

2016 ANNUAL REPORT



MISSION

The Energy Sector Management Assistance Program (ESMAP) is a global knowledge and technical assistance program administered by the World Bank. It provides analytical and advisory services to low- and middle-income countries to increase their know-how and institutional capacity to achieve environmentally sustainable energy solutions for poverty reduction and economic growth. ESMAP is funded by Australia, Austria, Denmark, the European Commission, Finland, France, Germany, Iceland, Japan, Lithuania, the Netherlands, Norway, Sweden, Switzerland, the United Kingdom, and the World Bank Group.



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CHAPTER 1




COMPLEX CHALLENGES, DYNAMIC OPPORTUNITIES

A GLOBAL ENERGY TRANSFORMATION

The global energy sector is at a turning point. The Sustainable Development Goals 7 (SDG7) to ensure access to affordable, reliable, sustainable, and modern energy for all by 2030 and a landmark climate change agreement in Paris during the 21st Conference of the Parties (COP21) represent a collective global ambition to put the sector on a transformational path. In addition, dramatic reductions in the cost of renewable energy have been realized, leading countries to think differently about how they meet their energy needs and creating new challenges for long-term energy planning.

Despite many countries implementing more large-scale renewable and energy efficiency programs, challenges remain. About 1.1 billion people still live without access to electricity and 2.9 billion do not have access to modern cooking and heating fuels. Communities still suffer power cuts that limit their development prospects. Moreover, about 4.3 million people die each year from indoor air pollution associated with cooking and heating using traditional biomass fuels.



Sectoral transformation can be slow and challenging for many countries as they attempt to map out their sustainable energy future. During this journey, they need innovative solutions, approaches that address the full value chain of the sector, better access to financing, and improved planning and governance. With an \$11.5 billion energy portfolio in 2016, the World Bank Group is one of the largest financiers of energy projects worldwide. Working together with its development partners, the World Bank helps countries grow their energy sectors with an emphasis on achieving universal access to affordable, reliable, and sustainable energy.

RESPONDING TO THE CHALLENGE

The World Bank's ability to respond to energy challenges and client demand has been greatly strengthened by the Energy Sector Management Assistance Program (ESMAP). A long-standing partnership between the World Bank and bilateral donors, ESMAP supports the World Bank's poverty reduction and shared prosperity efforts by financing the analytical work needed to inform the energy sector policy dialogue and strengthen the design and implementation of its investment projects. Knowledge generated by the program leverages lending, shapes policy, increases client capacity, and promotes innovation. The broader 'public good' nature of ESMAP's work has made the program a knowledge broker not only for World Bank clients but also for development partners more generally.



ESMAP'S PROGRESS, 2014–2016:

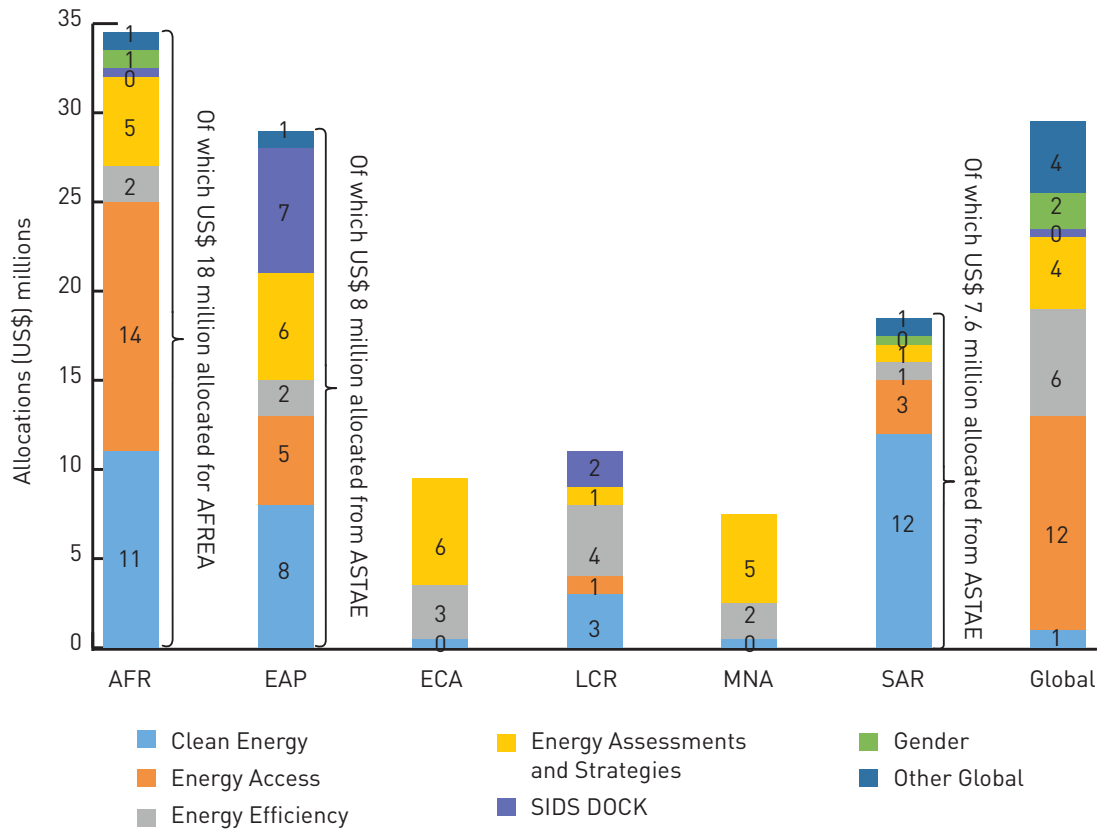
- Support to **250** activities globally, with a total allocation of **\$118 million**
- A portfolio that has influenced **\$3.7 billion** of World Bank IDA and IBRD financing, and leveraged an additional **\$1.8 billion** from other partners
- Support to activities in **130** countries
- ASTAE allocated **\$16 million** across **40** activities in South Asia, East Asia and the Pacific
- Implemented **140** activities in the **Africa region** and **24%** of ESMAP funding

ESMAP is one of the key trust-funded energy programs in the World Bank with disbursements of almost \$36 million in fiscal year 2016 (FY2016). It organizes its work around four key focus areas: Energy Assessments and Strategies (Chapter 2), Energy Access (Chapter 3), Energy Efficiency (Chapter 4), and Clean Energy—with special attention to Global Geothermal Development (Chapter 5), Renewable Energy Resource Mapping (Chapter 6), and Variable Renewable Energy Integration (Chapter 7).

The program has also supported the Sustainable Energy for All Knowledge Hub (Chapter 8), Gender and Energy (Chapter 9), the Africa Renewable Energy and Access Program (Chapter 10), the Asia Sustainable and Alternative Energy Program (Chapter 11), and the Small Island Developing States Support Program (Chapter 12).

FIGURE 1.1

ESMAP, SIDS, and ASTAE Allocation, by Region and Focus Area (\$ millions), FY2014–16




INFLUENCE AND IMPACT

ESMAP’s comparative advantages, such as its global reach and its direct connection to World Bank financing and sector policy dialogue, uniquely position it to shape the sector. In FY2016, ESMAP activities informed World Bank operations worth \$1.3 billion. Over the past three years, under the FY2014–16 Business Plan, cumulative ESMAP support has influenced over \$3.7 billion

in World Bank lending. In turn, these lending projects leveraged a further \$1.8 billion from public, private, and other sources.

Diagnostics supported by ESMAP’s Tool for Rapid Assessment of City Energy (TRACE) in **Mexico’s** Leon and Puebla municipalities were extended by the Mexican government to another 30 municipalities across the country. Based on this, Mexico’s Energy Ministry (SENER), financed by a



\$100 million World Bank loan, has launched its first national program targeting municipal energy efficiency, as part of a strategy to steer the country towards a sustainable and inclusive growth path.

In **Ethiopia**, ESMAP supported the first phase of a three-year energy sector review and strategy that informed an additional \$200 million in World Bank financing for the Ethiopia Electricity Network Reinforcement and Expansion Project approved in May 2016. This project will finance expansion and upgrading of the distribution network and access scale-up with the potential to reach 7 million customers by 2019.

The **China** Clean Stove Initiative (CSI) successfully piloted results-based financing mechanisms. In Hebei province, where the government has set a dissemination target of 6 million clean stoves by 2017, the China CSI supported the design and preparation of a clean stove component that applies the results-based financing approach under the World Bank \$500 million Hebei Air Pollution Prevention Program for Results Financing (PforR) Project approved in June 2016.

Lighting Africa, a flagship initiative launched by the World Bank and the International Finance Corporation (IFC) in 2007, has also been guiding the design of the International Development Association (IDA) off-grid energy access portfolio and has leveraged over \$40 million for seven IDA projects that are currently under implementation in Burkina Faso, the Democratic Republic of Congo, Ethiopia, Liberia, Mali, Uganda, and Tanzania.

ESMAP's Global Geothermal Development Plan (GGDP) has helped leverage a \$8.55 million

Scaling-up Renewable Energy Program (SREP)/ Climate Investment Funds (CIF) grant in **Armenia**, and a \$6 million IDA concessional credit with an additional \$6.04 million Global Environment Facility (GEF) grant in **Djibouti**. In **St. Lucia**, a grant from the SIDS DOCK of \$1 million leveraged \$2.3 million in additional financing (\$1 million from the GEF, \$0.5 million from Clinton Climate Initiative, and \$0.8 million from Government of New Zealand).

ADDRESSING REGIONAL CHALLENGES

In FY2014–16, more than two-thirds of allocations (68 percent) were implemented by the World Bank's Energy and Extractives Global Practice and 9 percent by other Global Practices.

Africa (AFR). The region with the highest electrification deficit, Africa (specifically Sub-Saharan Africa) still has 600 million people with limited or no access to electricity. Responding to client demand, in FY2014–16, ESMAP allocated 24 percent or \$32.6 million and an additional \$10.1 million from SIDS DOCK through 142 activities across Africa. \$14 million was allocated to help the continent increase energy access and \$11 million was devoted to clean energy issues. In FY2016, ESMAP allocated \$4.6 million to activities in Africa, primarily through AFREA, supporting renewable energy and access interventions.

Europe and Central Asia (ECA). ECA's efforts focus on helping client countries to secure reliable, efficient, and sustainable energy supply; designing and implementing socially and financially sustainable energy tariff and subsidy



reforms; and scaling-up energy efficiency and renewable energy. In FY2014–16, ESMAP allocated nearly \$9.1 million to the region through 99 activities, \$6 million of which covered energy efficiency issues; the remaining focused on energy assessments and strategies to help the region reform its sector, including for energy subsidy reforms. In FY2016, ESMAP allocated \$3.8 million to activities in ECA.

East Asia and Pacific (EAP). EAP’s priorities include scaling up renewable energy, increasing access to modern energy, promoting regional energy trade and market integration, and helping countries with sector reforms. In FY2014–16, ESMAP allocated \$13.0 million and SIDS DOCK allocated \$6.8 million through 97 activities in the region and ASTAE supplemented this with an additional \$8 million. Out of the total funding, \$8 million was used to address clean energy challenges and \$6 million was devoted to strengthening the region’s energy sector through assessments and strategies. In FY2016, ESMAP allocated \$6.4 million to activities in EAP and an additional \$6.8 million through SIDS DOCK.

Latin America and Caribbean (LCR). The World Bank estimates that investments amounting to \$430 billion will be needed in the region to meet the growing energy demand as power consumption is expected to double between 2010 and 2030. However, the region still faces energy challenges such as weak infrastructure and has been struggling with a wide range of issues in developing new electricity generation capacity. This is exacerbated by the unprecedented operational risk that climate change poses to Latin America’s energy landscape. In FY2014–16, through 107 activities amounting to \$8.5 million from ESMAP and

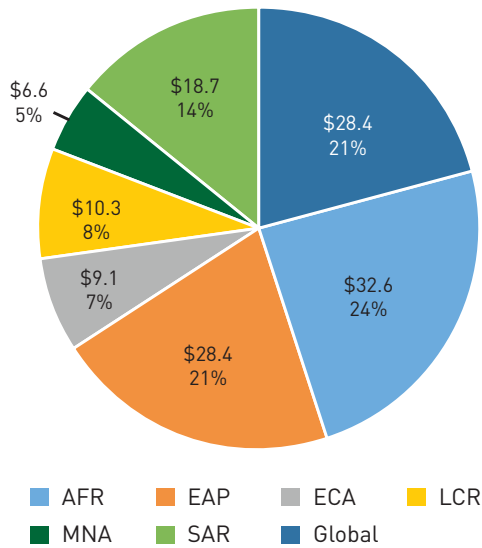
\$1.8 million from SIDS DOCK, ESMAP has been supporting countries in the region in terms of strengthening the enabling environment and institutions, and enhancing the climate resilience of their energy systems. Out of this support, \$4 million was employed for energy efficiency and another \$3 million towards clean energy. In FY2016, ESMAP and SIDS DOCK allocated \$1.8 million to activities in LCR.

Middle East North Africa (MNA). The region’s energy consumption has grown faster over the past 30 years compared to other regions even though per capita consumption is still low in non-Gulf countries. Decreasing oil prices led to lower revenues for oil exporting countries while energy subsidies continue to place a significant burden on budgets. ESMAP allocated \$6.6 million to the region in FY2014–16 through 59 activities. In FY2016, ESMAP allocated \$4.1 million to activities in MNA.

South Asia Region (SAR). Although the region has made notable improvement in its electrification rate in recent years, nearly 400 million people in the region are still without access to electricity and 1.1 billion people lack access to clean cooking. The challenge is likely to get more complex as energy demand grows to keep pace with an expanding population and economy. Regional priorities include: increasing access to modern energy services through grid and off-grid electricity and clean cooking; strengthening networks, utilities, and regional trade to improve the quality and reliability of supply; and ensuring long-term sector sustainability and promoting energy efficiency and renewable energy. Over the past three fiscal years, ESMAP has allocated \$11.1 million and ASTAE another \$7.7 million.

FIGURE 1.2

ESMAP, SIDS, and ASTAE Allocations, by Region (\$ Millions), FY2014–16



\$12 million was dedicated to promoting clean and renewable energy and another \$3 million to increasing energy access. In FY2016, ESMAP allocated \$1.7 million to activities in SAR.

PARTNERSHIPS: LEVERAGING FINANCE AND EXPERTISE

ESMAP values its close collaboration with various development partners, including international non-government organizations, bilateral development agencies, other multilateral institutions, and local and global think tanks. By engaging in global strategic initiatives, joint analytical work, and by informing follow-on work done by partners at the

country level, ESMAP is able to further its goal of achieving environmentally sustainable energy solutions for poverty reduction and economic growth.

Through **Lighting Africa**, ESMAP works in partnership with IFC, the Climate and Development Knowledge Network (CDKN), the Global Off-grid Lighting Association (GOGLA), the Global Partnership on Output-Based Aid (GPOBA), GEF, the Public-Private Infrastructure Advisory Facility (PPIAF), the Renewable Energy and Energy Efficiency Partnership (REEEP), and the United States to create better understanding of the opportunities presented by the rapidly growing market for high quality, affordable off-grid lighting products. The program generates critical market data, analyzes market trends, and maps existing and potential distribution channels to help manufacturers, distributors, and retailers make informed business decisions.

A joint World Bank-IFC team has collaborated to conduct an assessment of the barriers to development of small hydropower in the **Kyrgyz Republic**. Although the country has significant economic potential for small hydropower plants and a growing interest among private project developers, only around 3 percent of this potential is currently being utilized. Among the reasons for lack of commercial development are numerous legal, regulatory and institutional barriers. The joint team is combining analysis of these barriers with investor dialogue to understand the steps needed in designing commercially bankable projects. The project will help the government in attracting foreign direct investment into the sector.

BOX 1.1

ABOUT ESMAP

ESMAP is a global technical assistance program administered by the World Bank and situated in the World Bank's Energy and Extractives Global Practice in Washington, DC. ESMAP's program includes both regional and country-focused activities implemented primarily by regional energy teams at the World Bank and global initiatives managed by the ESMAP program unit. The ESMAP core unit of about 30 staff is responsible for the day-to-day management of the program and implementation of the strategy outlined in ESMAP's Business Plan. The unit comprises teams working on several thematic and cross-cutting solution areas such as energy access, renewable energy, energy efficiency, energy subsidy reform, gender, communications, and monitoring and evaluation. The ESMAP unit is also responsible for the management and administration of the ASTAE and SIDS DOCK Multi Donor Trust Funds (MDTF).

Consultative Group

ESMAP is governed by a Consultative Group (CG) comprising representatives from contributing donors and chaired by the Senior Director of the World Bank's Energy and Extractives Global Practice. The CG meets annually to review the strategic direction of ESMAP, its achievements, use of resources, and funding requirements.

ESMAP's donors are:

Australia	Department of Foreign Affairs and Trade
Austria	Federal Ministry of Finance
Denmark*	Royal Ministry of Foreign Affairs
European Commission†	
Finland	Ministry for Foreign Affairs
France	Agence Française de Développement
Germany	Federal Ministry for Economic Cooperation and Development; Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
Iceland	Ministry of Foreign Affairs
Japan‡	Ministry of Finance
Lithuania	Ministry of Foreign Affairs; Ministry of the Environment
The Netherlands§	Minister of Foreign Trade and Development Cooperation
Norway	Ministry of Foreign Affairs
Sweden§	Swedish International Development Cooperation Agency
Switzerland	Swiss State Secretariat for Economic Affairs
United Kingdom§	Department for International Development
The World Bank Group	

Technical Advisory Group

A Technical Advisory Group (TAG) consisting of three international experts, Tamara Babayan, Veena Joshi, and Willem van Nes, appointed by the CG provides informed, independent opinions to the CG about the purpose, strategic direction, and priorities of ESMAP. The TAG also provides advice and suggestions to the CG on current and emerging global energy sector issues likely to impact ESMAP's client countries.

*Denmark also provides funding for SIDS DOCK MDTF

†The European Commission has provided funding through Denmark for the Energy Subsidy Reform and Delivery Technical Assistance Facility

‡Japan provides funding for SIDS DOCK MDTF

§The Netherlands, Sweden, and the United Kingdom provide funding for both ESMAP and ASTAE MDTFs

FIGURE 1.3

ESMAP Operational Portfolio (including SIDS and ASTAE), by Region, FY2014–16

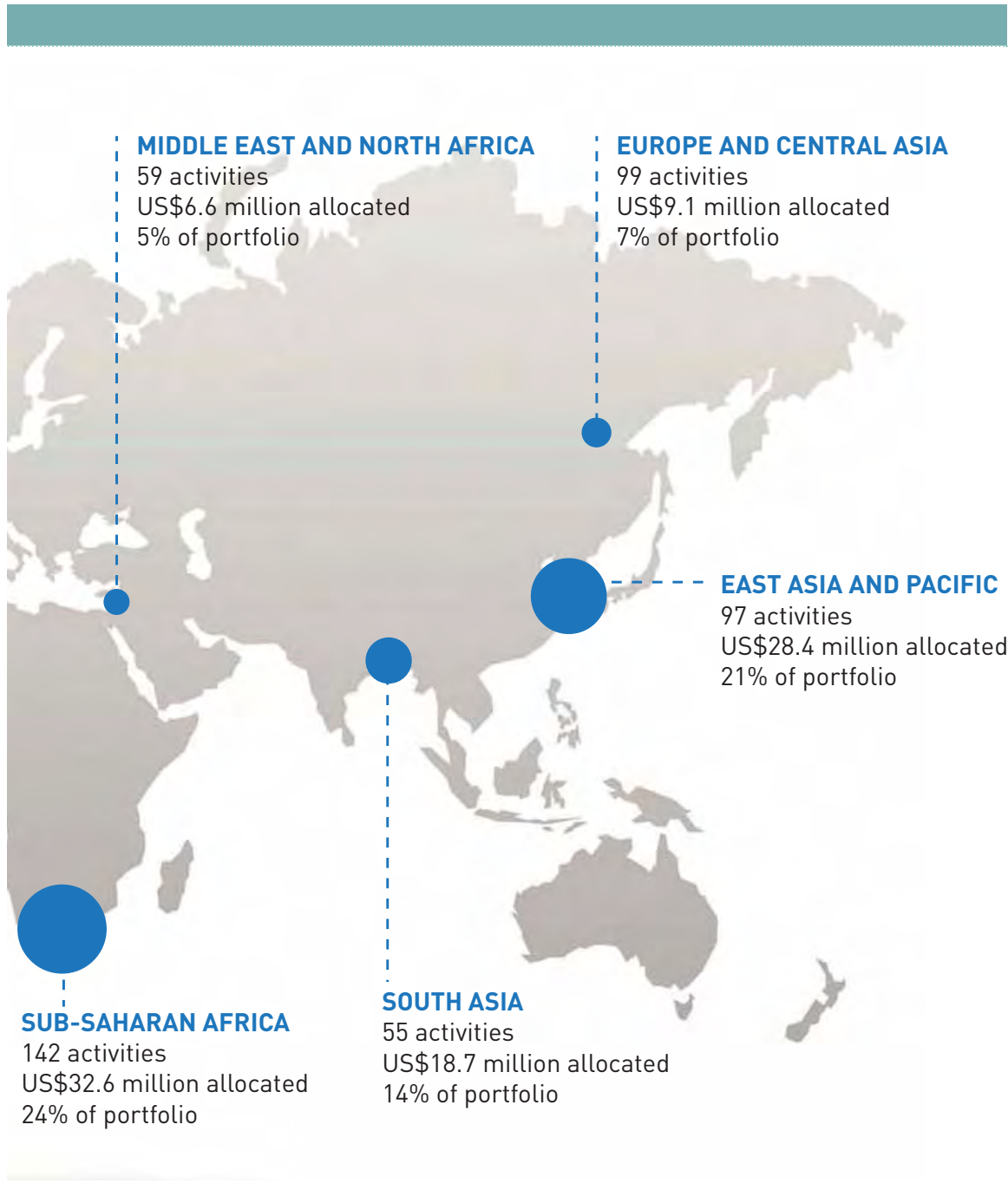
GLOBAL


97 activities
US\$28.3 million allocated
21% of portfolio

LATIN AMERICA AND CARIBBEAN

107 activities
US\$10.3 million allocated
8% of portfolio







In the **Western Balkans** region (Albania, Bosnia and Herzegovina, Croatia, Kosovo, the former Yugoslav Republic of Macedonia, Montenegro, and Serbia), ESMAP supported initial scoping work to help identify viable investment options and policy measures to increase the use of biomass for heating in a sustainable manner. This initial funding informed a comprehensive sector study on the use of biomass for heating, which is funded by the Western Balkans Investment Framework (WBIF). The analytical work carried out with the support of ESMAP and WBIF was implemented in close cooperation with the Energy Community Secretariat, and presented and discussed at regional and country levels with all seven countries involved.

Under the **Sustainable Energy for All (SE4All) Knowledge Hub**, the World Bank, ESMAP, and the International Energy Agency (IEA) led a consortium of 23 international agencies including donors, non-governmental organizations, and multilateral institutions to develop the methodology and deliver the Global Tracking Framework (GTF) in 2013 and 2015. Five United Nations Regional Economic Commissions¹ are joining the GTF Consortium for the 2017 update, to build closer links to the regions and countries.

ESMAP's **Variable Renewable Energy (VRE) Integration Program** leveraged resources through partnerships with the Global Sustainable Electricity Partnership (GSEP), the Clean Energy

¹ The United Nations Regional Economic Commissions are: United Nations Economic Commission for Europe (UNECE), United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), Economic Commission for Latin America and the Caribbean (ECLAC), United Nations Economic Commission for Africa (ECA), and United Nations Economic and Social Commission for Western Asia (UNESCWA).

