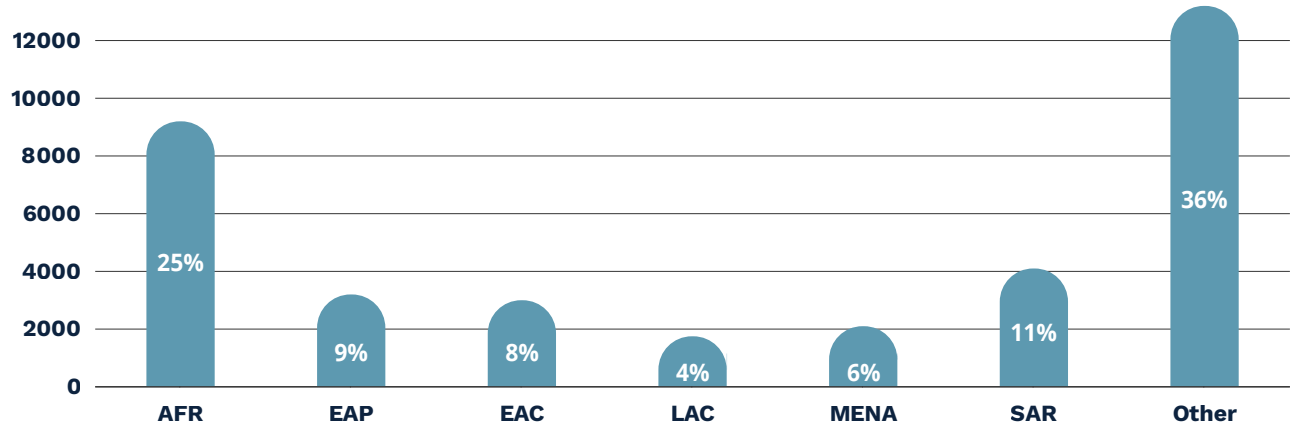

Table 3.3: ESMAP Disbursements, by Region and Program Management, FY2021 (in $ thousands)

ESMAP Disbursements, by Region, FY2021 ($ thousands)	
AFR	9,284
EAP	3,388
ECA	3,110
LCR	1,616
MNA	2,203
SAR	4,201
Other	13,370
Total	**37,172**

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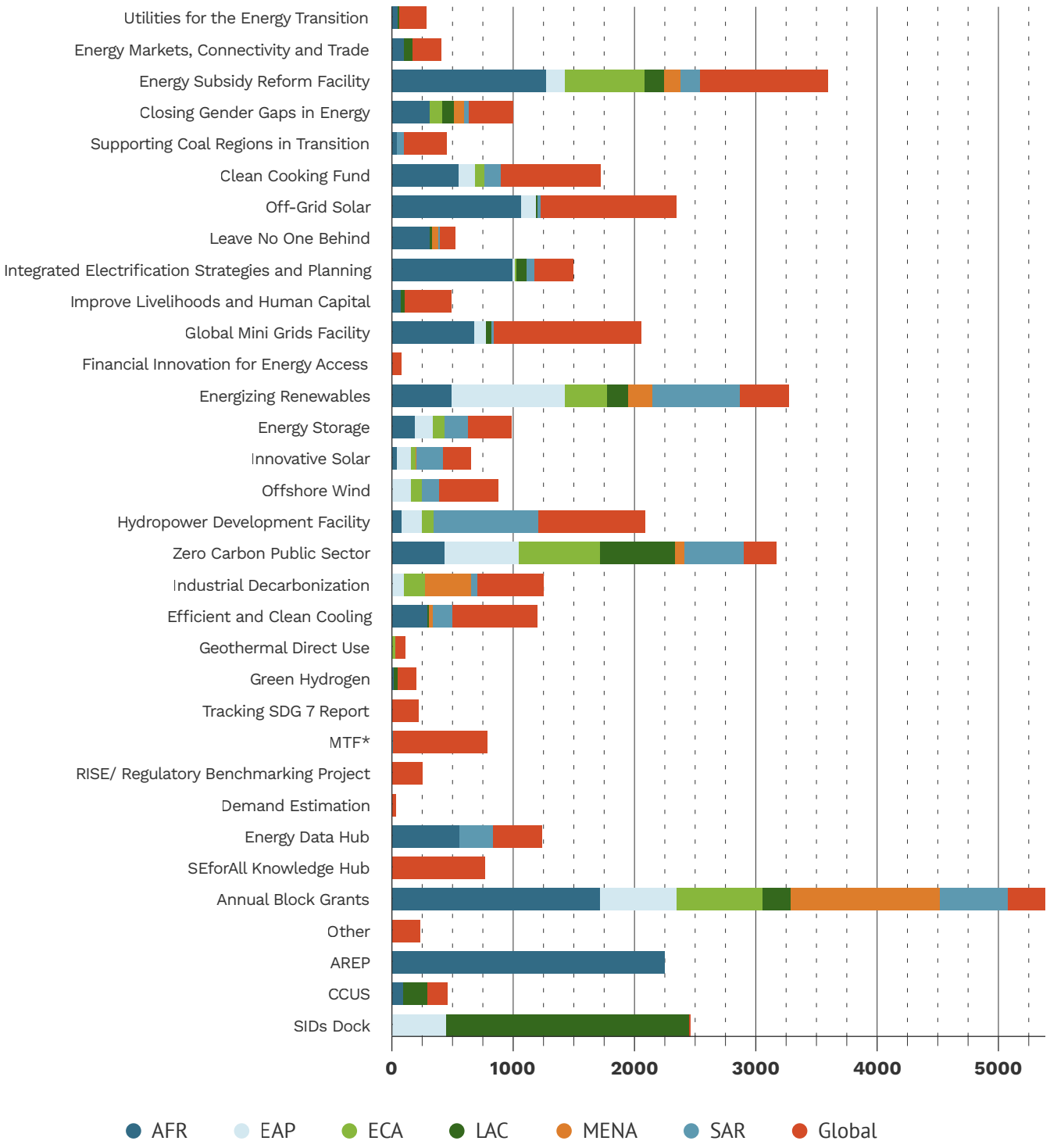
ESMAP Disbursements, by PM&A, FY2021 ($ thousands)	
Program Management & Administration	945
Monitoring & Evaluation	355
Communications	264
Knowledge Management	192
Total	**1,756**
Grand Total	**38,928**

Table 3.4: ESMAP and Associated Trust Funds Disbursements, by Region, FY2021 ($ thousand)

REGION	ESMAP	SIDS	AREP	CCUS
AFR	9,284		2,248	94
EAP	3,388	449		
ECA	3,110			
LCR	1,616	2,000		199
MNA	2,203			
SAR	4,201			
Other	13,370	11		163
Total	**37,172**	**2,460**	**2,248**	**456**

Note: There were no disbursements for the associated trust fund "Support to ROGEP" in FY2021.

Figure 3.2: ESMAP and Associated Trust Funds Disbursements, by Program Area, FY2021 (in $ thousands)



* Includes data on clean cooking and displaced communities.

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