ESMAP'S COOPERATION WITH DEVELOPMENT PARTNERS

- ESMAP partnered with **Australia, Austria, United Kingdom, Japan, Germany, and Norway** in support of IFC's Lighting Myanmar program
- In cooperation with **Australia, Denmark, Finland, France, and Germany**, ESMAP is funding a study on Afghanistan's electricity grid
- In support of the Lighting Africa program, ESMAP and IFC have coordinated with **Austria, Denmark, The Netherlands, Norway, and United Kingdom**
- ESMAP is cooperating with **France** on a number of activities, including a series of country specific studies on demand-side energy efficiency for Bangladesh, Pakistan, and India; the Geothermal Power Generation Project; the Niger Electricity Access Expansion Project; the Energy Efficiency Action Plan for West Bank and Gaza
- A National Electrification Strategy is under preparation in Mozambique, organized by ESMAP, **Germany, Japan, Norway, Sweden, and United Kingdom**
- In collaboration with **Germany**, ESMAP is funding the Clean Cooking activities in India, and hosting the data on wind measurement in Vietnam
- With support from ESMAP, **Austria, and Germany**, the Caribbean Sustainable Energy Roadmap and Strategy (C-SERMS) Platform was developed
- **Japan** provided parallel financing for subsidy reform in Jordan, for which ESMAP provided technical assistance
- ESMAP and **United Kingdom** are working together to assess potential for geothermal power in Dominica and St. Lucia

Ministerial (CEM), the National Renewable Energy Laboratories (NREL), and the Korean Green Growth Trust Fund. The CEM is a global forum to promote policies and share best practices to accelerate the global transition to clean energy. ESMAP's partnership with CEM and NREL enabled the participation of a renewable energy expert from NREL in several World Bank trainings and operational missions, helped with the organization of events and study tours, and supported the provision of the CEM "Ask an Expert" policy advice service to clients. The partnership with GSEP is helping to produce several technical knowledge products on Smart Grid technologies, grid codes, and requirements for grid-connected renewable energy technologies.

ESMAP is collaborating with the International Renewable Energy Agency (IRENA) to help disseminate **renewable energy resource maps** via their Global Atlas for Renewable Energy. The maps are hosted on a World Bank geoserver, and are streamed into the Global Atlas interface on demand. ESMAP and IRENA also work closely together to respond to country queries, and on providing best practice guidance to clients.

ESMAP also partnered with World Bank's Nordic Executive Director's Office (Denmark, Estonia, Finland, Iceland, Latvia, Lithuania, Norway, and Sweden), the United States, and the Friends of Fossil Fuel Subsidy Reform group of countries (Costa Rica, Denmark, Ethiopia, Finland, New Zealand, Norway, Sweden, and Switzerland) to organize an event during the World Bank Spring Meetings in April 2016 on "**Energy Subsidy Reform: Country Experiences and Progress Made.**" This ministerial-level seminar highlighted recent progress in energy subsidy reform efforts

in India, Indonesia, Malaysia, and Ukraine and allowed World Bank staff and external audiences to learn from the perspectives of these countries.

INCORPORATING ENERGY INTO KEY ECONOMIC SECTORS

ESMAP continues to strengthen collaboration with sectors like urban, health, transport, and water to leverage their expertise and knowledge, and to design integrated solutions that address complex, multifaceted challenges.

As part of ESMAP's commitment to transform the clean cooking sector, a cross-sectoral approach was established to mobilize financing and help close the global investment gap for reaching universal access to modern cooking, estimated to be at least \$4.4 billion annually. ESMAP's **Efficient, Clean Cooking and Heating (ECCH)** initiative teamed up with the World Bank's Energy, Climate, Health, and Gender teams and Cardano Development to organize a stakeholder consultation in Amsterdam, in June 2016, to explore the concept of monetizing the climate, health, and gender co-benefits of efficient, clean cooking and heating. The approach—in which funds are used to pay for verified climate, health and gender impact-level results—could potentially mobilize public and private investment. The consultation was chaired by the World Bank Director of the Health, Nutrition and Population Global Practice. Participants included representatives from the energy, health, climate change, and gender sectors; bilaterals; social impact investors; financiers; and key international stakeholders such as Energising Development (EnDev) and Global Alliance for

BOX 1.2

CONFLICT AND FRAGILITY: SECURING ENERGY DURING UNCERTAINTY

By 2030, almost half of the world's poor are expected to live in countries affected by fragility, conflict, and violence (FCV). FCV can negatively affect equitable growth and human development and compromise hard-earned development gains. Addressing this challenge remains a concern for achievement of the Sustainable Development Goals, and a priority for the World Bank's twin goals. Recent years have seen growing attention on the issue of energy security in countries affected by FCV. Continued migration of people from conflict seeking better life prospects will complicate efforts to provide affordable, reliable, and sustainable energy. There are many concerns such as resource depletion, reliance on foreign sources of energy, deteriorating and continuously damaged infrastructure, collapse of entire institutional systems, and corruption. Investing in energy infrastructure is pivotal to unlocking economic growth in these difficult environments. It would not only be crucial for reaching isolated communities and allow millions of disadvantaged people to access basic services but also contribute to rehabilitation efforts supporting state building. However, energy investments in these fragile situations are often complex.

As the international community strengthens its support to countries affected by FCV, ESMAP will continue to be instrumental for the World Bank and its partners in their efforts to promote energy security and alleviate energy poverty in these countries. During FY2014–16, ESMAP allocated 9 percent (or \$10 million) of its total budget to FCV countries.

In **West Bank and Gaza**, ESMAP, in collaboration with France's Agence Française de Développement (AFD), supported the Energy Efficiency Action Plan that identifies priority energy efficiency actions to be implemented between 2020 and 2030. Specifically, ESMAP supported the identification of energy efficiency gains and the design of an ambitious action plan to reduce total consumption of electricity by 5 percent (500 GWh/year). A complementary study, cofinanced by ESMAP and Norway's Ministry of Foreign Affairs, is underway, aiming to determine the optimal power generation portfolio and associated investment strategy to ensure energy security for West Bank and Gaza. Targeted at policymakers, the work is expected to produce an investment plan to build a resilient energy system in a context of high uncertainty.

Iraq's Kurdistan Region has been subject to political instability, which impacted the fiscal framework needed to provide basic electricity services. This inability to maintain or invest in the sector threatens to develop into a full-blown energy crisis. ESMAP's Energy Subsidies and Tariffs Reform activity focuses on diagnostics of subsidies and cost of service, assessments of economic and social impacts of reducing subsidies and public perceptions, as well as a communication strategy. The technical assistance produced analytical work and initiated policy dialogue, which served as entry points to discuss power sector reforms. As a result, tariff reform is now on the agenda of the government, as evidenced by their commitment in Paris during the 21st Conference of the Parties (COP21).

BOX 1.2 *Continued*

ESMAP and the Australian Department of Foreign Affairs and Trade (DFAT) jointly funded a study to comprehensively assess **Afghanistan's** energy sector with a focus on areas currently outside the electricity grid. The study will inform World Bank investments aimed at increasing accessibility to affordable and sustainable energy. In the context of the \$2 million study, regular collaboration and exchange occurs with stakeholders within Afghanistan's energy sector, as well as development partners including Denmark, Finland, France, and Germany.

In **South Sudan**, support through AFREA led to the development of the first electricity bill in the country as well as the first rural electrification policy, which is awaiting ratification from the parliament. Input was also provided to other legal and regulatory documents, such as the private power purchase agreement framework and policies on private sector investment promotion and tariff structure proclamation. The support strengthened institutional capacity in financial management and project accounting, technical advice, development of terms of reference, request for proposals, and bidding and regulatory documents.

At less than 2 percent, **Liberia's** electrification rate is one of the lowest in the world. Expanding access to reliable and affordable electricity, particularly to the rural poor, is one of Liberia's top-most priorities. Over the past decade, ESMAP has provided support to establish Liberia's Rural and Renewable Energy Agency and to help the country expand the use of local renewable sources of energy to increase energy access. These activities have helped to inform the \$27 million Liberia Renewable Energy Access Project—the first World Bank-supported energy access project outside the capital city of Monrovia in post-conflict Liberia.





Clean Cookstoves. Discussions resulted in a consensus to move forward with the initiative with the World Bank taking the lead in ensuring active stakeholder engagement. A second meeting is planned for fall 2016 in the United States.

ESMAP's **Energy Subsidy Reform Facility** embraces a multi-sectoral approach to policy reform, highlighting the complexity of energy subsidies. This work has bolstered the World Bank's ability to provide a coordinated and comprehensive response to clients in a manner that capitalizes on the full expertise of the Bank in macroeconomic and fiscal matters, poverty analysis and policy, communications and consultations, energy, and social protection. For example, the Energy Subsidy Reform Facility is leading a Bank-wide initiative to develop an assessment framework for diagnosing energy subsidies and the environment for reform that will help coordinate the work of sectoral experts to deliver comprehensive technical assistance to clients. The

initiative involves staff from eight Global Practices (Energy and Extractives, Macroeconomics and Fiscal Management, Poverty, Social Development, Social Protection and Labor, Trade and Competitiveness, Environment, and Governance), as well as communications experts.

Through the **Thirsty Energy** initiative launched in January 2014, ESMAP helps countries to integrate water constraints into energy planning. In FY2016, Thirsty Energy produced two knowledge notes—*Thirsty Energy: Understanding the Linkages between Energy and Water* and *Thirsty Energy and the Importance of Water for Oil and Gas Extraction*—which aim to raise awareness of the water-energy challenges and promote dialogue among governments, international organizations, and the private sector.

ESMAP is partnering with the Urban, Transport, and Water Global Practices of the World Bank to promote energy efficiency components in their

operations. For example, rapid urbanization in the **Kyrgyz Republic** presents many challenges as infrastructure and services need to be improved to accommodate increasing populations. A \$14.4 million Urban Development Project supported by the World Bank aims to improve the quality of municipal services and pilot energy efficiency and

seismic resilience retrofits in existing infrastructure. Collaborating closely with the Urban Global Practice, ESMAP is strengthening the capacity of local municipalities to plan and implement energy efficiency activities and to prepare related investments.





BOX 1.3

HOW ESMAP IS INFLUENCING THE WORLD BANK ON URBAN ENERGY EFFICIENCY

ESMAP has supported activities covering a broad spectrum of urban sectors, including buildings, industry, power and heat, public lighting, transportation, waste management, and water and wastewater. While many of the activities were undertaken through the Energy Global Practice of the World Bank, several others were undertaken by Urban, Water, or Transport World Bank teams and contributed to integrating energy efficiency into their country dialogues and operations.

WATER. ESMAP's energy efficient cities activities have provided input for the Water Sector Strategy for the **Latin America and Caribbean region**, where energy efficiency in water utilities has been a key action area of support in countries like Brazil, Nicaragua, and Uruguay. For example, ESMAP funded the assessment of the Nicaraguan Water and Sewerage Company (ENACAL) with a focus on energy efficiency and nonrevenue water reduction, developing a Master Plan for ENACAL's Operational Efficiency. By implementing the measures outlined in the Master Plan, ENACAL will realize a reduction in electricity bills from 50 percent of operational expenses to 30 percent. In **China**, ESMAP supported the analysis of energy savings that can be achieved with relevant facility expansion, upgrade, and modification for both the Guilin Water Supply Company and Guilin Wastewater Treatment Company. With these improvements, energy savings and improvements in the water quality of the Lijiang River will be achieved.

URBAN. ESMAP is also contributing to the integration of energy efficiency considerations in activities led by the Urban Global Practice, especially activities related to urban planning. For example, in **China**, ESMAP support is helping the city of Chongqing establish a set of indicators and an assessment framework to define and understand a new model for urbanization and to promote integrated urban planning. This work, with important replicability potential, will inform the World Bank's

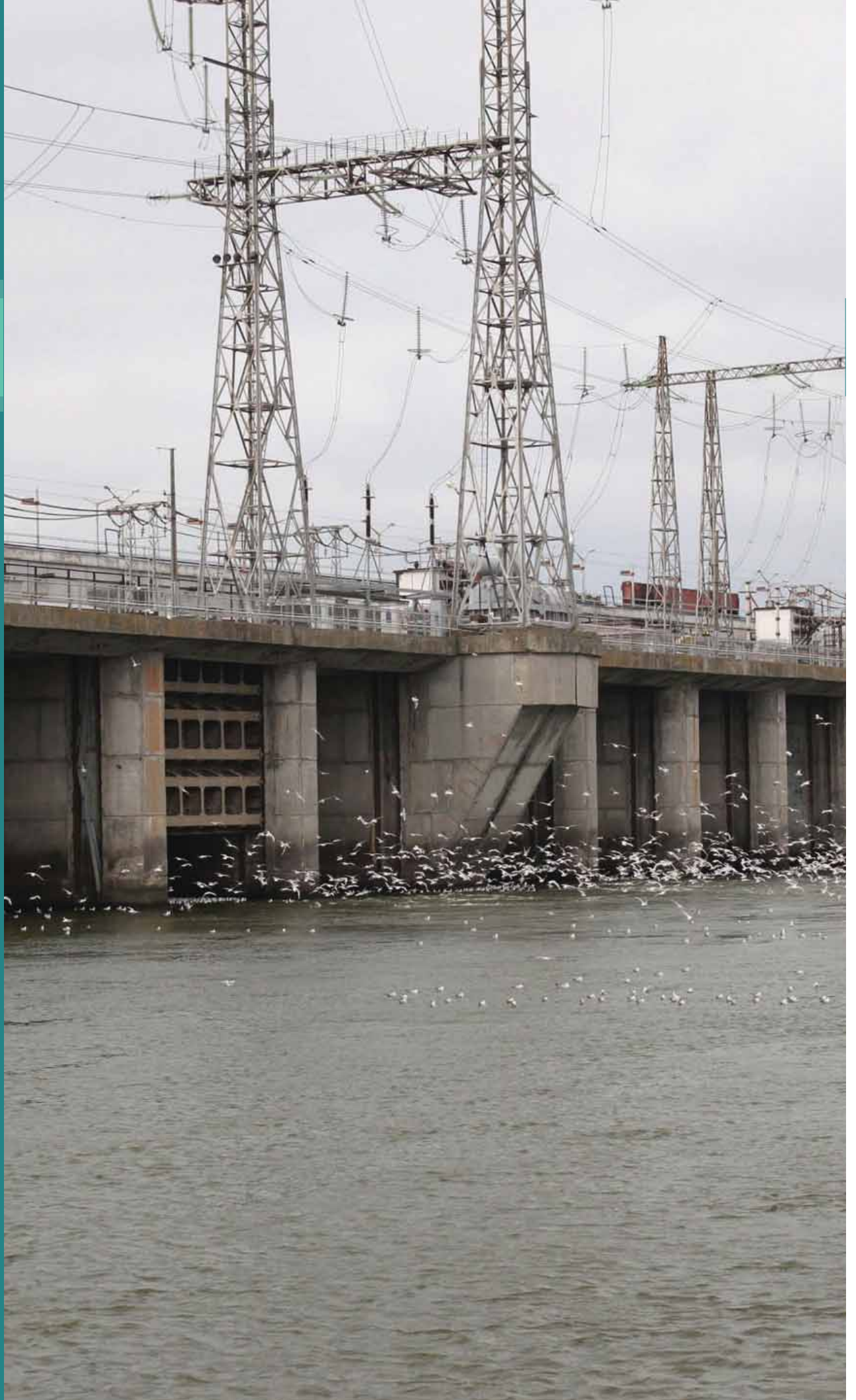


BOX 1.3 *Continued*

Chongqing New Urbanization Pilot and Demonstration Project, seeking to unlock a new wave of urban productivity and reshape urban forms. ESMAP support will also enable Chongqing to share its experience with—and learn from—the GEF-supported Global Platform for Sustainable Cities. In **Mexico**, ESMAP is supporting the piloting of a tool to analyze land-use patterns and their implications in terms of infrastructure costs, energy consumption, emissions of greenhouse gases and pollutants, as well as spending on transportation for its residents. This ESMAP-supported work, which has the potential to be replicated in other countries, will help Mexican cities make informed decisions about their future growth paths and could subsequently provide key technical input for reforming existing—or designing new—instruments to promote energy efficient, compact, and inclusive growth of Mexican cities.

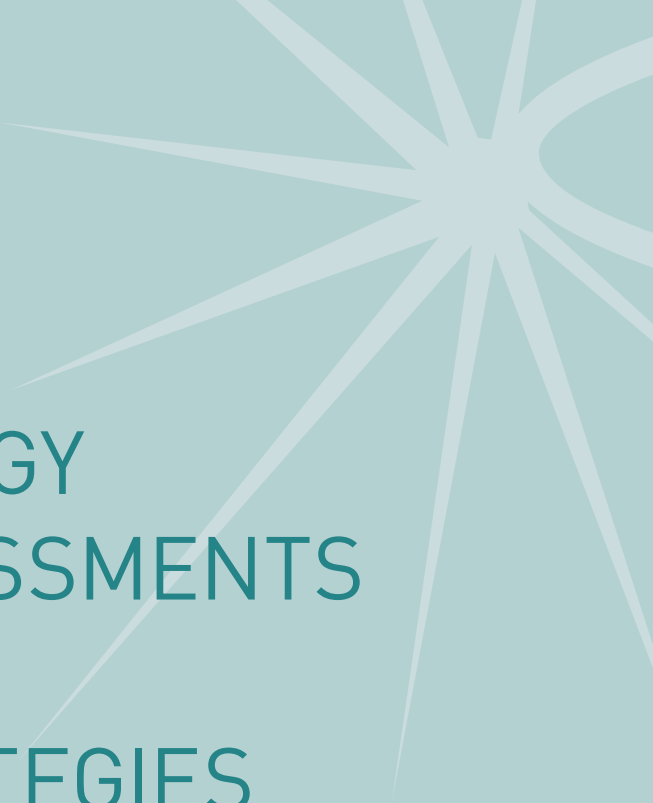
TRANSPORT. The Transport Global Practice is promoting more efficient solutions, including Bus Rapid Transit, travel demand management, open data, nonmotorized transport, and integrated land use and transport planning, particularly in the **Latin America and Caribbean** region. ESMAP has also worked with the Transport Global Practice on piloting the inclusion of gender considerations in urban transportation projects. In **Dhaka, Bangladesh**, ESMAP funding allowed for the analysis of accessibility of residents, particularly women, to jobs and urban services. The assessment provided insight into how future development of urban transport infrastructure could enhance or hinder accessibility.

At the corporate level, ESMAP's energy efficiency program was instrumental in the inclusion of energy efficiency in cities and buildings in the **World Bank's Climate Change Action Plan** released on April 7, 2016. ESMAP's continued support through the new ESMAP business plan will be critical for the World Bank to meet the targets outlined in the Climate Change Action Plan.





CHAPTER 2




ENERGY ASSESSMENTS AND STRATEGIES

The need for a conducive enabling environment to attract private capital for energy sector development, and the growing fiscal strain caused by energy subsidies reinforce the importance of getting sector fundamentals and prices right. ESMAP's support focuses on helping countries strengthen governance, planning, and markets. This includes advice on regulatory environments, market structures, regional integration of infrastructure, power system planning, and energy subsidy reforms.


To respond to increased demand from countries, ESMAP is harnessing its long-standing record of engagement in sector-wide assessments and of leveraging development financing and private sector investment. A few highlights of ESMAP's work in this area include:

In **Armenia**, a \$30 million World Bank project was approved in 2016. Taking advantage of the World Bank's Program-for-Results (PforR) financing mechanism, the project—Power Sector Financial Recovery Plan—will help Armenia ensure adequate and reliable electricity supply by improving the financial standing of state-owned power sector companies and the private power distribution company. ESMAP's work



in Armenia paved the way for this project. Starting in 2014, ESMAP prepared a policy note on Armenia's power sector, identifying key challenges facing the country's state-owned companies, such as inadequate governance and poor financial standing. Following this note, ESMAP helped the government of Armenia to develop a financial recovery plan and a detailed financial report to address these challenges and overcome the consequences of weak financial management.

Jordan has successfully overcome its fuel crisis of 2010–15, which caused financial distress in the sector. Since 2011, the country has made significant progress in increasing renewable energy capacity, putting it on track to reach its target of 10 percent renewable energy in its overall energy mix by 2020. The country also leased a new liquefied natural gas import terminal, which allowed Jordan to switch back from fuel oil to cleaner and cheaper natural gas to supply its conventional power plant fleet. Some of the most important reforms were supported by two \$250 million World Bank programmatic Development Policy Loans (DPL) in 2015–16, with parallel financing from the Japan International Cooperation Agency (JICA), which aims to improve the financial viability and increase efficiency gains in the energy and water sectors. To support the DPL series, the government requested technical assistance from ESMAP to improve performance of the National Electric Power Company. ESMAP's efforts focus on organizational restructuring, procurement procedures, and fuel and power system planning through the training of sector stakeholders, such as the Ministry of Energy and Mineral



IN THREE YEARS, ESMAP HAS:

- Allocated \$9.8 million through the annual block grants, covering 50 activities in 33 countries, resulting in \$1.2 billion of World Bank lending informed and improved policies and strategies for energy sector reforms, governance, markets and planning adopted in several countries, including Afghanistan, Armenia, Georgia, Kazakhstan, and Vietnam
- Provided \$9.8 million to 19 countries for comprehensive technical assistance to governments on energy subsidy reform, including quantification of subsidies; assessment of the impact of reform on households, firms, and the economy; design of impact mitigation mechanisms; analysis of stakeholders and of public perception; and support for communications, informing the preparation of Development Policy Loans for energy pricing and sector reforms, such as in Egypt and Jordan
- Organized 9 inter-governmental peer learning webinars and 2 regional events for a growing virtual collective of 233 government and expert members from 32 countries called the Energy Subsidy Reform Online Community

Resources and the National Electric Power Company. Strengthening the management and regulatory capacities will increase Jordan's energy sector efficiency and accelerate its energy transition.




In **Indonesia**, ESMAP conducted an assessment of the current legislative and regulatory situation and the challenges to local benefit sharing from hydropower projects.² The corresponding report examined Indonesia's regulations and policy environment, current practice in benefit sharing, reviewed relevant international experience and lessons learned, and provided guidance to introduce selected benefit sharing mechanisms on hydropower projects. These guidelines will be field-tested in a pilot program, in collaboration with KfW, on the Poko Hydropower Project being funded by a separate World Bank/IBRD loan. The pilot will include a component to manage

² Local benefit sharing in hydropower projects can be defined as the systematic efforts by project proponents to sustainably benefit local communities affected by hydropower investments. Benefit sharing is a promising approach for implementing hydropower projects sustainably, and is emerging as a supplement to the requirements of compensation and mitigation. <https://openknowledge.worldbank.org/handle/10986/18366?show=full>

sedimentation with improved agriculture and forest management practices, using an integrated watershed management approach, which could serve as a model for a benefit sharing mechanism like payment for ecological services.

In **India**, ESMAP and AusAid funded a stocktaking exercise of India's power sector, covering access levels and barriers to sustainable adoption of electricity; the financial and operational performance of sector utilities, with a specific focus on distribution; experience with private participation; and the quality of regulatory and corporate governance in the power sector across the different states in the country. This assessment contributed to the broader analytical base that has informed the World Bank's support to the power sector in India, in particular a programmatic series of two \$250 million IBRD-financed DPLs, focusing on one of India's largest states, Rajasthan. The loans support legislative changes



and institutional reforms, as well as the financial restructuring needed to turn around Rajasthan's electricity distribution sector under the central government's *24x7 Power for All* program, which aims to provide continuous, reliable power to all households in the country.

Further, ESMAP and AusAid supported a comprehensive diagnostic study of the power sector, focusing mainly on transmission, distribution, and regulation, in the sparsely populated but strategically important and resource-rich North Eastern Region of **India**. Based on the study's recommendations, the World Bank assisted the Government in preparing a Capacity Building and Institutional Strengthening Plan for eight utilities across six states to improve their operational functioning and service delivery, as well as contribute towards the development of the clean and renewable sources of energy present in the region and thus support economic activity in the region. Subsequently, this plan will be implemented under the North Eastern Region Power System Improvement Project—a \$470 million IBRD loan (approved in June 2016) to increase the delivery of electricity to the power distribution networks in the six participating states stretching across the eastern foothills of the Himalayas.

In **Ukraine**, technical assistance jointly financed by ESMAP and the European Commission is facilitating gas market reforms. The activity included the analysis of restructuring options for production, transmission, and storage business lines of the national vertically integrated gas company, Naftogaz. The analysis was based on a multi-criteria assessment framework agreed upon with

Ukrainian authorities and aimed to boost competition and integration with the European Union's gas market. Based on the recommendations of the technical assistance, the Government of Ukraine approved the ownership unbundling model for transmission and storage operations on July 1, 2015, and has embarked on its implementation.

In **Moldova**, ESMAP supported an Electric Power Market Options Study to provide the Government of Moldova with guidance on power market options, investments needed to enhance the security and reliability of supply, and options to effectively integrate the power sector into the Energy Community market. As a result of the study, the Government signed a Memorandum of Understanding with the Government of Romania on establishing an asynchronous interconnection between the two countries. The study and related follow-up work supported by ESMAP also helped to inform the design of a new investment lending operation in the power sector, which is currently in preparation. This activity aims to improve the security and reliability of the electricity transmission system through interconnections with Romania, and to enable the creation of a transparent and competitive electric power market in Moldova and its integration into the regional electric power market.

HELPING COUNTRIES NAVIGATE SUBSIDY REFORM

Countries around the world are finding that energy subsidies can pose barriers to their

economic, environmental, and fiscal health. In most cases, the benefits of energy subsidies are reaped by higher income groups. Energy subsidies can also create huge budget pressures for governments, cause distortions in the energy sector by encouraging inefficient consumption and by keeping prices artificially low, and increase energy consumption, contributing to pollution and greenhouse gas emissions. In 2015, global subsidies reached \$325 billion.³

Many countries have initiated energy subsidy reforms and have recently made important progress in subsidy removal, using the opportunity of low fuel prices. With the recent commitments in Paris to address climate change, countries are also increasingly concerned about the greenhouse gas emissions from burning more fossil fuels due to subsidies. At least 11 countries—Egypt, Ethiopia, Ghana, India, Iran, Kuwait, Morocco, Rwanda, Togo, United Arab Emirates, and Vietnam—have formally committed to fossil fuel subsidy reforms in their Nationally Determined Contributions (NDCs).⁴

ESMAP's **Energy Subsidy Reform and Delivery Technical Assistance Facility**, a \$20 million effort launched in 2013, with additional support from the European Commission, assists governments looking to embark upon the complicated journey of energy subsidy reforms. Since its inception, the facility has assisted 19 countries, undertaken 4 regional activities, and allocated \$9 million to


World Bank teams that provide technical assistance to clients.⁵ The teams are composed of experts in poverty reduction, social protection, energy pricing and sector reforms, fiscal policy, social development, and communications. Through an array of activities, the facility has helped countries assess their subsidies and the impacts of reforms, design reform programs, develop public communications strategies, and put in place social protection measures to help the poor during this transition.

Egypt embarked on an ambitious energy subsidy reform in 2014, aiming to phase out subsidies within five years. At that time, energy subsidies comprised 7 percent of the gross domestic product and 22 percent of the Government's budget, representing a major contributor to the fiscal deficit. Responding to the Government's request, the World Bank rapidly mobilized technical assistance through ESMAP, in parallel with funding from the African Development Bank (AfDB) and the European Union. In two phases, ESMAP support provided resources to undertake key policy and analytical work, as well as specialized training on issues ranging from gas pricing, to economic modeling, communications, and mitigation mechanisms. This support helped provide the analytical and institutional foundations that enabled the government to move ahead with the reforms. As a result, between 2014 and 2016, Egypt slashed subsidy spending by 3.6 percent of the gross domestic product, and spending on health and education

³ According to the International Energy Agency.

⁴ Detailed information at the regional, country, and sectoral levels on Nationally Determined Contributions (NDCs) can be found on the World Bank NDC Platform: Indc.worldbank.org

⁵ Countries supported by World Bank teams include: Algeria, Armenia, Azerbaijan, Belarus, China, Egypt, Haiti, Iraq, Kyrgyz Republic, Macedonia, Madagascar, Moldova, Serbia, Tajikistan, Turkey, Ukraine, Uzbekistan, Vietnam, and Zambia.



outstripped energy subsidies for the first time in FY2015. This support laid the groundwork for programmatic policy dialogue that led to a request for a three-year World Bank DPL series to support the Government's economic reform program, including continued subsidy reforms. The first DPL, totaling \$1 billion, was approved in December 2015. The second DPL, again for \$1 billion, will be presented to the World Bank's board of directors in mid FY2017.

In **Ukraine**, ESMAP assistance helped conduct an in-depth analysis and provided hands-on support to enable a strong policy response to wasteful energy subsidies. As a result, the government increased tariffs in 2015 and 2016 for a combined increase of 470 percent for residential gas and 193 percent for district heating. This helped to improve the financial viability of the gas sector, which made a profit for the first time in 2016. In terms of sheltering the poor from price increases, the government remarkably increased the number of poor beneficiaries under the Housing and Utilities Subsidy program from 1 million to 5 million households in 2015. Other work also included training for journalists to ensure informed coverage of the policy decisions and support to the government to strengthen social assistance mechanisms. The World Bank is now exploring the option of providing monetary subsidies (actual funds instead of price or tax rebates) and refining the Housing and Utilities Subsidy to better target the poor.

In **Uzbekistan**, ESMAP is helping the government to assess the fiscal, economic, and social impacts of energy subsidies in the gas, electricity, and heat sectors, and to design policy options for socially

responsible energy subsidy reform to maximize benefits to the poor. In this process, ESMAP reached out to the Central Asia Energy Water Development Program (CAEWDP) to combine forces towards common results. The work is coordinated by a multi-sectoral team, including the Energy, Social Development, and Poverty Global Practices of the World Bank. Strong client participation was ensured through a Joint Working Group, chaired by the Ministry of Finance.

BETTER KNOWLEDGE, MORE SUSTAINABLE REFORMS

To further strengthen learning and knowledge sharing among a growing community of experts and government counterparts, ESMAP launched the **Energy Subsidy Reform Online Community (ESROC)** in April 2015. The ESROC online platform and webinars provide a space for candid discussion, networking among peers, and exchanging knowledge and experiences related to the challenges of reforming energy subsidies. Since its inception, it has grown to 234 members from 32 countries, including 89 members from governments and academia, and 145 World Bank staff from five different Global Practices.

In FY2016, ESROC hosted six webinars for government officials to share their experiences with other members while World Bank experts helped to draw parallels with other countries and moderate the discussion. Members from 22 countries participated, at a rate of 50 to 60 people per session, as the webinars were simultaneously interpreted into Arabic, Russian, and English. Webinar topics covered communication strategies,



El Salvador's experience with mobile payment systems, Indonesia's engagement with social protection, and Iran's example of universal cash transfers. One of the highlights included a high-level discussion with India's Minister of Petroleum and Natural Gas on the use of biometric information, such as iris scans and fingerprints, to identify the legitimate recipients of liquefied petroleum gas subsidies through the country's

PaHal program—a program that was set up to provide direct monetary transfers to beneficiaries and allows them to know the actual price of each liquefied petroleum gas cylinder. This has spurred interest from governments across the Middle East and North Africa region who have planned consultation visits with India to exchange more details about their efforts.



CHAPTER 3


ACCESS TO ENERGY

Approximately 1.1 billion people worldwide still live without access to electricity—most of them in Africa and Asia—which has an impact on children’s education, public safety, services, and job creation. Another 2.9 billion rely on wood or other biomass for cooking and heating, resulting in indoor and outdoor air pollution that causes about 4.3 million deaths each year.⁶

To reverse this trend, and to meet the Sustainable Development Goal of universal energy access by 2030, additional electricity delivery options need to be explored.

Responding to this challenge, ESMAP focuses on four areas of intervention to scale up electrification: (i) national programs through geospatial planning and investment prospectuses; (ii) urban poor through comprehensive solutions that target legal, social, and institutional barriers to access; (iii) mini grids and isolated power systems, which can deliver energy services to households and businesses in rural areas;

⁶ World Bank and International Energy Agency. 2014. Sustainable Energy for All 2013–2014: Global Tracking Framework. Washington, DC: World Bank. <http://openknowledge.worldbank.org/handle/10986/16537>




and (iv) clean cooking and heating solutions, which can save millions of lives and help reach sustainable energy goals by 2030.

INCREASING ELECTRICITY ACCESS THROUGH NATIONWIDE PROGRAMS

Over the past year, ESMAP has remained a prominent global player in advancing the agenda on electricity access by helping countries to tackle complex challenges through national programs. During FY2016, ESMAP interventions have influenced further investment in the sector, initiated reforms, and helped strengthen institutions.

As part of the World Bank's commitment to SE4All, ESMAP has launched the **SE4All Technical Assistance Program** to work with selected countries on developing policy frameworks, improving planning processes, strengthening institutions, and mobilizing the financing needed to expand and accelerate their national energy access programs.

Achieving universal access by 2030 will require a steep increase in the rate of new connections and in levels of investment, particularly in countries with low energy access. Early results from countries that have implemented sector-wide approaches show that these programs tend to achieve better and faster results than a project-by-project approach. Promoting these types of programs for increasing energy access lies at the core of the SE4All Technical Assistance Program, which focuses on two key components: (i) the development of country-based investment



IN THREE YEARS, ESMAP HAS:

- Prepared SE4All technical assistance investment prospectuses in Myanmar, Guinea, and Nigeria for over \$1 billion of investment in energy access
- Supported, under the Global Facility on Mini Grids, is the development and implementation of a \$102 million portfolio funded by the Scaling Up Renewable Energy Program and \$50 million by the World Bank
- Helped accelerate, under the Urban Poor initiative, electrification in slum areas in Kenya to more than 100,000 connections per year

prospectuses that outline key interventions for scaling up access, and identify and mobilize funding; and (ii) the implementation of national plans, using geospatial planning and the right mix of grid and off-grid electrification for least-cost options, to optimize investments.

The goal of the program is to help extend energy access to 200 million people by 2030. Through its initial \$15 million phase, which began in 2013, support was provided to 11 countries: Burundi, Guatemala, Guinea, Honduras, Liberia, Mozambique, Myanmar, Nepal, Nicaragua, Nigeria, and Senegal, along with technical and financing studies to help strengthen regional power pools in Sub-Saharan Africa.


In Sub-Saharan Africa, the focus has remained on helping countries develop strategies and investment prospectuses for scaling up rural electrification:

- In **Burundi**, political stability was restored in 2016 enabling the development of a distribution expansion plan to be relaunched. The plan is expected to be finalized by June 2017. Additional support to develop legal and regulatory frameworks, as well as public-private partnerships, is ongoing.
- In **Guinea**, the investment prospectus has been completed in coordination with AFD, aiming to mobilize \$550 million for a comprehensive grid and off-grid electrification program, supported by geospatial mapping and an atlas mapping hydropower resources. Assistance was also provided to policy and regulatory reforms for establishing public-private partnerships for hydropower.
- In **Liberia**, four to six mini-hydropower sites have been identified to provide power to communities that will not be connected to the grid in the near term. In addition, support was provided for the development of a financial model for the sector; target setting and monitoring are in progress.
- In **Mozambique**, a National Electrification Strategy is under preparation in coordination with Germany, Japan, Norway, Sweden, and the United Kingdom with the goal of achieving universal access to electricity services that meet applicable standards on quality in a sustainable manner in the shortest possible time and optimizing the allocation of resources.
- In **Nigeria**, geospatial plans and investment prospectuses for the seven states covered by

the Kano and Kaduna distribution companies have supported recently privatized utilities to plan for energy access expansion, laid the path for off-grid investments, and assessed the key sector bottlenecks affecting the implementation of a nation-wide electrification rollout. The reports have also informed a World Bank access project currently under preparation.

- In **Senegal**, the investment prospectus has been drafted and is expected to be completed in FY2017. The investment prospectus is complemented by technical assistance activities to the rural electrification agency.

In **Myanmar**, where 84 percent of households in the rural areas have no electricity connection, the World Bank, with support from ESMAP, helped design an ambitious National Electrification Program which is now being implemented with the support of a \$400 million IDA credit approved by the World Bank in September 2015. Support from ASTAE helped prepare the project, which is expected to bring electricity to more than 1.2 million households by 2021. It will expand the existing electricity grid by adding medium- and low-voltage distribution networks, giving more towns and homes access to grid-based electricity. It will also include off-grid electrification systems such as solar systems and mini grids to bring electricity to rural communities located far from the national grid. ESMAP also helped the National Electrification Program mobilize an additional \$200 million in concessional financing and informed the development of the market-based IFC Lighting Myanmar Program, with support from Australia's Department of Foreign Affairs and Trade (DFAT), Austria's Federal Ministry of Finance, and the United Kingdom's Department for International



Development (DFID). In the process, ESMAP also partnered with Asian Development Bank (ADB), JICA, KfW, GIZ, Italy, and Norway to agree on common approaches, leverage synergies, and increase the impact of electrification efforts in Myanmar. ESMAP is supporting an impact assessment of electrification on a geographic information system (GIS). The activity will develop a GIS platform, collect data at the village level, and conduct a baseline household survey. The first international competitive bidding package on solar photovoltaic (PV) systems for rural households and public institutions was launched in March 2016 and installation for 140,000 households and nearly 10,000 public institutions in more than 2,000 villages is expected to start in January 2017.

In addition to these achievements, other highlights of the year included:

Institutional capacity was strengthened in **Niger**, a country with one of the lowest electricity access rates in Africa. Specifically, ESMAP supported the Ministry of Energy and Petroleum and NIGELEC, Niger's power utility, to fill important gaps in the policy environment. Technical assistance to the Ministry helped prepare a power sector strategy and identified the feasible energy supply options that Niger needs to consider to sustainably increase access. With ESMAP support, the World Bank also worked with the Ministry to strengthen oversight capacity by creating an energy sector regulatory agency and approving a new electricity law, which establishes clear roles for the Ministry, the regulator, and the utilities, and opens the sector to private investment. ESMAP assistance also facilitated policy dialogue on efficient tariff methodologies with key stakeholders—a crucial step to developing a tariff approach in the

context of the budgetary support provided by the World Bank to the government. Informed by these activities, the Government of Niger is now implementing a \$54.5 million IDA credit and \$10.5 million grant supporting increased access in urban areas, and is preparing a new operation focused on off-grid energy access in rural areas.

INCREASING ELECTRICITY ACCESS FOR THE URBAN POOR

Today, almost 1 billion people live in urban slums and informal settlements, often lacking access to safe, legal, reliable, and affordable electricity. Urban slum electrification is complex, often involving social, regulatory, financing, and urban planning issues in addition to expanding energy infrastructure. While pockets of progress exist in countries such as South Africa, India, and Brazil, substantial program scale-up has not yet happened. To this end, ESMAP has launched the **Energy Access for the Urban Poor** initiative to assist countries and World Bank project teams with customized interventions to increase access to the urban poor, help bridge knowledge gaps, and work with communities to raise public awareness of electrification options.

At a country level, the initiative cooperates with a number of partners, including the GPOBA, UN-Habitat, and Cities Alliance. Several World Bank projects are receiving support from ESMAP.

For example, in **Burkina Faso**, the initiative cofinanced work with Cities Alliance to integrate energy access interventions into the country's urban program led by the Ministry of Housing and Urban Development. It is funding a study to recommend



options for the electrification of informal settlements in selected major and secondary cities.

In **Kenya**, the initiative is involved in a multifaceted approach to make new connections affordable to slum dwellers. In support of the Kenya Slum Electrification Project financed by the World Bank and GPOBA, ESMAP led an assessment of barriers to electricity connections. Further, ESMAP organized a knowledge exchange forum in Nairobi to introduce Kenya Power, the national utility, to successful examples of slum electrification in Brazil, Colombia, and South Africa. As a result, using a community-based approach, Kenya Power has grown from connecting 5,000 households under its informal settlements program, to over 150,000 in just one year. A survey based on the ESMAP Multi-Tier Framework (MTF) approach is being carried out in the slum areas of Nairobi to help understand the drivers of success of slum programs and the quality of energy access in these communities.

The initiative is also supporting efforts to reduce nontechnical electricity losses while improving

electricity access in **Haiti**. It is contributing to a pilot aiming to regularize unauthorized electricity connections in selected zones in the Port-au-Prince Metropolitan Area under the World Bank-financed Rebuilding Energy Infrastructure and Access Project. If successful, the pilot will be scaled up to other areas.

Similarly, in **Jamaica**, a baseline survey was carried out to understand barriers to regularizing unauthorized electricity connections in selected low-income areas in Kingston. The results of the survey were presented at a workshop with the utility, government officials, and key stakeholders in June 2016. These efforts built on a 2015 workshop organized in partnership with the U.S. Agency for International Development (USAID) to disseminate lessons on electricity loss reduction. Representatives of power utilities and regulatory agencies from India, Brazil, Chile, Colombia, Dominican Republic, Kenya, and Jamaica shared experiences on this issue and discussed ways to tackle illegal electricity connections in slums. In a follow-up to the workshop,

the Jamaica Public Service Company, the sole distributor of electricity in the country, is designing and implementing programs to make electricity more affordable for low-income households. To ensure program sustainability, ESMAP continues to collaborate with the University of West Indies—Sir Arthur Lewis Institute of Social and Economic Studies (UWI-SALISES) and the

University of Chicago to help identify possible “soft” interventions and educational programs to complement infrastructure investments, such as wiring and metering. Technical assistance also supports Jamaica’s power utility to help it regularize illegal connections while reducing non-technical losses. The final findings will be presented in December 2016.



INCREASING ELECTRICITY ACCESS THROUGH MINI GRIDS

More than 95 percent of those without access to electricity live in Sub-Saharan Africa and Asia, with the majority residing in rural areas. Mini grids hold a great promise for electrifying remote areas in these regions, representing a low-cost option for more than 120,000 villages and towns. Innovations and declining costs have made mini grids a viable option to boost economic activity in areas that would otherwise be waiting years for grid connection.

While expansion of mini grids has been constrained by policy and regulatory gaps, lack of long-term financing, and technical capacity, the barriers are quickly breaking down. To build on this momentum, ESMAP has launched the **Global Facility on Mini Grids** to accelerate their expansion in Sub-Saharan Africa, South and East Asia, and Small Island Developing States. The facility works with World Bank project teams, governments, and other stakeholders to: (i) learn-by-doing through investments that scale up electricity service delivery with mini grids and (ii) enhance the enabling environment for mini grids in high potential countries while serving as a platform to share global knowledge to strengthen the global mini grid community.

In May 2016, ESMAP and the CIF organized a conference on *Upscaling Mini Grids for Least Cost and Timely Access to Electricity Services* in Nairobi, **Kenya**. The five-day event brought together, for the first time, more than 200 representatives from 29 countries to discuss ways to scale up mini grids as one of the solutions to meet energy demand

in their countries. It covered issues of tariff structure design of mini grids, financing, regulations, and interconnection of mini grids, once the main grid arrives. It also allowed for exchange of good practices on the successful implementation of mini grid projects. The event led to: (i) a request from the Government of Kenya to include a \$50 million component on mini grids in the new Kenya Off-grid Solar Access Project for underserved counties and (ii) the impetus of a mini grid industry association.

The World Bank, along with other multilateral partners in the CIF's Scaling-up Renewable Energy Program (SREP), is financing initial efforts to scale up mini grids in Kenya, Liberia, Mali, Nepal, and Tanzania. To date, more than \$102 million has been allocated for these mini grid programs from SREP and more than \$50 million from the World Bank. The ESMAP mini grids facility will provide technical assistance for these investments and seek to identify opportunities to scale up.

Additionally, ESMAP, in partnership with UN Foundation and SE4All High Impact Opportunity (HIO) on Mini Grids, produces a quarterly Mini Grid Newsletter that covers the latest news and upcoming events, tools and resources, and funding opportunities for mini grid private sector players. ESMAP also works with the private sector and IFC for better alignment of government policies and regulations to attract more investment and innovation in mini grids. As a result, several discussions with a coalition of large corporations within the energy access space took place, agreeing on the establishment of informal working groups to advance specific solutions within the mini grid industry.



SCALING UP CLEAN COOKING AND HEATING SOLUTIONS⁷

Nearly 3 billion people worldwide use solid fuels in open fires and traditional stoves as the primary source of cooking and heating energy. Exposure to household air pollution from cooking and heating causes more than 3 million premature deaths annually, disproportionately affecting women and small children. Women and children also face the physical and time burden of collecting firewood and other traditional fuels, making them, at times, vulnerable to gender-based violence. A major, global effort is needed to change the trajectory and to be on track to achieve universal access to modern energy by 2030. Yet, thus far, global, coordinated responses have been inadequate to effectively tackle this challenge.

Capitalizing on the global momentum driven by the SDG7 and the SE4All goals, ESMAP launched an initiative in 2015 to increase access to **efficient, clean cooking and heating (ECCH)** solutions. ECCH serves to coordinate Bank-wide efforts in clean cooking and heating, facilitating cross-sectoral collaborations among the Global Practices, and collaborates with the Global Alliance for Clean Cookstoves both globally and at the country level.⁸ Reflecting on ESMAP's commitment to transform the clean cooking sector, ECCH is

designed to help countries scale up the use of clean and efficient cooking and heating solutions by catalyzing innovation, utilizing results-based approaches, and scaling up public financing and increased private investment to help close the global investment gap for reaching universal access to modern cooking, estimated to be at least \$4.4 billion annually.

ECCH has mobilized lending in World Bank operations in South and East Asia, such as in the **China** Hebei Air Pollution and Prevention Control Program; developed gender-sensitive and user-centric approaches, such as in the **Indonesia** Clean Stove Initiative (CSI); and integrated clean cooking across sectors, such as in the Lao PDR CSI and Health Project, which is collaborating with the Health, Education, and the Poverty Reduction teams of the World Bank and the **Lao PDR** government to pilot an approach to monetize the health, climate, and gender co-benefits of clean cooking. The initiative has also piloted approaches to attract private sector investment through results-based financing, such as in Indonesia and **Uganda**.

In the **Kyrgyz Republic**, ESMAP, through the World Bank Europe and Central Asia regional unit and the ECCH, supported a comprehensive heating sector assessment and two related follow-up analyses that explored in-depth the district heating sector and the use of efficient and clean heating stoves at the household level. As part of these activities, a knowledge exchange was organized with a Finnish district heating utility to share best practices for the sustainable operation of heating services. A pilot phase for efficient and clean

⁷ More detailed examples of the initiative's work in these countries can be found in Chapters 9 (Gender), 10 (AFREA) and 11 (ASTAE).

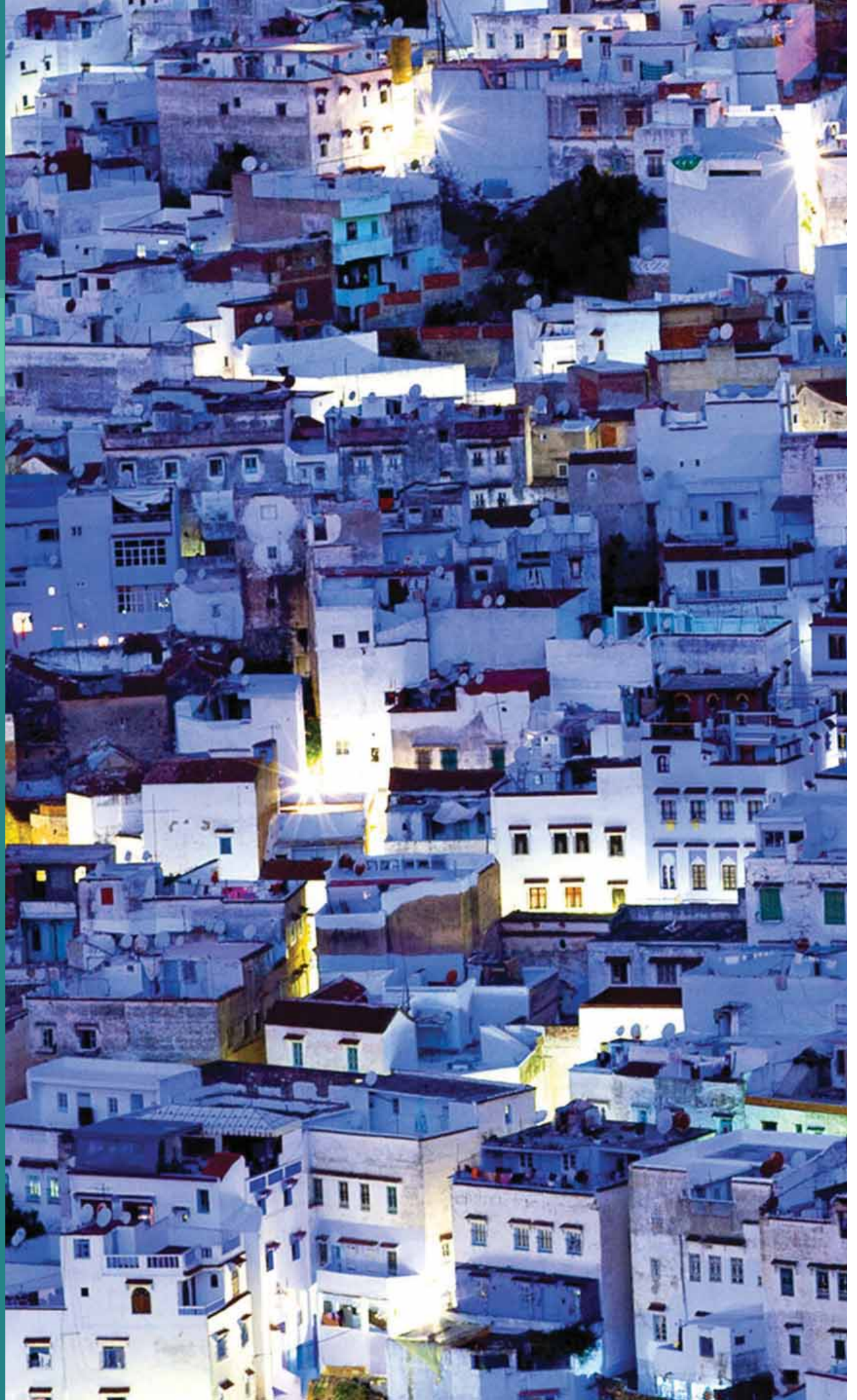
⁸ For more information on the partnership between the World Bank and the Global Alliance for Clean Cookstoves, please see: <http://www.worldbank.org/en/news/press-release/2014/11/21/new-partnership-to-help-bring-clean-cooking-to-100-million-households-by-2020>

heating stoves for households without access to district heating was developed with the support of a multi-donor trust fund from the United Kingdom. The activities were further cofinanced by the Central Asia Energy Water Development Program, which is supported by Switzerland, the United Kingdom, the European Commission, and the United States. ESMAP support in the heating sector helped to develop and inform a new investment lending operation aimed at improving the efficiency and quality of heat supply at the district and household levels.

The Clean Cooking activities in **India** are coordinated with Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, operating on

behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ). In addition to coordinating with the GIZ in stakeholder consultation and discussions with the Government of India through the Ministry of New and Renewable Energy, GIZ and ESMAP provide support for the annual India Clean Cooking Forum. The 2016 forum is scheduled for December 6, 2016.

The initiative is also preparing a proposal to leverage private sector investment through the Green Climate Fund through a four-year program to expand clean cooking operations in three countries. Additional countries may be added to the program at a later stage.





CHAPTER 4

ENERGY EFFICIENT CITIES

Approximately 3.5 billion people currently live in urban centers and are expected to grow to 5 billion by 2030. Approximately 90 percent of this increase will occur in developing countries, where poor urban communities are growing rapidly. This urbanization has led to massive demand for energy to power economic activity, expand infrastructure, and deliver municipal services. Cities now consume about two-thirds of the world's energy, and are responsible for 70 percent of the global greenhouse gas emissions. Given the long-term nature of urban infrastructure, cities can lock themselves into unsustainable and costly energy consumption patterns. Investing in energy efficiency can help expand and improve urban services, while contributing to cities' efforts to be more competitive and address climate change.

PRIORITIZING ENERGY EFFICIENCY POTENTIAL


To date, energy efficiency diagnostics using ESMAP's **Tool for Rapid Assessment of City Energy** (TRACE) have been conducted in nearly 70 cities around the world. The diagnostics have helped raise awareness and open constructive dialogues with local, as well as national, authorities on the potential and



ways to improve energy efficiency in cities. Some of these diagnostics have leveraged significant investments in municipal energy efficiency. For example, ESMAP supported TRACE-enabled diagnostics in **Mexico's** Leon and Puebla. The diagnostics were subsequently replicated by the Mexican government in another 30 municipalities across the country. These assessments laid the groundwork for the design of the Mexico Municipal Energy Efficiency Project, led by Mexico's Energy Ministry (SENER), supported by a \$100 million World Bank loan approved in March 2016, which will finance the implementation of municipal energy efficiency investments in several Mexican cities across the country. This forms the country's first national program targeting municipal energy efficiency, as part of a strategy to steer the country towards a sustainable and inclusive growth path. ESMAP also supported the development of the first pipeline of projects through detailed energy audits in six municipalities covering three municipal sectors—street lighting, municipal buildings, and water and wastewater.

Likewise, in the **Kyrgyz Republic**, ESMAP supported energy efficiency assessments in four cities. These informed municipal energy savings plans adopted by the city councils in three cities and the development of a \$14 million World Bank urban energy efficiency project. The project supports seismic and energy efficient retrofitting of schools, street lighting, water pumps, and waste collection equipment. Within the framework of the project, capacity for local construction companies was also strengthened to perform energy efficiency retrofits.

The private sector and other institutions are also funding urban energy efficiency investments



IN THREE YEARS, ESMAP HAS:

- Supported 23 urban energy efficiency technical assistance programs for national and local governments in more than 50 cities in 28 countries
- Built the foundation for urban energy efficiency planning and investments through city-level diagnostics using TRACE in 70 cities
- Informed the development of several investments, including a \$100 million IBRD loan for municipal energy efficiency in Mexico, \$14 million IDA financing for urban energy efficiency in the Kyrgyz Republic, and a \$300 million public-private partnership for street lighting in Belo Horizonte, Brazil

informed by ESMAP-supported technical assistance. For example, in June 2016, the city of Belo Horizonte in **Brazil** began the replacement of its 178,000 streetlights with energy efficient LEDs, identified as a priority by the TRACE-based city energy diagnostics. The diagnostics, as well as subsequent ESMAP supported pre-feasibility studies, informed the establishment of a public-private partnership (PPP) to implement the street light replacement project. The PPP (covering both investments and maintenance) is worth \$300 million, which is \$130 million less than the \$430 million that the city would have had to pay under the business-as-usual scenario. Efficient public lighting is now being expanded to 300 other cities across Brazil. ESMAP support is also targeting energy efficiency in buildings, such as 2,000 schools in Rio de Janeiro and Belo Horizonte where technical assistance is enabling pre-

feasibility studies that examine rooftop solar panels combined with energy efficiency measures inside schools.

ESMAP launched the **City Energy Efficiency Transformation Initiative** (CEETI) in 2013—a \$10 million program that helps cities identify, develop, and mobilize financing for transformational programs in urban energy efficiency. The program works across sectors to address urban issues in power, heat, transport, buildings, lighting, and water to better tackle the drivers of energy consumption. Broadly divided into three areas of support—technical assistance, capacity building, and knowledge creation and dissemination—the ESMAP initiative works with teams from across regions and global practices of the World Bank who provide assistance to local and national governments.

ESMAP's CEETI is supporting technical assistance in nearly 35 cities in 13 countries—Brazil, China, Egypt, Indonesia, Jamaica, Kyrgyz Republic, Macedonia, Mexico, Morocco, South Africa, Turkey, Ukraine, and Uzbekistan. These activities build on ESMAP's extensive work in city energy diagnostics carried out using TRACE. ESMAP has also provided support for the development of case studies, detailed energy assessments, energy audits, pre-feasibility studies, training, roadmaps, and the design of financing and implementation mechanisms that are instrumental to help understand, address, and remove some of the barriers to scaling up energy efficiency in cities. In addition, ESMAP has provided support for energy efficiency technical assistance activities through dedicated grant funding windows targeting urban transport and water services (together totaling \$2.4 million over FY2014–16),

which enabled support to another 20 programs in 20 countries.⁹


SUPPORT FOR MUNICIPAL ENERGY EFFICIENCY PLANNING, POLICIES, AND CAPACITY BUILDING

To help countries and cities implement their energy efficiency agendas, ESMAP has provided training and capacity building support to an array of clients in FY2016.

In **Ukraine**, ESMAP helped to build capacity among relevant stakeholders in Kiev, Ternopil, and Kamianets-Podilskyi to perform city-level energy diagnostics with TRACE. Public buildings were identified as a priority and pre-feasibility studies and financial analyses were undertaken in these cities. As a follow-up, the Association of Energy Efficient Cities of Ukraine organized testing of the forthcoming TRACE 2.0 in a fourth city, Zaporizhia, and trained about 60 city representatives in deploying the tool. Building on ESMAP's technical assistance, the World Bank is helping the City of Ternopil to design a revolving energy efficiency fund and develop a business plan for the establishment of a local energy service company (ESCO).

ESMAP has assisted **Macedonia** in strengthening the capacity of local governments to identify energy efficiency opportunities. Two action plans

⁹ A few countries receive ESMAP support for more than one urban energy efficiency technical assistance program (e.g., ESMAP supports both a water services and an urban transport program in Tanzania; similarly ESMAP supports a water services technical assistance program, and a multi-sector urban energy efficiency program in Brazil); and some technical assistance programs cover more than one country.



and five pre-feasibility studies addressed barriers and made actionable recommendations on implementation and financing options for buildings, street lighting, and water services. Already, four pre-feasibility studies have been submitted to the ongoing Municipal Services Improvement Project financed by the World Bank. The ESMAP work has also led to the development of a guidance note, training material (in English, Macedonian, and Albanian), and case studies that were disseminated across 50 municipalities.

ESMAP's overall work on energy efficient cities has contributed to shaping policies, building institutional capacity, and helping leverage investments.

ESMAP support enabled an assessment of **Turkey's** national energy efficiency policies and the development of recommendations to help the government meet its national targets. This work provided key input for the government's 2014–18 Development Plan, which includes an Energy Efficiency Action Plan, calling for strengthening institutions in line with the ESMAP-supported report's recommendations. In addition, the lead energy efficiency agency in Turkey (General Directorate for Renewable Energy) has also accepted the recommendation to strengthening their monitoring, reporting, and evaluation processes, which was one of the most critical gaps identified in the report.

In the **Europe and Central Asia** region, a series of activities focusing on financing approaches for energy efficiency brought to the governments' attention the benefits and feasibility of sustainable energy efficiency financing through revolving energy efficiency funds, particularly for the public sector. This ESMAP-supported work also

raised awareness on innovative solutions such as the use of energy service agreements, which enable municipalities to finance energy efficiency without taking on debt and can be scaled up to other municipalities. Since this work began, energy efficiency funds and energy service agreements are being adopted in World Bank energy efficiency lending operations in Macedonia, Armenia, and in Mexico, and are under consideration in another 15 countries.

In the **South Asia** region, ESMAP collaborated with bilateral partners, including AFD, KfW, and USAID, to complete a series of country-specific studies on demand-side energy efficiency for Bangladesh, Pakistan, and India. These studies explore how demand-side management interventions can potentially help in managing electricity shortfall; evaluate the barriers with respect to institutional capacity, policies, programs, financing, and markets at the state level; and aim to help understand the attitudes of consumers, suppliers, and decision makers about energy efficiency. The results of the studies will be presented in the fall of 2016 at an international conference in New Delhi organized by the ADB, IEA, Copenhagen Centre on Energy Efficiency (C2E2), Energy Efficiency Services Limited (EESL), and supported by ESMAP.

ESMAP is assisting the government of **Morocco** to design a sustainable public lighting transformation program using a PPP. The program will contribute to increasing the energy efficiency of Morocco's public lighting systems through the effective implementation of a carefully chosen and integrated mix of project components. Specifically, the program will focus on identifying and developing appropriate mechanisms for addressing and removing market and institutional

barriers that are restricting the adoption and implementation of energy efficient technologies and practices in the public sector, such as the lack of awareness and incentives, insufficient implementation capacity, and limited access to financing. This activity is part of a broader ESMAP-supported program—the Morocco City Energy Efficiency Technical Assistance project—that also includes an energy efficiency diagnostic of Marrakech and support to upgrade the city’s public lighting system to LED.


SHARING OF GLOBAL EXPERIENCES

In **Brazil**, ESMAP support to Sao Paulo, Belo Horizonte and Rio de Janeiro in modernizing their public street lighting was complemented by knowledge exchange and collaboration with industry experts such as General Electric, Philips, and Siemens. Several conferences were held to disseminate lessons of the project. Outreach efforts have successfully communicated to municipalities the value and opportunity to integrate innovative telecommunication technologies to operate public street lighting networks more efficiently using new LED technology.

To share experience and insights on efficient street lighting more broadly, ESMAP produced and disseminated *Proven Delivery Models for LED Public Lighting: Synthesis of Six Case Studies*, which summarizes the cross-cutting findings from real-life experiences, challenges, and solutions encountered in implementing different LED-delivery models, the roles played by government, and ways for cities to mitigate technical, financial, and performance issues.

In **Mexico**, ESMAP, along with the World Bank Group, SENER, IEA, the Development Bank for Latin America (CAF), the International Partnership for Energy Efficiency Cooperation (IPEEC), and the British Embassy in Mexico, supported the International Conference on Energy Efficiency in Cities, hosted by Mexico’s Energy Ministry (SENER) in Puebla in February 2016. The conference aimed to promote dialogue on practical financing mechanisms, transformational policies, and national programs, as well as share experiences from Mexico and around the globe to help local and national governments in promoting smart, efficient, and sustainable cities. Over 200 participants from different parts of Mexico and a dozen countries joined the conference.

An **International Workshop on Energy Efficient Lighting: Urban Experiences and Implementation Practices** was organized by the Energy Efficiency Services Limited (EESL) of India and the World Bank in Vijayawada, Andhra Pradesh, India, in April 2016 with support from ESMAP, in collaboration with Vijayawada Municipal Corporation (VMC), the Government of Andhra Pradesh, and the India Bureau of Energy Efficiency. The objective of the workshop was to showcase India’s national LED lighting program, share experiences, and learn from other countries and stakeholders about how various implementing models and innovative financing mechanisms could be replicated on a larger scale in India and other developing countries. The workshop, attended by over 150 participants from the public and private sectors in India, along with 20 international participants from China, Korea, Singapore, the United States, Brazil, Bangladesh, the United Kingdom, IFC, IEA, ADB, KfW, and AFD, shared their experiences that helped inform the India program



which has currently replaced 175 million household incandescent bulbs with LED bulbs and aims to replace about 770 million all over India by 2019.

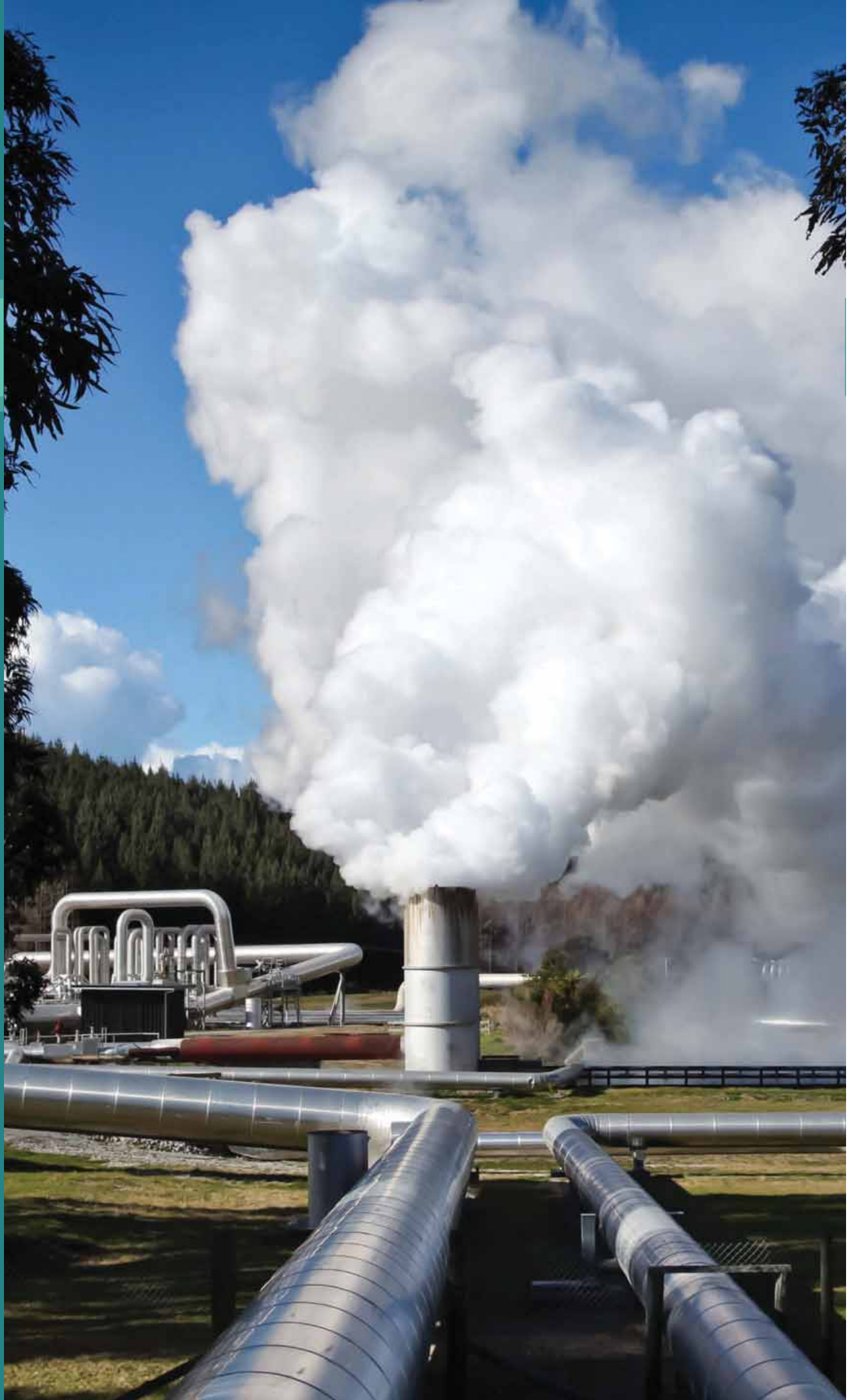
ESMAP supports the Global Knowledge Platform of the IFC's **EDGE Green Building Market Transformation Program**. This includes certification and governance protocols, the EDGE software design tool, training materials, and a global IT platform, which form the backbone of the EDGE Program. To date, the EDGE Program has certified over 880,000 m² of floor space in developing countries, yielding approximately 43 million kWh in energy savings; 800,000 m³ in water savings, and 7 million MJ in material savings annually.¹⁰ ESMAP also supported EDGE in the rollout of a voluntary Green Building Certification System in South Africa.

¹⁰ See <https://www.edgebuildings.com/> for up-to-date totals.

The **Energy Efficiency Project Resource Center** has been developed, in cooperation with Energy-*pedia*, to provide practitioners from around the world with project documents not widely available or easily accessible (e.g., technical specifications, terms of reference, etc.). To date, it has nearly 130 documents and has had more than 6,300 hits since it went online. In addition, a self-paced-learning program on Energy Efficiency in Cities has been developed by ESMAP in collaboration with the World Bank Climate Change Group and the Online Learning Center, as well as financial support from the Korea Green Growth Trust Fund. Targeting city leaders and policymakers, the course consists of a series of modules covering diverse topics (e.g., energy efficiency and public lighting, energy efficiency and water, wastewater, etc.) available on a single platform to facilitate user access.









CHAPTER 5




ACCELERATING INVESTMENT IN GEOHERMAL ENERGY

Geothermal energy can offer low-carbon baseload power that many countries could potentially tap into as a clean and reliable option to expand access to electricity, grow their economies, and mitigate the effects of climate change. But compared to other renewables, geothermal development has been lagging behind. Geothermal production today stands at only seven percent of global energy output. Out of the 90 countries with geothermal potential, only 27 use it to produce electricity according to the International Geothermal Association.

The main reason is that a site's geothermal energy potential is not known until a fairly large investment is committed upfront for exploration, which may reveal inadequate resources to produce power. Most private investors and developers are not willing to take the risk.


In 2013, ESMAP launched the **Global Geothermal Development Plan** (GGDP), with the objective of accelerating the pace of investments in geothermal energy production in developing countries. By mobilizing multilateral and bilateral development financing to share the risks of investments in



early-stage drilling carried out to explore and confirm geothermal resources, the GGDP focuses on correcting a market failure.

Since its launch, the ESMAP initiative has played a crucial fundraising role. It has mobilized \$235 million through the Clean Technology Fund (CTF), which is expected to leverage at least \$1.5 billion in public and private capital. ESMAP also allocated \$7.5 million for technical assistance to identify and structure investments focused on geothermal exploration. As a result of ESMAP's active role in raising awareness on the importance of focusing scarce concessional funding into riskier investment, the initiative helped to triple the share of geothermal energy financing allocated to exploration by multilateral development banks—including the World Bank Group, Inter-American Development Bank (IABD), Asian Development Bank (ABD), African Development Bank (AfDB), European Bank for Reconstruction and Development (EBRD)—from 6 percent in 2012 to about 17 percent of their geothermal investments in 2015.

Before the GGDP, over 80 percent of World Bank financing for geothermal projects—or around \$1.5 billion in three decades—was committed to low risk investments, such as above the ground steam gathering systems, power plants, and ancillary infrastructure such as transmission lines. The ESMAP initiative has managed to shift this trend: for the past two years, new projects almost exclusively focus on (i) financing actual exploration and confirmation drilling; and (ii) on establishing risk mitigation mechanisms to effectively deploy scarce concessional financing and maximize the potential to leverage private capital.



IN THREE YEARS, ESMAP HAS:

- Mobilized \$235 million through the Clean Technology Fund, which is expected to leverage at least \$1.5 billion in public and private capital
- Helped triple the share of multilateral financing for early development stages from 6% of the total in 2012 to 17% of their geothermal investments in 2015
- Provided technical assistance to 13 countries to identify and prepare projects; 3 of these projects are now being implemented with support from the World Bank

To date, ESMAP has provided technical assistance to 13 countries to identify and prepare projects. Three of these projects are now being implemented with support from the World Bank:

In **Armenia**, a \$8.55 million grant from SREP is helping to confirm resource suitability for power generation in Sjunik region's Karkar site. If exploration leads to the development of a power plant, it could help Armenia meet electricity demand and improve its energy security. Low-cost electricity from the plant would keep it affordable for the poor. In **Djibouti**, \$6 million from Global Environment Facility (GEF) and \$1.1 million from ESMAP (with cofinancing from IDA, AFD, AfDB, and the OPEC Fund for International Development) for the Geothermal Power Generation Project is helping to assess the commercial viability of the resource in Fiale Caldera within the Lake Assal region. The project has the potential to reduce energy costs and boost private sector development and access to electricity for the

entire population. In **St. Lucia**, a \$3.5 million grant from GEF and SIDS DOCK is helping upstream geothermal development preparation, including transaction and regulatory support.

The World Bank is also supporting the preparation of critical strategies to develop the sector in some key geothermal countries. For instance, in **Kenya**, ESMAP and IFC are financing the preparation of a National Geothermal Strategy to mobilize public and private investment to increase the pace of geothermal development. The World Bank is also cofinancing local infrastructure for the development of the Olkaria I & IV geothermal fields—one of the largest single geothermal investment projects in the world. Geothermal capacity now constitutes 26 percent of the total installed generation capacity, expanding renewable energy penetration to 63 percent of the installed capacity. This has allowed geothermal to become the largest generation source in Kenya with 44 percent of the total electricity produced in 2015. In **Chile**, ESMAP is cofinancing a \$5 million CTF technical assistance project to improve the policy framework and strengthen management capabilities for mobilizing investment in geothermal and to enhance market conditions for promoting sustainable development of the sector.

These investments generated a repository of knowledge on sustainable geothermal development. Country experiences shared during the 3rd **GGDP Roundtable** organized by ESMAP in Reykjavik, Iceland, pointed to the need for long-term commitment from all stakeholders and for public investment to absorb part of the resource risk and thus encourage the private sector to step in. The roundtable was attended by more than 150 representatives from 30 countries. During the

event, representatives from Armenia, Turkey, Djibouti, Chile, Indonesia, Kenya, Ethiopia, Mexico, El Salvador, Nicaragua, St. Lucia, Dominica, and Turkey—some of which have received CIF financing to cost-share the riskiest phases of geothermal development—presented the development models and financing options currently in use for scaling up geothermal development.

Continuing to lead the knowledge frontier on global geothermal development, ESMAP has released two key reports. The first report, *Comparative Analysis of Approaches to Geothermal Resource Risk Mitigation: A Global Survey*, seeks to inform countries in evaluating the pros and cons of various risk mitigation approaches in order to select the most optimal arrangement given a country's existing institutional capacity, depth of the financial market, and appetite of investors and developers, as well as history and current status of geothermal development. The second report, *Addressing Greenhouse Gases from Geothermal Power Production*, examines the current state of knowledge on greenhouse gases emissions from geothermal power plants and provides guidance to estimate, ex-ante, potential emissions from geothermal projects.

In collaboration with partners, ESMAP has also supported the preparation of a globally applicable, harmonized standard to streamline measurement of geothermal resources across fields—the *Definition of Global Standards for Geothermal Resource Classification*. The standard, which will be a crucial step in building confidence among policymakers, investors, and the public to position and scale up geothermal in the global energy mix, is expected to be adopted by the United Nations Framework for Fossil Energy and Mineral Reserves and Resources (UNFC) in the fall of 2016.






CHAPTER 6

RENEWABLE ENERGY RESOURCE MAPPING

Demand for ESMAP support to help countries understand their renewable energy potential grew noticeably in FY2016, largely as a result of the surge of interest in solar power due to sustained cost reductions.


ESMAP's global initiative on **Renewable Energy Resource Mapping**, launched in FY2013, continued to support the implementation of projects in 11 countries, and has provided technical advice to many others to develop or increase power generation from domestic renewable energy resources, such as biomass, small hydropower, solar, and wind. It has been providing those countries with the data needed to understand their renewable energy potential as they plan to incorporate renewables in their energy mix. Resource assessment combines multiple sources of information, including satellite data, ground-based surveys, and meteorological measurements, to produce high-quality maps and accompanying datasets that can be used for strategic planning, grid integration activities, and site evaluations by commercial developers. As an open data initiative, all key outputs and datasets are made publicly available.



All of the 11 country projects have now delivered preliminary Phase 1 outputs, which in most cases comprise a first assessment of resource potential based on modeled or remote sensing data. During FY2016, several projects, including those in Madagascar, Maldives, Pakistan, Tanzania and Zambia, started Phase 2, involving ground-based data collection from field surveys (biomass), stream gauges (small hydropower), meteorological stations (solar), and 80m masts (wind). In the case of **Pakistan**, the biomass mapping was completed in FY2016 and a final biomass atlas published. The work involved extensive field surveys across the main agricultural production areas, carried out by seven universities, with the data then cross-referenced against satellite data.

Some of the preliminary outputs and data published under this initiative have already led to discussions with World Bank task teams and other development partners on how to capitalize on the ESMAP-funded efforts. For example, in **Nepal** the government has requested World Bank support to explore potential sites for wind farms, and now wishes to add solar mapping to the project. In **Pakistan**, data on solar is being eagerly used by developers, where it is helping to build confidence in the validity of their bids, as tariffs for solar and wind decrease. In **Vietnam**, ESMAP has closely cooperated with GIZ to host the data on wind measurement component that they financed. This data will be used to validate the final wind map.

Drawing on the experience generated from these and other country projects, and the expertise built up centrally, ESMAP published a Knowledge Series report during FY2016 titled ***Assessing and Mapping Renewable Energy Resources***. This short



IN THREE YEARS, ESMAP HAS:

- Helped eight countries to obtain an initial assessment of their wind power resource and five countries for solar, resulting in improved data for government planning and private sector development*
- Completed the first biomass mapping activity in Pakistan, involving an extensive cross-referencing of satellite and field survey data
- Set a new standard for conducting and publishing resource assessment studies, including detailed equipment and data specifications that have been adopted by other development partners, and has become one of the lead data providers behind the IRENA Global Atlas on Renewable Energy

* Wind Mapping (8): Ethiopia, Maldives, Nepal, Pakistan, Papua New Guinea, Tanzania, Vietnam, Zambia
Solar Mapping (5): Malawi, Maldives, Pakistan, Tanzania, Zambia

publication targets governments and development partners, and explains the importance of resource assessment and mapping, key steps and good practices, methodological issues, and potential sources for further advice and support.

LOOKING FORWARD

The need for a new approach to help meet increased demand became clear during preparations for the FY2017–20 ESMAP Business Plan. There is clearly a need to provide all countries,

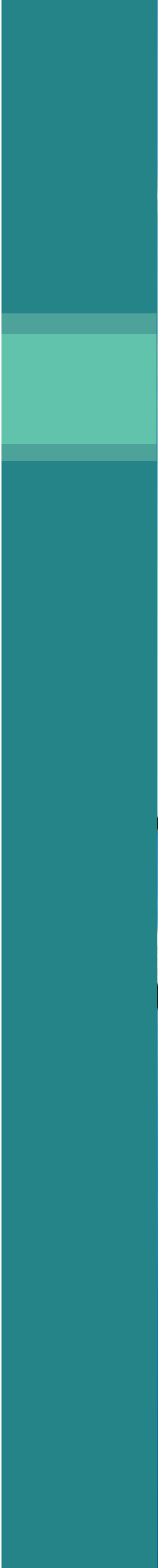
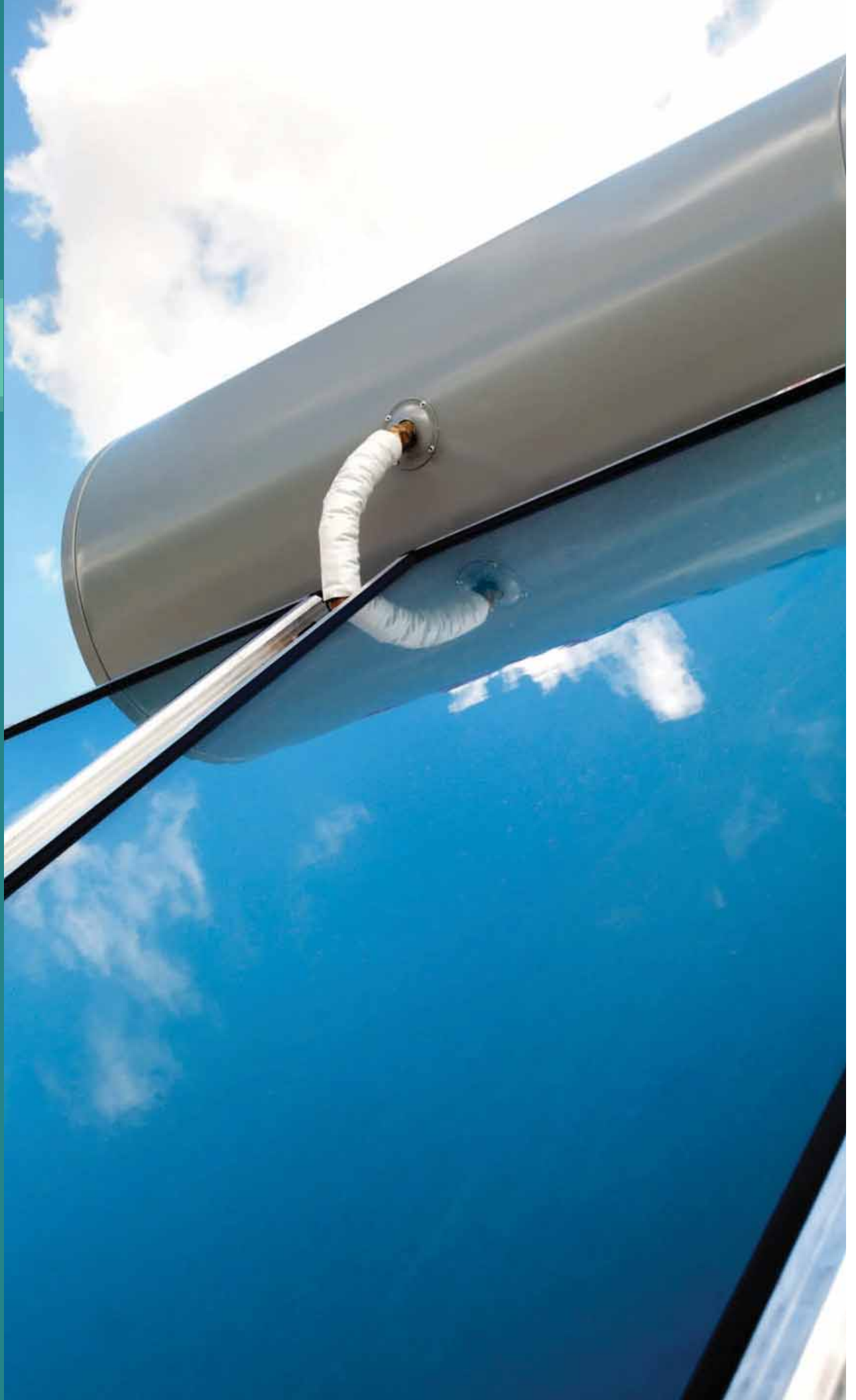


not just a select few, with good-quality, updated solar and wind resource maps and associated data, while still enabling some countries to move on to more detailed analysis where funding allows. In addition, there is increased demand for resource data in support of specific client investments and lending operations, especially with regard to solar measurements.

The priority for FY2017 will be to operationalize a new business model for solar and wind mapping that leverages the specialized data services that are now available to provide a more

comprehensive service to all World Bank client countries, plus on-demand data to World Bank and IFC teams. Biomass and small hydropower mapping will continue on a country-by-country basis where funding permits, but attempts will be made to streamline these efforts.

ESMAP will also give greater attention to integrating resource assessment and data collection into World Bank operations, for example the Scaling Solar initiative, and large World Bank lending projects focusing on solar and wind energy development.






CHAPTER 7



INTEGRATING VARIABLE RENEWABLE ENERGY INTO POWER SYSTEMS

Cost reductions for wind and solar electricity generation technologies offer an opportunity for countries to develop a cleaner, more diversified, and more secure energy mix. However, integrating a sizeable share of variable renewable energy (VRE) to the grid to meet electricity demand raises concerns about the potential adverse impacts on the grid and so limits investment in renewable energy generation. Early analysis, planning, and preparation can significantly reduce the costs of integration, but this is still a relatively new and complex area for many countries. Conventional electricity utilities need assistance to upgrade their capacity and business practices. The need for technical assistance in VRE grid integration is greatest in countries with limited capacity to tackle technical and regulatory challenges.




To respond to this need, ESMAP launched the **Variable Renewable Energy Grid Integration Support Program** in FY2015 to assist countries in achieving cost-efficient scale-up and reducing the adverse economic and operational impacts that accompany the integration of large shares of VRE into existing power systems.

The program leveraged resources through partnerships with the Global Sustainable Electricity Partnership, the Clean Energy Ministerial, National Renewable Energy Laboratory (NREL), and with support from the Korean Green Growth Trust Fund. Over the past year, ESMAP has supported VRE integration-related engagements in 22 countries and two regional projects.

In the **Philippines**, ESMAP supported the revision of the distribution grid code to facilitate connection of VRE at distribution voltages, which was approved by the Energy Regulatory Commission. This work builds on previous ESMAP technical assistance to amend the transmission grid code that was approved in 2013.

In **Seychelles**, ESMAP financed a grid expansion planning study to evaluate the potential role of liquefied natural gas and VRE, including a roadmap for future investment. The study is expected to inform government decisions on potential changes in the energy mix.

ESMAP also supported several knowledge exchange events globally. In July 2015, at the request of the Government of **Mexico**, ESMAP conducted a workshop focused on the main drivers and barriers for the implementation and the potential role of pumped storage for the integration of variable renewables as Mexico continues to reform its power



IN THREE YEARS, ESMAP HAS:

- Completed technical studies in the Philippines and Seychelles, which informed power sector planning strategies and key policy decisions to enable the scale-up of renewables
- Leveraged resources through partnerships with the Global Sustainable Electricity Partnership, the Clean Energy Ministerial, US National Renewable Energy Laboratory, and with support from the Korean Green Growth Trust Fund to provide additional assistance to clients
- Provided technical assistance to 22 countries, including technical studies, capacity building, and knowledge exchange events

sector. Jointly organized with the World Bank Latin America & Caribbean energy team, the Mexican Energy Secretariat (SENER), and the Mexican Federal Electricity Commission (CFE), the event was attended by experts from Germany, Japan, the United States, Spain, and Chile, who shared their insights on pumped storage technologies and applications, as well as the regulatory, legal, and economic conditions that have made the expansion of pumped storage possible in their countries. Following the event, ESMAP is supporting an analysis of the financial feasibility of pumped storage in the Mexican context.

ESMAP also focused on building institutional capacity in response to requests from the World Bank's Europe and Central Asia region. Working directly with the utilities TEIAS and Uzbekenergo in **Turkey** and **Uzbekistan**, respectively, the



ESMAP team conducted training sessions on grid planning for VRE grid integration as part of a broader training on planning for the electricity sector led by the World Bank. In **Kazakhstan**, ESMAP collaborated with IFC on a workshop on grid integration and market analysis.

In June 2016, ESMAP partnered with the Clean Energy Ministerial and the NREL to provide training for World Bank staff on the **latest issues and technology changes regarding the distribution grid**—from policy trends to technical issues, including distribution grid electrical issues common in developing countries, future trends in solar PV for distributed systems, and future trends in demand response and smart-grids for developing countries.

The partnership also allowed the **secondment of a Renewable Energy expert from NREL**. In his temporary assignment to ESMAP, the expert participated in and helped design World Bank lending operations in India and Vietnam, as well as contributed to an initiative to rethink the World Bank’s strategy for power sector reform engagement in client countries in conjunction with the World Bank’s Energy Economics, Markets, and Institutions Global Solutions Group.

In May 2016, culminating a year of learning and sharing, ESMAP, in collaboration with the World Bank’s Clean Energy Global Solutions Group,

organized a **study tour to Hawaii**. The study tour provided the opportunity for over 20 policymakers and technical experts from 9 different small island developing states and 1 regional organization—CARICOM—to learn about Hawaii’s experience in supporting, deploying, and integrating multiple renewable energy and storage technologies into local grids. Through visits to several sites and institutions on Oahu and Hawaii, known as the Big Island, the participants learned about the necessary enabling regulatory and policy framework for successful integration, as well as technologies suitable for island environments such as waste-to-energy, geothermal, and ocean thermal energy conversion, among others. The tour helped to scope future grid integration activities in the Pacific financed by the ESMAP SIDS DOCK program and provided excellent networking opportunities, especially for Mauritius, as it prepares for the African Ministerial Conference on Ocean Economy and Climate Change to be held in September 2016.

The number of countries requesting ESMAP support in this area is growing. Currently, ESMAP is directly engaged and financing activities in Brazil, Costa Rica, Guatemala, Honduras, Mexico, India, Sri Lanka, Mongolia, Cabo Verde, Kenya, West African Power Pool countries, and Vietnam, as well as in the Pacific Islands. ESMAP is also providing technical support to World Bank lending projects in Morocco, Armenia, Haiti, Peru, Mongolia, Bangladesh, Ukraine, and China.






CHAPTER 8

SUSTAINABLE ENERGY FOR ALL KNOWLEDGE HUB

Implementation of the Sustainable Energy for All (SE4All) initiative requires the development of key global public good knowledge products to drive policy development, improve prioritization, and assess progress.


The ESMAP **SE4All Knowledge Hub** leverages ESMAP's comparative advantage in working across the three SE4All areas, while building on the World Bank's convening power and analytical capacity. The Hub includes four activities supported by ESMAP and implemented in collaboration with the SE4All initiative: the Global Tracking Framework; the Multi-tier Framework for Measuring Energy Access; Readiness for Investment in Sustainable Energy; and the global State of the Energy Access Report.

The World Bank, ESMAP, and IEA led a consortium of 23 international agencies, including development partners, nongovernmental organizations, and multilateral institutions, to develop the methodology and deliver the **Global Tracking Framework (GTF)** in 2013 and 2015. In FY2016, a nexus chapter was added to the 2015 update to understand the interactions between energy and nexus areas of water, food, health, and gender. Five UN Regional Economic Commissions are



joining the GTF Consortium for the 2017 update, to build closer links to the regions and countries. The GTF data platform is now publicly available and there have been more than 2,300 abstract views on the website. The GTF was the tracking methodology used to inform the Sustainable Development Goal 7 (SDG7) on “access to reliable and affordable energy services.”

The **Measuring Energy Access** (MTF) complements the Global Tracking Framework in tracking progress toward SE4All and SDG7 access goals. By providing more accurate, granular, and disaggregated data on the actual services households receive, the MTF is gearing up to become a powerful tool for informing policy and investment decisions. The MTF goes beyond the binary approach to look at access in terms of service levels experienced by households, businesses, and communities. It aims to determine the ‘usability’ of the service and classifies energy services into tiers, adopting a technology-neutral methodology. This approach helps to track progress, enables detailed analysis of energy usage, considers country-specific access targets, and helps design targeted interventions by identifying the reasons that may hinder countries from achieving higher access levels. In its first phase, with co-funding mobilized by SREP, the global MTF energy survey will establish country-level data collection in 10 to 15 high access deficit countries by the end of 2017; in its second phase, the MTF will include an additional 10 to 15 countries set for implementation between 2017 and 2020. The MTF will present Country Energy Access Diagnostic Reports containing a multitier detailed analysis of key indicators of energy access services, by country. After the implementation of the global survey, the



IN THREE YEARS, ESMAP HAS:

- Implemented three series of flagship publications that provide critical data to inform sustainable energy goals and policies: the *Global Tracking Framework* (2013, 2015); *Readiness for Investment in Sustainable Energy* (2014); and *Beyond Connections* (2015)
- Provided technical advisory input to the UN Interagency Expert Group on the design of SDG7 and its associated indicators, and reconfigured the 2017 GTF to better fit the annual global reporting needs for the Sustainable Development Goals
- Leveraged \$1.5 million from SREP to conduct baseline MTF surveys in 11 countries and completed the collection, validation, and analysis of sustainable energy policies with RISE in 111 countries

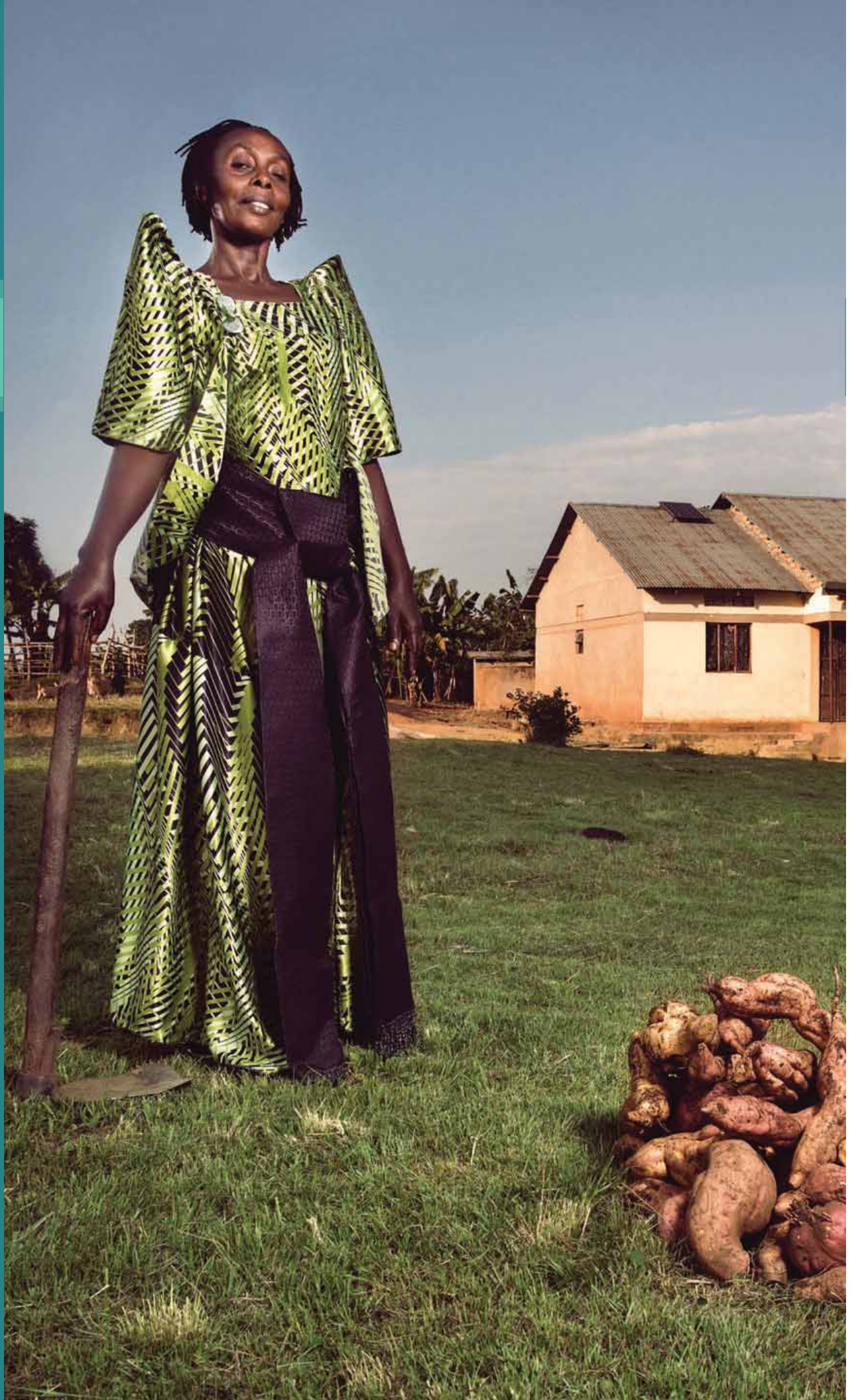
Open-Source Country Energy Databases will be globally accessible via the web. The World Bank and ESMAP are working with several partners to promote broader adoption of the MTF as the key monitoring platform for tracking progress from the baseline toward SE4All and SDG7.

To help decision makers understand and evaluate national policy and regulatory frameworks for private investment in renewable electricity generation, energy efficiency, and access to modern energy services, ESMAP is supporting the global roll out of **Readiness for Investment in Sustainable Energy** (RISE). With 27 detailed indicators for 111 countries—representing 96 percent of the global population—RISE aims to identify gaps in



national policy frameworks and catalyze effective reforms by benchmarking country performance and providing examples of good practices. Each indicator targets an element of the policy or regulatory system important to mobilizing investment. The combination of carefully designed indicators and a wealth of country-specific data can serve as the basis for sharing experiences across countries and highlighting best practices. It is expected that RISE will contribute to policy dialogue by providing a global reference point on measures to strengthen the enabling environment to support investments and to inform country interventions. RISE is also a valuable source of information to private investors and developers. In FY2017, RISE data will be available through a user-friendly, open-web platform that will allow global audiences to run reports and conduct customized country analysis.

State of Energy Access Report (SEAR) will complement the other aspects of the SE4All Knowledge Hub work by serving as a stocktaking of the status and nature of progress on access to energy services. SEAR, which is due to be released in FY2017, will present a comprehensive picture of the global efforts to address energy access challenges, including status and trends, enabling environment, clean energy, and emerging and innovative delivery models of modern services. In this respect, SEAR will present a narrative beyond quantitative metrics to offer more comprehensive information to stakeholders such as governments, investors, donors, and practitioners.






CHAPTER 9

EMPOWERING WOMEN TO ENERGIZE COMMUNITIES

ESMAP has played an important role in ensuring that gender issues in energy move beyond advocacy to produce concrete results in project design and impact. Through the **Gender and Social Inclusion** initiative, ESMAP has not only established a foundation of knowledge that shows how gender-informed projects can improve development outcomes, but also spearheaded innovative approaches to mainstream gender considerations in those projects.

IMPROVING KNOWLEDGE

In close collaboration with the World Bank's Social Inclusion team, ESMAP has supported research aimed to understand gender-specific impacts of electricity infrastructure in areas such as displacement, resettlement, loss of livelihood, job creation, and land titles, among others. Research was completed in 2016 and initial findings were presented at an event with USAID and the Millennium Challenge Corporation, as well as webinars with the International Union for




Conservation of Nature (IUCN). The final report will be disseminated in FY2017.

In December 2015, ESMAP, in partnership with the World Bank Gender group and the Online Learning Campus, delivered for the second time the Gender and Energy e-course to a group of 150 practitioners from over 50 countries, representing client governments, private sector, civil society, academia, and multilateral and bilateral agencies. The e-course was converted to a self-paced module for easier access and use, and its materials will continue to be used in training events.

Based on the practical work carried out so far, and ESMAP's continued efforts on knowledge generation and sharing, ESMAP has helped curate a strong set of best practices and roster of gender experts that have been called upon repeatedly to provide expertise. To assist World Bank teams to integrate gender considerations in investment operations, ESMAP and the World Bank Energy Global Practice collaborated to produce a guidance sourcebook highlighting examples of gender assessments, actions, and monitoring and evaluation efforts during project design. ESMAP will continue to promote the lessons learned and tools developed to help project teams get started and provide timely technical support during design and implementation.

SUPPORT TO COUNTRY PROJECTS

Through its gender and energy regional programs in Africa and East Asia and Pacific regions, ESMAP is currently engaged in over 20 countries. This support resulted in several projects, including gen-



IN THREE YEARS, ESMAP HAS:

- Strengthened the foundation of knowledge on gender and energy through the development and delivery of a Gender and Energy online learning course
- Delivered in-country support through regional gender and energy programs in Africa and East Asia & Pacific regions in over 20 World Bank projects, resulting in improved gender analysis, piloted interventions, trainings, and increased participation of women during project design and implementation

der analysis, actions, and monitoring and evaluation (M&E) within the design.

Gender and Energy in Africa

Since 2009, ESMAP has supported a gender and energy program in Africa through **AFREA** to integrate gender considerations in projects and policy dialogue across the region. A summary of project highlights are below.

In **Senegal**, support from AFREA to integrate gender specific activities and indicators during project design resulted in significant increase of women's income and status in the community, as part of the Second Sustainable and Participatory Energy Management Project (PROGEDE II). About 3,270 women became charcoal producers while the share of community income going to women has risen from 12 percent in 2013 to 18.62 percent in 2016. The project also found that 40 percent of women were able to secure decision-making positions in local forest management committees. In addition, more than 600,000 clean

cookstoves were distributed benefiting 610,160 people, mostly women. Next steps for the project will focus on gender training for local forest management groups, mayors, and others; an assessment of the socioeconomic impact of gender activities; and the design of a communications strategy. Based on the lessons learned, the team provided support across the entire energy program in Senegal.


ESMAP is providing support to the Rural and Renewable Energy Agency in **Liberia** to identify opportunities for men and women in the development of the mini-grid in Lofa County. Approaches being piloted include diverse representation on the electrification committees, integrating women's productive uses of energy, connections to key social services, and the simplification of connection procedures. In addition, under the Lighting Lives Liberia program, gender-informed national consumer assessments are tracking gender-disaggregated data trends, and a retailer and consumer impact case study is being developed to look at various gender dimensions. A gender specialist has also been hired to manage the on-the-ground activities and strengthen the capacity of the Rural and Renewable Energy Agency.

In the development of the Rural Electrification Expansion Project in **Tanzania**, a gender analysis was completed during project preparation using national survey data to establish the rates of access to electricity of male- and female-headed households and corresponding poverty rates. Results revealed that a lower percent of female-headed households are connected to the grid in urban areas and are poorer than male-headed

households. As an outcome, the project is now focusing on addressing the gender inequality in access. To ensure that the poor, women-headed households obtain access to electricity during implementation, a needs-based methodology for administering the connection subsidy is being developed, consultative meetings to explain electrification procedures and safety practices are being designed, and sex-disaggregated data will be collected.

In **Ethiopia**, a gender assessment is being launched, covering the country's energy portfolio to help develop a baseline for understanding key gender issues and data points that could be addressed in existing and pipeline projects. Focus is placed on stakeholder consultations, decision-making abilities amongst women and men, consumer education on solar and cooking technologies, helping women access financing to purchase energy products, and the collection of sex-disaggregated information. Under the Additional Financing Electricity Network Reinforcement and Expansion Project, gender-specific targets have been set to increase equity and balance in the number of loans to female applicants through micro-finance institutions.

In **Nigeria**, support is being provided on the ongoing World Bank Poverty and Social Impact Analysis to assess the distributional and social impacts of policy reforms and inform the country's energy portfolio. In addition, ESMAP is placing specific focus on the design of gender-sensitive, off-grid lighting approaches under the Electricity Sector Credit Facility Project. Issues being explored include household decision-making dynamics, access to information, and preferences about



technology options, as well as income-generating opportunities through jobs for both men and women.

In the **Comoros Islands**, ESMAP is helping the state-owned electricity and water utility to address energy efficiency issues and commercial losses, and to strengthen customer trust in the utility. Using community engagement methods, the approach urges citizens to take an active part in the solution by highlighting customer responsibility in combating electricity theft. The team is trying to build a shared vision where electricity is recognized as a national and common good, and local women are trained in how to guide energy consumers in tangible actions to increase bill payment and stop electricity theft. The utility's female employees are also working with front-line customer-facing employees to encourage them to stop illicit behaviors—such as selling electricity in the informal market, stealing clients' meters, and threatening clients.

In **São Tomé and Príncipe**, ESMAP is helping develop a gender-sensitive communications and citizen engagement campaign to address nontechnical losses, such as nonpayment of bills, electricity theft, and meter tampering. Funding is also being used to train the female employees as “utility ambassadors” to provide more client-oriented services and improve customer relations. A social compact is also being piloted, whereby women's groups raise awareness among customers about their role in supporting the improvement of energy services to reduce electricity theft and promote bill payments. ESMAP is also supporting the utility in collecting sex-disaggregated data through its new management information system to

monitor female- and male-headed households and business connections, and guide strategic interventions to support equal access to and use of energy among them.

To complement this country work above, over the past year, ESMAP's Africa gender initiative has strengthened its efforts on data collection, analysis, and M&E. A Lead Gender and Energy M&E Specialist has joined the team to focus on operational support, capacity building and knowledge development in M&E frameworks, indicator development and impact studies. Technical input has been provided for project preparation to help identify gender-specific indicators and to improve data collection and monitoring systems. The team is developing an M&E Toolkit focused on practical guidance on gender and energy forthcoming for FY2017.

Gender and Energy in East Asia and the Pacific

In the World Bank's **East Asia and the Pacific** region, the Gender and Energy Facility was launched in FY2015 with funding from ASTAE and ESMAP. The facility is managed by the World Bank's regional gender team and implemented by the regional social and energy teams. It focuses on three key areas: identifying gender entry points in ongoing and future energy projects in the region; designing gender-smart solutions and project mechanisms; and updating monitoring systems. To date, eight projects have benefited from technical and operational support from Gender and M&E experts.

In **Vietnam**, ESMAP and ASTAE helped the Trung Son Hydropower Company to reach more women by using appropriate channels, and increasing

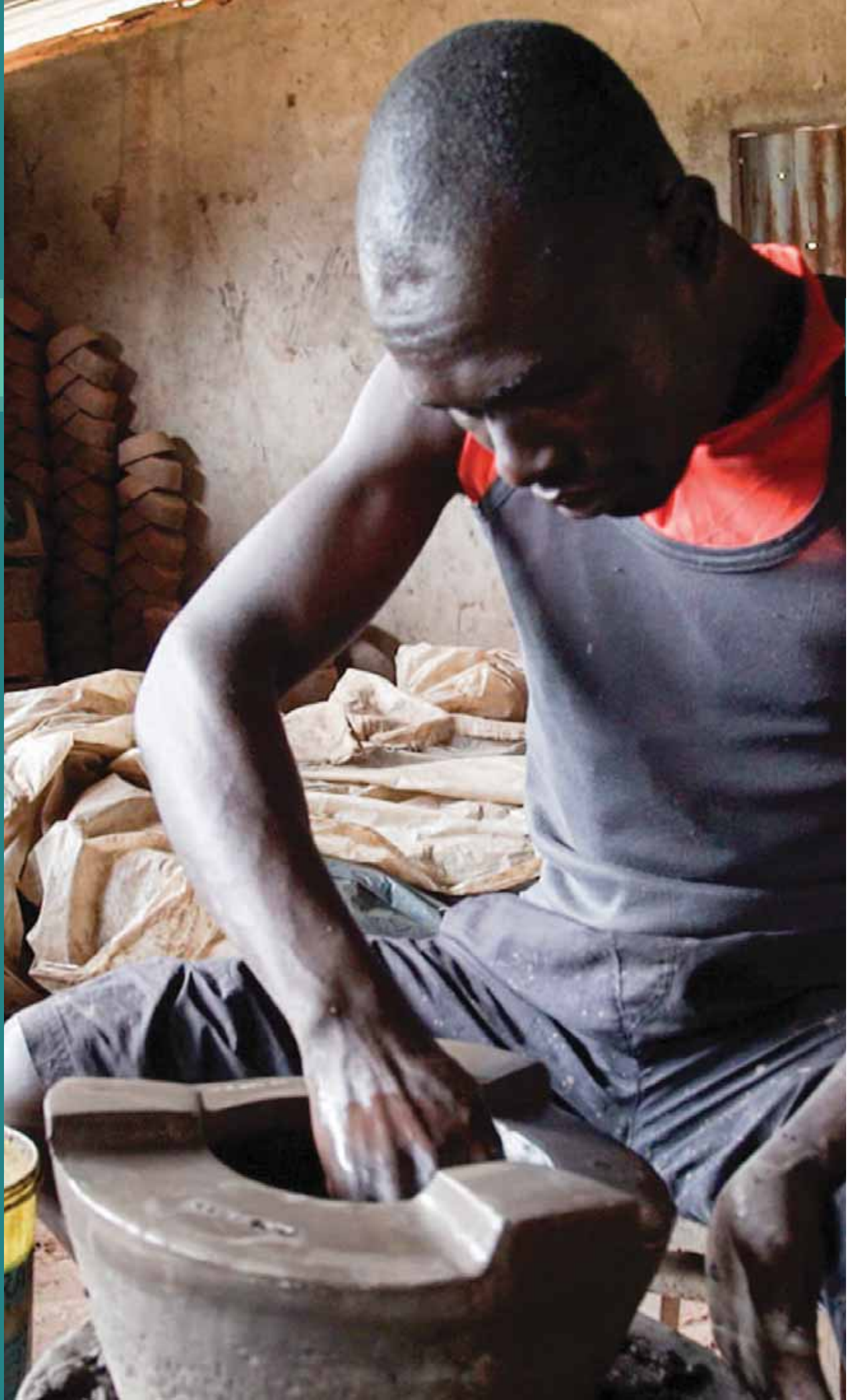


their awareness of compensation and livelihood programs. More specifically, technical assistance enabled the company to update the design, implementation, and monitoring mechanisms for women's livelihood programs, helped ensure that ethnic minority and resettlement programs benefit both genders equally, and that monitoring mechanisms capture gender-disaggregated progress and results. Moreover, it strengthened the capacity and cooperation among local Women's Union groups. A communications campaign helped ethnic minority women understand how to deal with potential impacts and benefit from the services provided by the Trung Son project.

ESMAP and ASTAE were instrumental in providing input to the **Philippines'** Renewable Energy Development Project to help understand, from a gender perspective, the market and demographics served by national electricity cooperatives. The energy needs, use, and priorities of male and female customers are being mapped to better target service delivery. This approach is now being adopted by four pilot energy cooperatives.

In the **Solomon Islands'** Tina River Hydropower Project, ESMAP and ASTAE collaborated closely with project managers to develop a comprehensive gender action plan that addresses specific gender-based challenges regarding decision making over land, compensation, grievances, and benefit sharing. The action plan, which also includes a strong monitoring framework, was developed in time to inform project design.

As part of ESMAP's clean cooking initiative, support was provided to the **Indonesian** Clean Stove Initiative (CSI) to conduct in-depth research to understand the social and gender drivers of clean stove adoption in households. The findings led to the development of innovative tools to test stoves and training of local nongovernmental organizations. The recommendations have been translated into practical social marketing actions to address national capacity building, community outreach, and monitoring, as well as fostering the participation of women in the clean stove market value chain.





CHAPTER 10




FOCUS ON AFRICA

In Sub-Saharan Africa, more than 600 million people do not have access to electricity, making it the region with the highest electrification deficit. Nearly 80 percent of those without power are in rural areas. In addition, over 700 million people rely on solid biomass such as wood or charcoal for cooking, usually with inefficient stoves. Such practices contribute to indoor air pollution in households, which leads to 600,000 premature deaths each year, disproportionately affecting women and children.

The **Africa Renewable Energy and Access Program (AFREA)** was established in 2008 to provide targeted regional support to help Africa scale up energy access and the use of clean energy. Its first phase, which closed successfully in 2014, was followed by a second phase designed around country-specific activities, regional initiatives, and regional strategic studies.

Underlying these focal areas are the two cross-cutting themes of enhancing impact through gender and productive uses, and supporting post-conflict and fragile states.




Between FY2014–16, AFREA supported 22 activities, including regional initiatives, country-specific activities, and regional strategic studies.

REGIONAL INITIATIVES

To help the continent tackle energy issues of shared concern, ESMAP, through AFREA, provides tailored support by leveraging regional experience and knowledge. Regional activities include Lighting Africa, the Africa Electrification Initiative, Accelerating On-grid Access Team, and the Africa Clean Cooking Energy Solutions.

Lighting Africa. A flagship initiative launched by the World Bank and the IFC in 2007, it supports the delivery of modern energy services through off-grid solar solutions. Since its inception, the initiative has had significant success: it is now operating in 12 countries and helped investments in off-grid lighting to rise by \$276 million from 2012 to 2015. Lighting Africa has become the global benchmark for quality in the pico-PV market. In some country programs, Lighting Africa has collaborated with development partners such as EnDev and GIZ to deliver technical training to retail importers. Over 9 million quality lighting products were certified and sold through the initiative, benefiting over 15 million Africans.

The initiative influenced the design of the IDA's energy access portfolio and has leveraged over \$40 million for 7 IDA projects that are currently under implementation in Burkina Faso, the Democratic Republic of Congo, Ethiopia, Liberia, Mali, Uganda, and Tanzania.



IN THREE YEARS, ESMAP HAS:

- Supported 22 AFREA activities in 14 countries for a total allocation of \$16 million
- Influenced preparation and implementation of 9 IDA/IBRD operations, for more than \$800 million
- Lighting Africa has facilitated the sale of over 9 million quality-certified products, resulting in over 15 million people with Tier 1 access per the SE4All Multi-Tier Framework

In **Ethiopia**, Lighting Africa supported the preparation and supervision of a \$20 million off-grid component in the Electricity Network Reinforcement and Expansion Project, which helped sell over 800,000 Lighting Africa quality-verified products. The initiative also supported the initiation and scale-up of the Lighting Lives in Liberia Program to foster the development of a national market for solar lanterns and has leveraged seed funding from SREP and GEF to stimulate the development of a national market for solar systems. To date, about 20,000 products have been sold, demonstrating the demand for solar products. In **Uganda**, Lighting Africa supported the Energy for Rural Transformation III project, which will provide a credit line and guarantee instruments to facilitate consumers and solar businesses' financing needs. Through the **Mali** Rural Electrification Hybrid System (SHER) project, Lighting Africa supported the design of a \$2.7 million component to expand off-grid lighting and solar lanterns in rural areas. In the **Democratic Republic of Congo**, Lighting Africa also supported the design and roll

out of an off-grid lighting campaign that makes available an estimated 25,000 solar lighting products for social infrastructure and community influencers such as health care workers, teachers, and leaders in areas beyond the reach of the grid. In **Burkina Faso**, Lighting Africa provides technical assistance for scaling up solar home systems in remote and poor communities.

The program will continue to provide technical advice to Sub-Saharan Africa countries on off-grid products, including Uganda (consumer awareness campaign), Tanzania (technical assistance for solar financing facility), Somalia and Zambia (market assessment studies), Kenya (off-grid support to public institutions), Rwanda (support to off-grid interventions), and Niger (market assessment activities for off-grid electrification).

Africa Electrification Initiative (AEI) and Accelerating On-grid Access Team (AGAT). AEI seeks to increase the effectiveness of rural electricity access programs in Sub-Saharan Africa through capacity building and knowledge exchange. AGAT aims to provide support to countries where on-grid access is a priority. The programs will merge to form AGAT+ in FY2017.


In **Uganda**, AGAT activities in FY2016 included the following activities: (i) local training on management skills such as accounting, warehouse management, and inventory for rural electricity service providers; and (ii) assessment on financing options for connection charges to inform the new policy on connection charges to be elaborated by the Government of Uganda.

AEI and AGAT jointly organized in October 2015 a study tour on low-cost technologies for rural

electrification to Namibia and Ghana for a team of Zambian representatives of the power sector. The Zambian team obtained first-hand knowledge of two low-cost electrification technologies that have been successfully implemented in a number of countries in Sub-Saharan Africa: shield wire systems (SWS) and single wire earth return (SWER). AGAT also enhanced hands-on knowledge for practitioners through the publication of two manuals: *From the Bottom Up: How Small Power Producers and Mini-Grids Can Deliver Electrification and Renewable Energy in Africa* and *Rural Electrification with the Shield Wire Scheme in Low-Income Countries: Design, Construction, and Operation*.

AGAT also informed the preparation of the recipient-executed Uganda Clean Cooking Supply Chain Extension Project, currently under implementation.

Africa Clean Cooking Energy Solutions (ACCES). To build on new opportunities for transforming the cooking sector, the World Bank launched the Africa Clean Cooking Energy Solutions (ACCES) initiative in 2012. ACCES aims to promote enterprise-based, large-scale dissemination and adoption of clean cooking solutions in Sub-Saharan Africa. In FY2016, ESMAP supported the implementation of a project component to distribute improved cookstoves in Kinshasa, Democratic Republic of Congo. In addition, it funded several reports, including a study on market-based interventions for alternative biomass cooking fuels—an advocacy toolkit for removing trade barriers; and knowledge products such as a willingness to pay and consumer acceptance assessment for Uganda, and a customizable Excel model design to generate high-level projections to inform advocacy for lowering trade barriers to clean and improved cookstoves. ACCES



is one of several regional programs supported by ESMAP's Efficient, Clean Cooking and Heating initiative (ECCH) in FY2016, which aims to coordinate efforts in clean cooking and heating across the World Bank.

COUNTRY-SPECIFIC ACTIVITIES

AFREA has been supporting country-specific activities in more than 15 countries. Below is a description of some of the country engagements:

Niger Electricity Access Expansion Project. In support of the project, ESMAP and AFD funds were used to help Niger's power sector improve the enabling environment for medium- and long-term development of the power sector by helping fill important gaps in the policy environment.¹¹

Kenya: Support to Energy Access Enhancement. AFREA support in Kenya has been instrumental in providing targeted and timely assistance to the country's access strategy, in particular: (i) last-mile grid electrification through AGAT support on on-grid access plus just-in-time consultancy; and (ii) off-grid access through Lighting Africa's technical advice for the design of the \$150 million IDA credit under preparation for delivery in FY2017. In addition, ESMAP is supporting (i) the implementation of the new Energy Bill as well as the institutional reorganization and a business plan for the new, expanded mandate of the Rural Electrification Agency; (ii) a comprehensive geospatial plan to develop a phased and least-cost grid and

off-grid based electrification plan covering a period of 10 years; and (iii) a national geothermal strategy and business plan for geothermal development.

REGION-SPECIFIC STUDIES

Reforming Power Markets in Africa. Under this activity, ESMAP financed the study *Independent Power Projects (IPPs) in Sub-Saharan Africa: Lessons from Five Key Countries*, a comprehensive review of IPPs in the region aiming to inform strategies to scale up private sector participation in Africa's power sectors. The report identifies critical areas of assistance spanning policy dialogue focused on reforms; technical assistance for planning and performance improvements at the utility level; support to project preparation, assessment and negotiation of IPPs; and traditional financing and risk mitigation. The study provides an action plan for countries to promote more effective and sustainable private participation and key insights for the World Bank to strengthen strategic engagements to help clients attract private investments.

Rural Electrification and Agriculture. In FY2016, the activity produced the report *Double Dividend: Power and Agriculture Nexus in Sub-Saharan Africa*, a first-of-its-kind landscape view of the potential to integrate countries' agriculture and rural electrification objectives. The findings aim to help develop innovative approaches to make off-grid electrification viable. Eight case studies—six actual studies conducted in Tanzania, Kenya, and Zambia, and two case studies based on simulations in Ethiopia and Mali—target policy makers by providing important lessons on the benefits and risks of large power loads, supply options, and viability.

¹¹ A detailed description of ESMAP's work in support of the Niger Electricity Access Expansion Project can be found in Chapter 3.

Making Power Affordable for Africa and Viable for Its Utilities. By distilling lessons from dozens of countries across the region, this study aims to better understand the linkages between financial sustainability of power sectors in Sub-Saharan Africa and the goal of universal access to electricity. Findings pointed out that almost no country in the region recovers the cost of supply, but one-third of African countries could do so by achieving operational efficiencies and reducing costs. A remedy prescribed for the remaining countries include increasing tariffs in ways that would make

it easier to gain public acceptance. The study also found that subsistence consumption of electricity would be affordable for the majority of the poor in many countries, but only if each household is separately and accurately metered. High initial connection costs and other barriers lead to a widespread practice of multiple connections by households. The report offers options for making electricity connection and consumption more affordable while minimizing utilities' financial losses.

BOX 10.1

INNOVATIVE APPROACH TO INCREASE ADOPTION OF CLEANER, MORE EFFICIENT COOKSTOVES ACROSS UGANDA

ESMAP pushes for innovation and cutting-edge methodologies through piloting new approaches, scaling them up, and mainstreaming them into larger programs. In **Uganda**, a country where less than 15 percent of its population use an energy efficient cookstove, a \$2.2 million ESMAP grant is helping to implement a unique approach to achieve increased adoption rates of efficient, clean cookstoves. The approach focuses on results-based commercial distribution of cookstoves through a Distribution Challenge Fund competition. The Fund provides competitive grants to encourage partnerships between manufacturers and distributors to expand the distribution networks of high-quality, efficient cookstoves to support the implementation of high impact marketing and sales campaigns. By reducing high costs and risks for manufacturers, this approach will free up manufacturers' resources to expand production and progressively make available more efficient, cleaner stoves that consumers want to use. In turn, this support will increase both the growth in demand for improved cookstoves and the strengthening of the supply chain, thereby achieving greater economies of scale.






CHAPTER 11

FOCUS ON ASIA

The Asia-Pacific region accounts for over half of the world's energy consumption and energy demand is projected to almost double by 2030. There is an urgent need to find innovative ways to generate power in a sustainable manner. Compounding the problem is widespread energy poverty across Asia, with almost 450 million people still without access to electricity. In addition, more than 2 billion people rely on traditional fuels such as firewood to meet their cooking and heating needs, which leads to premature deaths—especially among women—from respiratory diseases associated with indoor smoke inhalation as well as increased local pollution.

The **Asia Sustainable and Alternative Energy Program (ASTAE)** is a global partnership created in 1992 to help the Asia-Pacific and South Asia regions reduce energy poverty, protect the environment, and leapfrog towards a low-carbon green path. Activities focus on renewable energy, energy efficiency, and access to energy while helping countries adapt to and mitigate the impacts of climate change.

ASTAE currently provides technical assistance to 21 East Asia and Pacific (EAP) and South Asia (SAR) countries with disbursements of \$5.6 million in FY2016. ASTAE's depth of knowledge and flexible funding helps accelerate early-stage energy sector innovations, and timely support enables World Bank projects to adjust better to rapidly evolving conditions. ASTAE also shares best practices to improve institutional, policy, financial, legal, and regulatory frameworks across the region to attract more investment, especially from the private sector.



The ASTAE business plan was scheduled to close in FY2016 but has been extended to FY2017, when the multi-donor trust fund will close. In FY2016, ASTAE started 8 new country activities—4 in East Asia & Pacific, 4 in South Asia regions—totaling \$1.4 million, and 1 regional activity, all together influencing 8 World Bank projects totaling \$1.05 billion. Since the beginning of the current FY2012–17 Business Plan, ASTAE supported \$6.3 billion in World Bank lending, double the pledged amount under the original business plan.

ASTAE also paid special attention to measuring results through a Result Framework consisting of five indicators. Three indicators are related specifically to the renewable energy, energy efficiency, and access to modern energy services pillars and two indicators cross all pillars. ASTAE aims to influence World Bank loans and sets specific targets for its indicators by the end of each business plan. Table 11.1 summarizes ASTAE’s results framework and progress.

SUPPORT TO RENEWABLE ENERGY

ASTAE helps its clients scale up the use of renewables in their energy mix to slow the depletion of natural resources, limit environmental damage and rely less on fossil fuels, which are also imported resources in many Asian countries. Successful examples include:

Vietnam Renewable Energy Integration and System Efficiency and Reliability Enhancement.

The activity supported Vietnam’s National Power Transmission Corporation in refining its smart grid strategy to improve the efficiency and resilience

IN THE FOUR YEARS OF ITS BUSINESS PLAN (FY2012–17), ASTAE HAS:

- Provided technical assistance to identify, prepare, or supervise projects in 21 Asian countries that catalysed 24 World Bank Projects for a total of \$6.3 billion
- Supported the installation across 10 countries of 1,484 MW of renewable energy generating 3,200 GWh annually
- Enabled 5.3 million households in 7 countries to gain access to electricity and 2 million in 3 countries to gain clean cooking solutions

of the transmission network. A detailed investment plan was laid out to help seize potential opportunities brought by emerging technologies and relevant international experience, which was presented in the *Smart Grid to Enhance Power Transmission in Vietnam* report prepared in partnership with ESMAP. Discussions with the National Power Transmission Corporation are ongoing to include smart grid investments identified in the plan in a World Bank \$500 million Transmission Efficiency Project to improve the capacity, efficiency, and reliability of electricity transmission services in selected parts of Vietnam.

Philippines Electric Cooperatives Reform and Restructuring and Philippines Renewable Energy Policy Implementation Support. These two ASTAE grants started in FY2014 and FY2015, respectively, and led to the approval of the IBRD/CTF Philippines Renewable Energy Development (PHRED) project in FY2016, one of the first CTF guarantee projects, of which \$44 million is

TABLE 11.1


ASTAE Business Plan Result Framework, FY2012–16

DIRECT INDICATORS	UNIT	VALUE PLEDGED	VALUE ACHIEVED FY2012–15	VALUE ACHIEVED FY2016	VALUE ACHIEVED FY2012–16	PROGRESS (%)
1. Total World Bank Lending Catalyzed by ASTAE Activities						
Project and Program Lending	\$ million	3,200	5,232	1,050	6,282	194%
2. New Capacity and Increased Generation of Renewable Electricity						
Renewable Energy, Capacity	MW	1,500	1,372	112	1,484	99%
Renewable Energy, Generation	GWh/yr	3,000	2,868	344	3,212	107%
3. Electricity Savings Resulting from Efficiency Improvements						
Energy Savings, Capacity	MWe	1,000	351	25	376	38%
Energy Savings, Generation	GWh/yr	2,000	2,829	162	2,991	150%
4. Households with Access to Modern Energy Services						
Access to Electricity (new)	households	2,000,000	558,000	4,802,500	5,360,500	268%
Access to Electricity (improved)	households	1,000,000	313,000	–	313,000	31%
Improved Stoves for Heating (cooking & space)	households	5,000,000	1,195,000	800,000	1,995,000	40%
5. Avoided Greenhouse Gas Emissions						
Direct CO ₂ Avoided over 20 Years	million tons	200	379	32	411	205
6. Countries Benefiting from ASTAE Support						
Number of Countries	countries	15	21	21	21	140%

Note: *Direct* refers to values achieved, or expected to be achieved, in the course of World Bank–funded projects that benefited from ASTAE support.

expected to leverage \$500 million in private sector investments. The first grant identified the central role of electric cooperatives as leaders in network expansion and electrification and as purchasers or equity participants in local renewable energy development projects. The activity also focused on strengthening the institutional and financial capacity of electric cooperatives to help them become reliable off-takers of renewable energy and credible partners of the private sector

in the development of new projects—something that enhanced the operational readiness of the PHRED. The second grant supported the implementation of critical elements of the policy and regulatory framework for renewable energy investment. This resulted in the creation of the Renewable Energy Certificate for Electric Cooperatives that exceed their Renewable Portfolio Standard. It also supported the development of a portfolio of renewable energy projects that could be



embedded in the service territories of the electric cooperatives and provide improved system reliability and power quality. PHRED is expected to add 75MW of small-scale renewable energy and produce 344GWh annually.

Strategy to Scale-Up Renewable Energy in Pakistan. ESMAP, through ASTAE, partnered with the Government of Pakistan to assess the potential for scaling up the development of renewable energy resources, particularly solar. The activity assessed the technical potential for distributed generation in Karachi, Lahore, and rural areas outside Islamabad and identified near-term priorities for potential World Bank interventions in the sector to scale up the development of solar energy. Throughout the activity, ESMAP coordinated closely with IRENA and other donors, including on the delivery of a workshop to present the final Biomass Atlas from the associated Renewable Energy Resource Mapping activity and the results of the study. The activities in the first year of the associated Renewable Energy Resource Mapping activity fed into the strategy for this activity. The development of this strategy directly benefits the parallel work being undertaken in the renewable energy sector by GIZ and ADB. Discussions are ongoing on how the World Bank can best support Pakistan, at both the federal and provincial level, in achieving some concrete investments in solar power.

PROMOTING ENERGY EFFICIENCY

Sustainable Urban Energy and Emissions Planning: Energizing Green Growth of Da Nang City in Vietnam. Energy consumption per unit of the gross domestic product is high in most Asian coun-

tries, indicating that room for efficiency improvement is present in all sectors of the economy.

Da Nang was one of three pilot cities in the East Asia & Pacific region along with Cebu City, Philippines and Surabaya, Indonesia for the Sustainable Urban Energy and Emissions Planning (SUEEP) process, which provides a framework to help cities mobilize financing and carry out a series of investments in energy efficiency and green infrastructure. The preliminary findings from audits of these cities informed the design of the SUEEP guidebook, which provides a comprehensive framework and step-by-step guidance to help a city develop its own energy and emissions plan. With funding from ASTAE, Da Nang used SUEEP tools to analyze the city's energy and emissions profile, determine targets for reduction, and identify investment opportunities for energy efficiency projects. The results and findings of the SUEEP activities in Da Nang helped the World Bank team prepare a paper entitled *Energizing Green Cities in Southeast Asia: Application of Sustainable Urban Energy and Emissions Planning in Vietnam*, which was accepted for publication by the International Council on Large Electric Systems (CIGRE) to be shared with relevant stakeholders and decision makers, including at a biennial global knowledge sharing event organized by CIGRE in August 2016. The Da Nang city government approved two private companies—Philips Electronics Vietnam Co., Ltd and Stanley Electric Japan—to participate in the planning process of the LED street lighting project. The SUEEP activities in Da Nang generated interest in Surabaya, **Indonesia**. ESMAP is providing technical assistance to support Surabaya's efforts to increase energy efficiency and reduce greenhouse gas emissions by applying the SUEEP framework and developing a Green Growth Plan with a roadmap of priority



projects and a LED Street Lighting Retrofit Project Implementation Plan for the city.

EXPANDING ACCESS TO MODERN ENERGY

Access to modern energy can significantly improve people's quality of life, providing them with light, heat, and power for electrical appliances in a much more efficient, inexpensive, and less polluting way. Over the past decades, several Asian countries have made dramatic progress in increasing electricity access, but others still lag behind. Additionally, most countries in the region have been slow to devise strategies to transition households to modern fuels or to improve the efficiency and cleanliness of traditional fuels.

Using Satellite Imagery to Monitor Progress of Rural Electrification. Building on remote sensing tools and geographical information systems, the ASTAE work aims to validate a new satellite-based approach for monitoring the progress of rural electrification over time and develop a corresponding toolkit. ASTAE funds helped validate the proof-of-concept in **Vietnam** and were also used to develop the monitoring approach using daily satellite imagery in **India**. The satellite-based monitoring approach has been successfully established and the results have been shared widely with stakeholders and institutions involved in rural electrification programs. The innovative approach has attracted strong interest from the development community and practitioners across the world. The open source visualization platform has also proved a great success; a blog post promoting the platform was viewed over 6,000 times in five languages, becoming one of the top three most popular blog posts on the World

Bank Energy Blog so far this year. The Government of India has agreed to cooperate with the World Bank to develop a mobile application, building on the platform to further inform its citizens about progress of rural electrification in India.

Support to 24x7 Power for All Program in India:

The states of Andhra Pradesh & Rajasthan. India has the largest energy access deficit of any single country. A recent study estimates that, of the almost 300 million people who are without access to electricity, over 200 million could legally connect to the electricity grid, but choose not to because electricity supply is so unreliable. Approved in February 2016, projects under the Support to 24x7 Power for All Program in India will support the operational and financial turnaround of the power distribution utilities in Rajasthan, one of India's largest states, and focus on strengthening the power distribution system in Andhra Pradesh by helping utilities to deploy new smart grid technologies and bolster their monitoring and evaluation capacity. In Rajasthan, a diagnostic study was completed covering aspects of feeder metering, consumer indexing, energy audits, and IT systems and commercial processes, along with assistance for improving the action plan for turnaround and implementation support. ASTAE funding supported the IT strategy and implementation roadmap for improving commercial processes, and enabling deployment of new technologies for improving service delivery in the power distribution utilities of Andhra Pradesh. These technologies include systems for remote monitoring and control to improve reliability of supply to consumers, and smart meters that increase transparency in billing and also promote energy efficiency.

EAST ASIA PACIFIC CLEAN STOVE INITIATIVE

In East Asia and the Pacific region, about 1 billion people—nearly half of all households in the region—depend on solid fuels for cooking and heating, and, according to the World Health Organization, more than 1.8 million people die prematurely each year from exposure to household air pollution linked to solid fuel use. Launched in 2012, the East Asia and Pacific Clean Stove Initiative (CSI) focuses on scaling up access to modern cooking and heating in the region, particularly for poor households in rural areas. Funded by Australian Aid (AusAid), ESMAP, and ASTAE, the program has a three-pronged implementation strategy: (i) establishing an enabling policy and regulatory environment for scaled up access to advanced stoves, while strengthening institutional capacity; (ii) supporting supply-side market and business development; and (iii) stimulating demand for clean and efficient stoves. The initiative adopts a phased approach focused on national implementation, knowledge sharing across countries and regions, and innovation. It includes four country programs and one cross-cutting regional program.

China. The China CSI completed successful results-based financing (RBF) pilots in two villages, where 480 stoves were sold. In Hebei province, where the government has set a target for distributing 6 million clean stoves by 2017, the CSI supported the design and preparation of a clean stove component that incorporated the lessons learned from the RBF pilot, under the World Bank \$500 million Hebei Air Pollution Prevention Program-for-Results Project approved in June 2016.

Indonesia. The initiative set up an RBF fund of \$190,000, managed by Bank Rakyat Indonesia, and launched two sets of open calls for stove technologies and market aggregators—legal entities such as stove producers, wholesalers, and retailers willing to take investment risks. More than 30 stove technologies were tested, 14 technologies (half international and half national) became eligible for the pilot, and 10 market aggregators signed agreements for the RBF incentives. About 6,000 clean stoves were on the market and verified for RBF incentives. Based on lessons learned from this work, a national clean cookstove program is being designed to scale up impact.

Lao PDR. Building on initial work by AusAID, ESMAP and ASTAE worked at the nexus of health, gender, and energy to support the Laos CSI, which is helping to increase access to modern cooking and heating through RBF approaches. The project helped to develop the first national clean cookstove standards, to pilot an innovative health impact RBF based on quantification of health benefits as averted disability-adjusted life years (ADALYs); and to quantify gender benefits primarily as time savings to women who could spend more time with their families or resting.

Mongolia. The Mongolia CSI supports the RBF approach under the ongoing stove-switching program of the Ulaanbaatar Clean Air Project, which has already disseminated 36,533 low-emission heating stoves, covering more than four-fifths of the potential household market. As a result, air pollution has dropped considerably in the town's most-polluted, high-density areas. A national strategy that aims to lower subsidies, diversify stove models, and advocate for avoidance of polluting stoves has been implemented.

Regional. The CSI regional program held two regional forums and various South-South knowledge exchange events, established a virtual forum, and generated numerous knowledge products.

BOX 11.2

IMPACT OF CLIMATE CHANGE ON WATER IN SOUTH ASIA

As the World Bank accelerates its investments in both the water and energy sectors in South Asia, there is increasing need to better understand the impact of climate risks on hydropower, dams, and water management. Since 2013, IDA requires that all World Bank operations be screened for climate change and disaster risks and integrate resilience measures, if needed. ASTAE-funded work assessed various scientific methods of screening climate change and disaster risks and of integrating appropriate resilience measures in water, hydropower, and dams projects and helped to build capacity of selected agencies in the South Asia region. Teams from several sectors across the World Bank collaborated to test the Climate Change Decision Tree method in Nepal, which was used to incorporate resilience into a hydropower project.

BOX 11.3

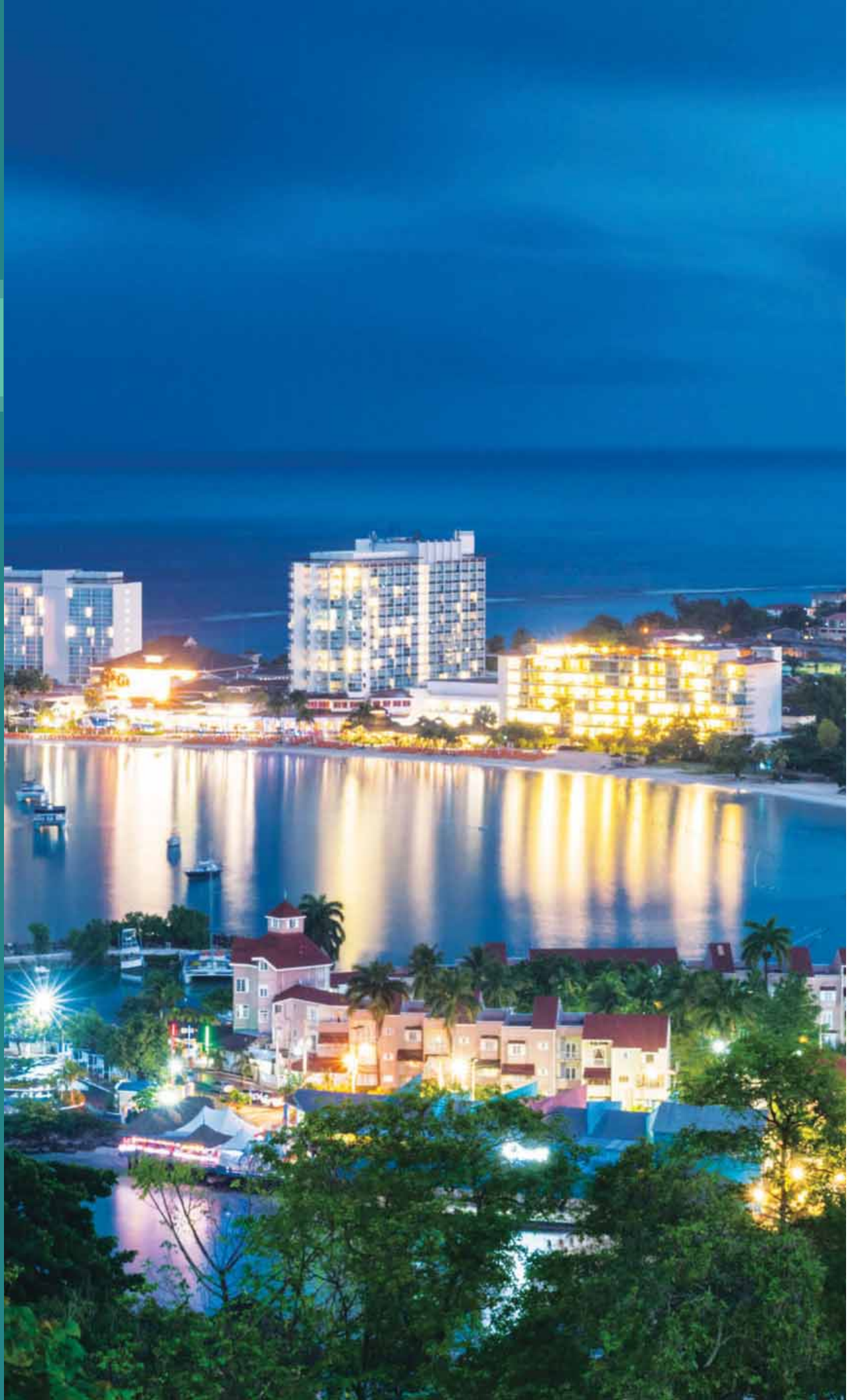
RENEWABLE ENERGY RESOURCE MAPPING AND ASTAE

In support of ESMAP's global initiative on Renewable Energy Resource Mapping (Chapter 6), ASTAE has provided parallel funding to three activities where there was strong demand.

Maldives. Maldives's island geography is uniquely suited for solar installations for distributed generation, while wind resources are more promising in the northern part of the archipelago. ASTAE's support in mapping both solar and wind resources has produced preliminary outputs, including a mesoscale wind modeling report and a solar modeling report. In December 2015, solar measurement stations were installed at four sites to collect high quality resource data for model validation, with wind measurement scheduled to start during FY2017. When two years of data have been collected, the initial models will be re-run and validated, and final solar and wind maps will be produced. The work is carried out in parallel with a World Bank project on rooftop solar energy, and there are now preliminary discussions over development of wind power on some northern islands.

Pakistan. ASTAE funding for this activity is supporting the wind mapping component, including the installation of 12 wind masts, which were installed over the summer of 2016. Pakistan has considerable wind resource potential, but so far only two zones in the south of the country are well understood and validated. The objective of the ASTAE- and ESMAP-funded wind mapping component is to gather high quality measurement data from sites across the country, and use this to generate a fully validated national wind map that will support development of new areas.

Papua New Guinea. At the request of the government, ESMAP and ASTAE are funding an activity that will increase the viability of wind energy generation in the country and support future investment. The activity has already resulted in a preliminary wind map, showing potentially viable wind resources near the two main cities of Port Moresby and Lae. The next phase will involve the installation of wind measuring equipment in a few key sites in the country, generating data for validation of the national wind map but also for potential use by commercial developers in site investigation studies. Once two years of measurement data are available, the final phase of the project will involve remodeling and validation of the wind resource model, leading to production of a final wind atlas.






CHAPTER 12

FOCUS ON SMALL ISLAND DEVELOPING STATES

With growing threats from climate change, small island developing states (SIDS) are increasingly susceptible to extreme weather such as tropical cyclones and monsoons. This, combined with SIDS's unique socioeconomic situation—insufficient resources, small populations, remoteness, susceptibility to natural disasters and dependence on international trade and tourism—makes SIDS some of the most vulnerable areas in the world. SIDS also have to cope with high transportation, communication, and infrastructure costs. They are often highly dependent on imported fuel to meet their energy needs, including electricity generation. As a result many SIDS experience high and often rising costs for electricity, supply interruptions, and vulnerability to oil price shocks. Many SIDS are now looking to transition to a more sustainable energy path, where improved energy efficiency and renewable energy play a crucial role.

To help SIDS tackle the challenges associated with their unique environments, ESMAP established the **SIDS DOCK Support Program** in 2011. The program provides grants to SIDS focused on strengthening the enabling environment to remove barriers to renewable energy and energy efficiency




policy reforms, and on the implementation of renewable and energy efficiency projects that have potential for scale up.

In FY2016, ESMAP supported nine projects for SIDS in the Africa, Caribbean, and Pacific regions.

Cabo Verde | Solar PV for Healthcare. To help the country develop distributed solar energy systems, the ESMAP-funded project focuses on the installation of solar PV systems for at least three hospitals. The SIDS DOCK grant complements an ongoing World Bank energy operation that is supporting generation reinforcement in Santiago and São Vicente. The key expected outcome is a successful demonstration of PV for health care facilities whereby hospitals will be required to cofinance part of the cost of equipment, which enables scale-up through public-private partnerships in the islands. The project was approved in January 2016 and is under implementation, with the bidding process for the installation of the PV solar equipment to be launched before the end of FY2017.

Tuvalu | Energy Sector Development Project. In 2015, the World Bank approved a \$7 million IDA project to enhance Tuvalu's energy security by reducing its dependence on imported fuel for power generation and improving the efficiency and sustainability of its electricity systems. ESMAP is financing the renewable energy component of the project with a \$2.1 million SIDS DOCK grant. This funding is helping the state-owned Tuvalu Electricity Corporation that manages on-grid and off-grid systems with the installation of renewable energy technology. The terms of reference to procure prepaid meters was recently completed and bidding documents are



IN THREE YEARS, ESMAP HAS:

- Supported technical assistance activities in 19 SIDS across the Caribbean, Pacific, and Africa regions
- Provided more than \$10 million to support SIDS transition to low-emission, climate-resilient development
- Helped mobilize additional investments of \$29 million in São Tomé and Príncipe and laid the foundation for significant investments in for geothermal development in the Caribbean

under review. An international procurement adviser has been hired to assist Tuvalu Electricity Corporation in implementation. With funding from ASTAE, the project team engaged a firm to help define technical specifications of the equipment for renewable energy and energy efficiency investments.

Vanuatu | Energy Sector Development. ESMAP's SIDS DOCK is supporting the development and implementation of a National Energy Road Map to coordinate investments among the government, private sector, and development partners. In FY2016, Vanuatu's Department of Energy revised the road map, which was later approved by the Council of Ministers. In April 2016, the government also drafted a number of key energy regulations and legislation, including geothermal drilling regulations to facilitate investment in geothermal energy, instruments for the safe disposal of toxic materials from renewable energy installations, and national electricity wiring standards to enable safe installation of renewable energy systems. The Department of Energy has now

procured a firm to conduct a mini-hydropower resource mapping assessment to determine hydropower potential for the development of micro and mini grids in rural areas. In May 2016, ESMAP supported the participation of two Department of Energy officials in a study tour in Hawaii to learn about the regulatory and policy side of renewable deployment, as well as the type of storage technologies suitable for island environments.

Pacific Island Countries | Sustainable Energy Industry Development. Pacific Island countries have some of the world’s highest electricity prices, and each country spends as much as 25 percent of its gross domestic product to import petroleum in order to provide essential services. The \$5.6 million Regional Sustainable Energy Industry Development Project approved in September 2015 is helping them to access significantly stronger data about renewable energy options and integrate various renewable energy sources into existing power systems. SIDS DOCK, SREP, the Global Facility for Disaster Reduction and Recovery, and ESMAP have provided a \$3.47 million grant under the project to finance access to data, and strengthen the capacity of power utilities in the Pacific Island Countries and Papua New Guinea to manage renewable energy technologies and incorporate long-term disaster risk planning. One country has completed a procurement package and several other countries are drafting terms of reference. The Pacific Power Association, the project’s implementing agency, has hired a part-time international procurement adviser and a full-time project implementation officer to support its executive director with day-to-day implementation, monitoring, and reporting.

Eastern Caribbean | Energy Regulatory Agency Project. To harmonize policies, regulations, and guidelines for energy sector development through a regional approach in the Eastern Caribbean, a \$5.6 million World Bank project is supporting the creation of a legal framework and building capacity for the Eastern Caribbean Energy Regulatory Agency (ECERA). Through this project, both St. Lucia and Grenada have approved legislation for the establishment and implementation of national electricity sector regulators—the National Utility Regulatory Commission in St. Lucia and the Public Utilities Regulatory Commission in Grenada. A SIDS DOCK grant from ESMAP provided critical training and technical assistance that led to the establishment of these regulatory bodies and supported the preparation of standardized energy laws and regulations that form part of the implementation framework for regulation in the Eastern Caribbean. Funding also helped the countries of the Organization of Eastern Caribbean States prepare and develop national grid integration studies and grid codes.

Dominica | Geothermal Project. To help realize the potential for a geothermal power plant in Dominica’s Wotten Waven/Laudat geothermal field, SIDS DOCK funded a gap analysis that identified key areas to address in order to meet international standards for development. Subsequent follow-up on the analysis in terms of guidance on drilling, environmental standards and safeguards, advisory support on financing and pricing, and help with funding mobilization (in coordination with the CTF, DFID and GEF), contributed to the successful development of the steam field for the domestic power plant, confirmed the viability of



the operation, and initiated the upgrade of the safeguards work. The Government also formally requested the World Bank's financial assistance to complete the project. Next steps include establishing the project development company and the offtaker utility company that will purchase the power.

St. Lucia | Geothermal Project. To help St. Lucia tap into its geothermal power generation potential, the project is assisting the government in identifying areas for drilling, preparing a resource exploration program, and engaging with a qualified developer. The World Bank is working in collaboration with the Government of New Zealand and the Clinton Climate Initiative on the project, with funding from the SIDS DOCK Support Program, GEF, and DFID. In FY2016, the government finalized surface exploration studies and related activities that indicate a potentially exploitable geothermal resource of up to 70MW, hired an internationally renowned geothermal expert, and advanced negotiations with a qualified developer. The project is now assisting in the preparation of a pre-feasibility study and an environmental and social impact assessment that will allow the government to make informed investment decisions and raise concessional financing for future exploratory drilling.

Fiji | Geothermal Project. ESMAP is providing technical assistance to the Government of Fiji to inform its approach to the development of geothermal power. In support of Fiji's national energy policy objectives and the implementation of the draft Strategic Action Plan, ESMAP support has allowed for the preparation of a pre-feasibility study on geothermal power and a roadmap for

the development of geothermal resources. If successful, there is potential for the nation to realize the majority of electricity generation through renewable resources and serve as a model for the development of geothermal resources in other Pacific Island Countries.

Grenada/St. Lucia/St. Vincent and the Grenadines | Regional Solar PV Scale-Up Project. In December 2015, the World Bank approved the Regional Solar PV Scale-Up Project funded by ESMAP with a \$2 million SIDS DOCK Support Program grant. It will support at least one commercial rooftop PV system on each island to assess how solar PV can be deployed on public buildings that are connected to the national grids. The sites selected for installation include hospitals, schools, and a national prison. The pilot project will provide technical expertise to support implementation and strengthen local technical capacity through on-the-job training and knowledge transfer. Once the pilots are completed, the case studies will be compiled in a report to set the path for replication of successful business models of commercial-scale solar PV in the region. The project will include a focus on offtake agreements between the buyer and seller on future production, such as power purchase agreements (PPAs) and net billing arrangements, as well as business development options, including PV leasing models, energy service companies (ESCOs), and PV retail businesses.

São Tomé and Príncipe | Power Sector Efficiency Improvement. SIDS DOCK financing from ESMAP supported pre-feasibility studies to rehabilitate a key hydropower plant in the island of São Tomé, as well as recommend measures to reduce the



transmission and distribution losses in the electricity network of both islands. The studies influenced the São Tomé and Príncipe Power Sector Recovery Project which was approved by the World Bank to finance and implement the recommendations of the studies. The \$29 million project combined a \$16 million IDA grant and leveraged \$13 million of cofinancing from the European Investment Bank to increase renewable energy generation through an upgrade of the country's largest hydropower plant, as well as improve the reliability of the electricity supply through distribution network rehabilitation and technical assistance. In addition to essential infrastructure investments, the project also incorporates consumer feedback mechanisms to better target interventions and monitor utility performance.

Caribbean | Caribbean Centre for Renewable Energy and Energy Efficiency. ESMAP provided a \$600,000 SIDS DOCK grant to support the regional and national efforts to deploy renewable energy and energy efficiency systems in the Caribbean through the establishment of the Caribbean Sustainable Energy Roadmap and Strategy (C-SERMS) Platform. The SIDS DOCK grant will help enable the C-SERMS Platform to assist CARICOM member states in meeting their individual renewable energy and energy efficiency targets through activities organized around five thematic areas: technical assistance; capacity building and research; information and knowledge management; policy and regulations; and financing. Complementary funding for the C-SERMS Platform has been provided by the Austrian Federal Ministry of Finance and GIZ.






CHAPTER 13



THE WAY FORWARD: HELPING COUNTRIES THROUGH THEIR ENERGY TRANSFORMATION

The international community is mobilizing to tackle the triple challenge of increasing energy access, increasing the share of renewables in the energy mix, and increasing the rate of improvement in energy efficiency, while mitigating and adapting to climate change. In this context, ESMAP has an opportunity to play a significant role in shaping the energy transition and this is reflected in its new Business Plan for 2017–20. Drawing from lessons learned in implementing the previous three-year business plan, the new plan outlines ESMAP’s strategic priorities and resource requirements for FY2017–20. It also draws on input from ESMAP’s Consultative Group and advice from the Technical Advisory Group, as well as recommendations



of the program's 2015 External Evaluation and lessons learned from its annual Portfolio Review.

THE NEW BUSINESS PLAN

In support of Sustainable Development Goal 7 (SDG7), the Paris Agreement, the World Bank's Climate Change Action Plan as well as the World Bank's twin goals of eliminating extreme poverty and boosting shared prosperity, ESMAP's work program for FY2017–20 is shaped by the need to: (i) ensure universal access to modern energy services in low- and middle-income countries; (ii) decarbonize the energy sector in line with global climate change commitments; and (iii) ensure energy security, reliability, and affordability.

The Business Plan capitalizes on ESMAP's comparative advantage stemming from its unique position within the World Bank, which enables it to draw on global expertise from across the organization, and to influence policy advice and lending. Going forward, ESMAP will scale up support to areas where the World Bank has the ability to catalyze transformational change, for example, through:

- Its capacity to leverage public and private sector financing through country operations
- Its global presence in client countries and widespread engagement in other relevant sectors such as urban, water, transport, macroeconomic and fiscal management, poverty, social protection, environment, and health

- Its involvement in high-level policy dialogue with governments, in many cases, as the leading development partner convening other stakeholders in the energy sector

TRANSFORMATION THROUGH TARGETED INTERVENTIONS

ESMAP's work program for FY2017–20 is organized around three thematic areas corresponding to the three SDG7 targets on *energy access, renewable energy, and energy efficiency*. Each thematic area comprises specific components to enable ESMAP to respond quickly to client needs. Three cross-cutting areas aim to address broader sectoral issues. These relate to energy subsidy reforms; energy sector governance, markets, and planning; and providing knowledge as a global public good through the SE4All Knowledge Hub. Aligned with the strategy of the World Bank and the ESMAP donors, gender considerations are mainstreamed across the entire work program.

THEMATIC AREAS

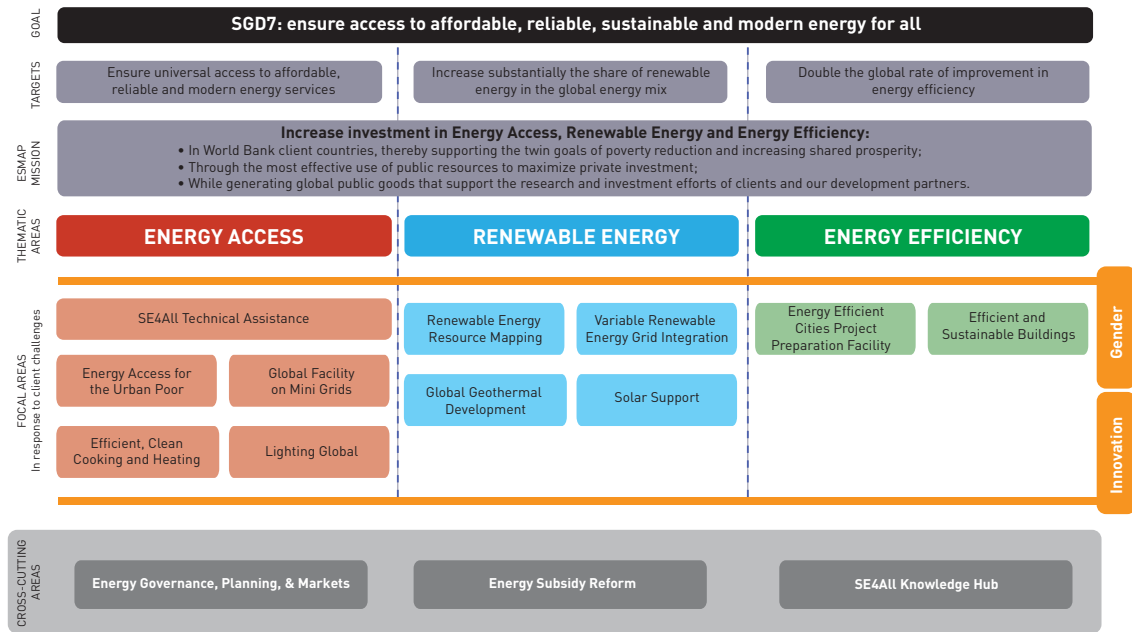
Energy Access

ESMAP will concentrate on areas where a combination of knowledge generation and operational support can accelerate the pace of progress in countries and communities that would otherwise be left behind. These include:

- Supporting low-income countries to improve their enabling environments and capacity to implement large-scale, grid-based electrification efforts through more programmatic,

FIGURE 13.1

Theory of Change Diagram



sector-wide investments and geospatial-based, least-cost planning

- Leveraging the recent surge in private sector interest in off-grid solar and mini grid electrification to drive up electricity access rates in rural areas
- Demonstrating and documenting solutions for reaching the urban poor, particularly in slums and informal settlements that often require targeted, innovative approaches
- Initiating a transformation in the cooking sector by monetizing co-benefits in health, gender, and climate change; mobilizing public and private sector resources; and driving the existing cooking stoves and fuels markets towards higher standards

Renewable Energy

ESMAP has identified four areas where World Bank engagement will help spur increased investment in renewable energy and where ESMAP has the potential to influence policy and lending. These are:

- Renewable resource assessment and mapping, which can shape policy and investment in countries considering renewable energy options while helping more advanced countries to open up new areas for development
- Support to solar power projects to help countries structure initial programs and develop strategies for large-scale deployment

BOX 13.1

SUPPORTING COUNTRY NDCS AND THE WORLD BANK CLIMATE ACTION PLAN

At the most recent UNFCCC Conference of the Parties (COP21) in Paris, 140 World Bank client countries committed to implement their Nationally Determined Contributions (NDCs) as part of an agreement to limit global warming to less than 2°C by 2030. At the same time, public and private actors have renewed their pledges to increase climate change investments, enhance carbon pricing, and end wasteful energy subsidies.

As a response to this unprecedented drive, the World Bank put forth its Climate Change Action Plan, which aims to urgently help developing countries deliver on their plans through transition to renewable energy, decrease in high-carbon energy sources, and development of green transport systems and sustainable cities. The plan reaffirms the World Bank's commitment to increase the climate-related share of its portfolio from 21 to 28 percent by 2020 in response to client demand, with total financing (including leveraged cofinancing) of potentially \$29 billion per year by 2020.

The agreement reached in Paris sets the foundation for a global transformation to a low carbon, sustainable future. As it calls for global peaking of greenhouse gases as soon as possible, followed by rapid reductions leading to net zero emissions after 2050, the energy sector's role to global action is crucial. If country pledges are to be implemented, financial resources will need to be mobilized at a collective level of \$100 billion per year.

ESMAP's new Business Plan for FY2017–20 supports COP21's call to action and the World Bank's Climate Change Action Plan. Around half of all NDCs include explicit energy-focused targets and place emphasis on increasing renewables and energy efficiency. They also call for drastically reducing power sector emissions growth while satisfying an increasing demand, mostly coming from developing countries. In addition, NDCs highlight targets and actions in several energy-related sectors such as cities, clean cooking, energy efficient and green buildings, urban transport, waste management, water and wastewater—all related to ESMAP's line of work.

ESMAP will expand its support to this agenda through its three thematic areas and its cross-cutting activities.

- Integration of variable renewable energy sources through power system planning and grid improvements
- To continue to mitigate the risks and costs of exploration drilling and accelerate investments in geothermal development

Energy Efficiency

ESMAP will continue to target energy use in cities. A special area of emphasis in the new business plan is the buildings sector, which is responsible for more than 50 percent of global energy consumption (IEA 2015) and where projected business-as-usual growth could lock in

inefficient, polluting, and expensive development that will further strain many fragile energy supply systems. Specifically, ESMAP's two initiatives under the Energy Efficiency Thematic Area are:

- Energy Efficient Cities Project Preparation Facility will focus on municipal services, such as public lighting, transport, water and wastewater, solid waste, power and district energy, as well as the relationship between cities and industries within their borders, which in many cases accounts for the largest share of the city's energy consumption.
- Efficient and Sustainable Buildings initiative will support the integration of energy efficiency with renewable energy and other sustainability aspects in buildings in client countries, including how buildings are constructed, how they are retrofitted, how they use energy, and where they are located.

CROSS-CUTTING AREAS

Energy, Governance, Planning and Markets

ESMAP will support effective energy sector policies and institutions through annual block grants to World Bank regional energy units for energy sector governance, planning, and markets. The support will be demand driven and flexible, with the indicative areas of focus identified in consultation with the regions as follows:


- Power Sector Reform
 - ∞ Technical assistance to government bodies, regulators, and system operators on effective institutional/governance structures for greater market efficiency,

private sector participation, and technological innovation

- ∞ Advice on regulatory incentives for expanded energy access
- ∞ Advice on cutting-edge options for efficient and competitive market design
- ∞ Advice on market structures and pricing conducive to VRE integration
- Power System Planning, including support to programs/projects involving transfer of tools to clients and associated training
- Regional Integration of Infrastructure, including technical assistance to power trade institutions

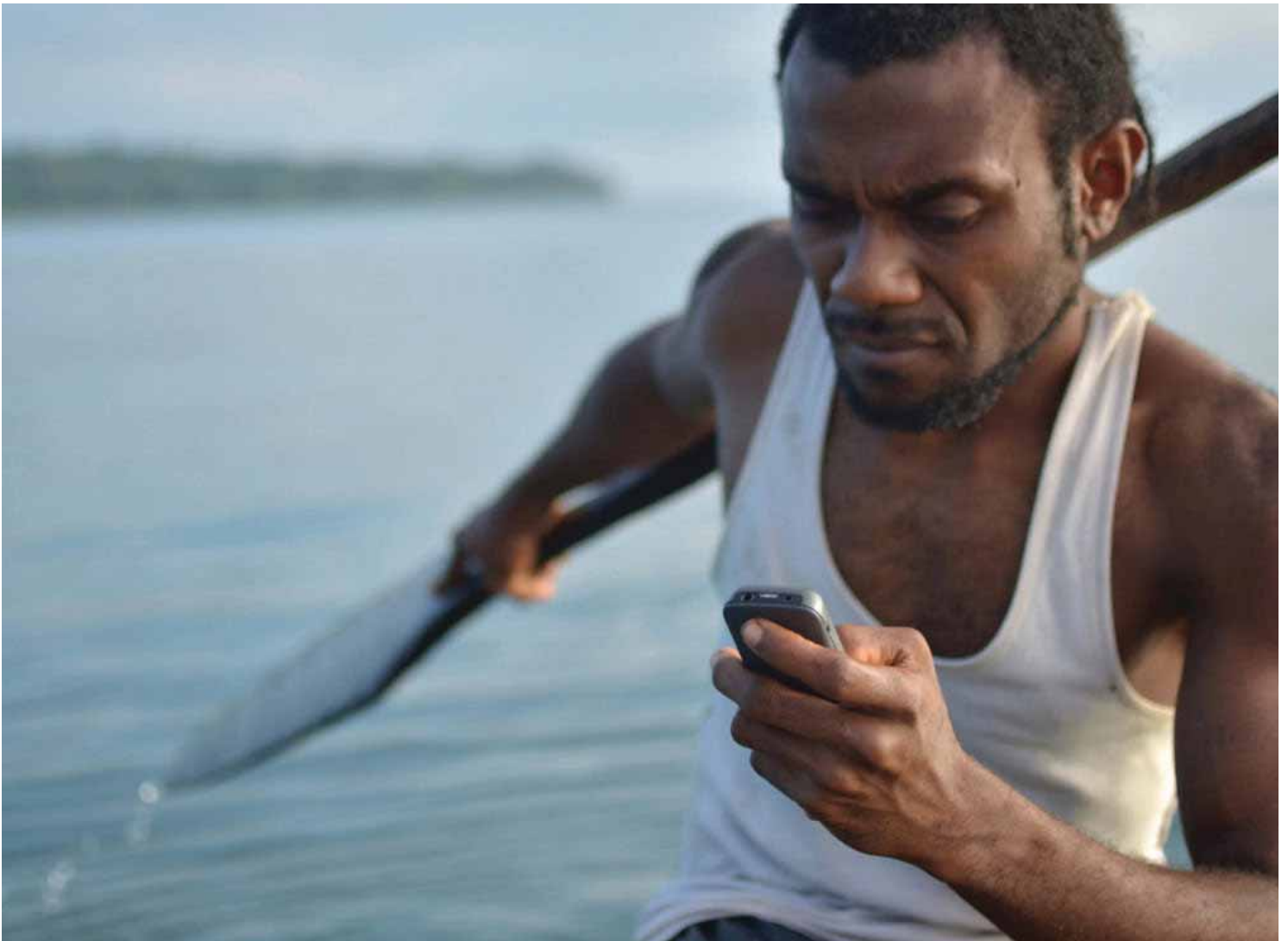
Energy Subsidy Reform

The \$20 million, multiyear Energy Subsidy Reform and Delivery Technical Assistance Facility will continue to provide comprehensive technical assistance to countries considering or implementing energy subsidy reforms. While the facility remains in ESMAP, it is now co-led by the World Bank Macroeconomics and Fiscal Management and Energy and Extractives Global Practices in recognition of the important fiscal impetus behind sustainable subsidy reform and the need for a multi-sectoral approach in addressing the issue. A diagnostic framework for quantifying and analyzing energy subsidies and their impacts will be made available as well as methodological guidance for the assessments and activities that underpin implementation of subsidy reform. Key areas of emphasis for the facility will continue to be: the political economy of pricing reforms; analysis of the poverty, social, fiscal, macroeconomic, and climate change aspects of subsidy reform; design of pricing and price adjustment frameworks; support for policy dialogue, stakeholder consultations,



and communication, including on the negative impacts of subsidies and the need to reduce them; development of transition plans; and design of specific solutions to mitigate the adverse impacts of reform on poor and vulnerable populations. Engagements at the country and regional levels will be demand driven and linked with

World Bank lending operations to the extent possible. As appropriate, they will be conducted through multi-sectoral World Bank teams composed of experts in energy pricing and reforms, fiscal policy, poverty reduction, social protection, climate change, social development, and communications.



SE4All Knowledge Hub

ESMAP will continue to develop and refine the SE4All Knowledge Hub products, providing critical information about progress towards global sustainable energy goals and SDG7.

The Global Tracking Framework (GTF) will move from a biennial to annual publication schedule to synchronize with the reporting period for SDG7. Also, starting in 2017, the GTF suite of reports will include five stand-alone regional publications that will go into detail on the key drivers and challenges facing sustainable energy progress in different geographical regions. These regional publications will be developed in collaboration with the United Nations Regional Commissions.

ESMAP will implement the Multi-Tier Framework (MTF) methodology to characterize energy access by the amount and quality of electricity or off-grid services used at a household level, publishing 20 to 30 Country Energy Access Diagnostic Reports that will contain detailed analysis of key indicators of energy access services by country. ESMAP will also seek to incorporate a condensed version of the MTF survey in the regular National Household Surveys carried out by the National

Statistical Offices and increase the data collection capabilities of the National Statistical Offices.

The Readiness for Investment in Sustainable Energy (RISE) will continue to evaluate the enabling environment for sustainable energy, with new data on the legal and policy frameworks in 100+ collected and scored every two years. Indicators will be revised to ensure they continue to represent best practices as technologies and markets mature, and future reports will include time series data to highlight the evolution of policy support globally and by country. The RISE website will be updated periodically to serve as an effective, one-stop shop for information on energy sector laws, regulations, structure, and institutions in each country covered.

Periodic State of Energy Access Reports (SEAR) will provide context and qualitative detail to complement the more data-driven GTF, MTF, and RISE. SEAR will include an initial “synthesis report” that highlights trends, key energy access challenges and drivers, and best practices in financial and delivery models, as well as impact evaluations and case studies on relevant public and private access interventions.





CHAPTER 14



FINANCIAL REVIEW

The FY2016 figures in this chapter detail financial information for the three multi-donor trust funds (MDTFs) that are under ESMAP's management and administration: ESMAP, ASTAE, and SIDS DOCK. This is the third year that financial figures for all three MDTFs are being reported side-by-side in a joint annual report.

CONTRIBUTIONS

In FY2016, ESMAP received a total of \$31 million from 9 donors, including the World Bank. ASTAE and SIDS DOCK did not receive any contributions in FY2016. Table 14.1 shows the receipts from individual donors for the three MDTFs for FY2016, as well as cumulative receipts since FY2010.

TABLE 14.1

Overview of Donor Contributions to ESMAP, ASTAE, and SIDS DOCK MDTFs, FY2010–16 (\$, thousands)

Country	FY2016 Paid In Contribution			Cumulative Paid In FY2010–16			Total Receipts	% Cumulative
	ESMAP	ASTAE	SIDS DOCK	ESMAP	ASTAE	SIDS DOCK	FY2010–16	
Australia	1,154.40			8,729.14			8,729.14	4.1%
Austria	547.80			6,144.96			6,144.96	2.9%
Denmark*				31,961.77		7,093.12	39,054.88	18.3%
Finland				1,527.54			1,527.54	0.7%
France				1,967.14			1,967.14	0.9%
Germany				7,871.20			7,871.20	3.7%
Iceland	300.00			2,106.13			2,106.13	1.0%
Japan						9,000.00	9,000.00	4.2%
Lithuania				97.79			97.79	0.0%
Netherlands	12,699.23			37,899.23	12,000.00		49,899.23	23.4%
Norway	3,996.76			15,884.20			15,884.20	7.5%
Sweden	4,061.86			8,627.20	5,913.75		14,540.95	6.8%
Switzerland	4,000.00			4,000.00			4,000.00	1.9%
United Kingdom	3,733.99			43,179.03	6,324.75		49,503.78	23.2%
World Bank	450.00			2,676.84			2,676.84	1.3%
Total	30,944.03	.00	.00	172,672.16	24,238.50	16,093.12	213,003.77	100%

*Denmark's contribution includes \$3.26 million provided by the European Commission.



DISBURSEMENTS

ESMAP disbursed \$36 million, in FY2016—an increase of 38 percent from the year before (\$26 million). ASTAE disbursements for FY2016 are at \$5.5 million, on a slight upwards trend compared to FY2015, while SIDS DOCK has almost doubled its disbursements this year. Table 14.2 shows disbursements for all three MDTFs for FY2014–16. Projects costs are separated into (i) disbursements by region and for global programs and (ii) disbursements for program management, administration, and other centralized functions.

BREAKDOWN BY REGION AND PROGRAM AREA

Table 14.3 shows FY2016 spending by region for all three MDTFs, as well as by program area for ESMAP. SE4All comprised the largest portion of ESMAP’s portfolio followed by AFREA, the Renewable Energy Resource Mapping initiative, and the Cities Energy Efficiency Initiative (CEETI).

TABLE 14.2

ESMAP, ASTAE, and SIDS DOCK Disbursements, FY2014–16 (\$, thousands)

	FY14			FY15			FY16			
	ESMAP	ASTAE	SIDS	ESMAP	ASTAE	SIDS	ESMAP	ASTAE	SIDS	
Project Cost	\$19,852.74	\$5,030.18	\$765.75	\$25,082.21	\$4,858.66	\$1,040.88	\$33,974.83	\$5,471.33	\$1,968.60	95%
Africa	7,681.48		179.77	8,972.78		539.23	11,973.99		52.18	
East Asia	2,132.92	3,847.86	74.88	2,680.42	3,801.59	36.39	3,052.50	3,289.12	419.04	
Europe & Central Asia	1,419.49			2,224.79			3,265.22			
Latin America & Caribbean	2,153.29		379.91	2,110.19		465.26	2,231.31		1,497.37	
Middle East & North Africa	448.13			413.85			2,100.21			
South Asia	878.73	965.59		2,834.55	1,014.09		2,191.04	2,182.22		
Global Program	5,138.70	216.73	131.19	5,845.62	42.98		9,160.56			
Program Management & Sustaining	\$1,910.43	\$77.55	\$82.31	\$1,708.448	\$58.181	\$165.298	\$1,991.326	\$104.053	\$66.685	5%
Program Management	784.69	68.19	82.31	736.29	58.18	89.57	829.12	87.30	55.63	
Governance (CG, TAG)	98.58	9.36		85.37			58.17			
Resource Management/Trust Fund Administration	217.42			151.51			12.86			
Portfolio Management (Monitoring and Evaluation)	213.46			189.51			641.44	16.76		
Knowledge Forums	116.65			97.95		75.72			11.05	
Communication and Outreach (publications, website, and other dissemination)	479.62			447.81			449.75			
Total	\$21,763.17	\$5,107.73	\$848.06	\$26,790.65	\$4,916.84	\$1,206.18	\$35,966.15	\$5,575.39	\$2,035.28	100%
<i>Of which:</i>										
Funded by Donors	21,182.40	5,107.73	848.06	26,572.43	4,916.84	1,206.18	35,516.15	5,575.39	2,035.28	
Funded from World Bank Budget	344.62			218.22			450.00			
Funded from Fee Income	236.15									

TABLE 14.3

ESMAP, ASTAE, and SIDS DOCK Disbursements, by Program Area, FY2016 (\$, thousands)

	ESMAP													TOTAL DISBURSEMENT				
	Annual Block Grants	Transport	Water	(SE/ALL)	ECCH	Mini Grids	VRE	GGDP	RBF	RE Mapping	Subsidy	AFREA	CEETI Programs*	Other Programs*	ESMAP	ASTAE	SIDS	TOTAL
Africa	693.827	29.041	159.855	3,236.993		40.887	3.193	152.548		2,203.220	33.251	5,421.176			11,973.990		52.180	12,026.170
East Asia	998.843	43.841	29.884	231.392	39.267			195.111	21.018	666.135	356.161		315.694	155.159	3,052.505	3,289.118	419.045	6,760.668
Europe & Central Asia	1,103.881	42.126	31.476		29.984						1,090.185		967.588		3,265.218			3,265.218
Latin America & Caribbean	478.081	52.300	198.786	57.419	10.335			134.768			343.384		742.091	69.127	2,231.308		1,497.371	3,728.679
Middle East & North Africa	1,412.269	59.765									451.927		176.244		2,100.205			2,100.205
South Asia	422.330	97.294		150.790				64.014		1,456.618					2,191.045	2,182.215		4,373.260
Global Programs		142.397		2,520.561	646.840	405.700	169.271	714.018	7.308	251.283	481.566	56.872	1,358.599	2,406.139	9,160.555			9,160.555
Program Management & Sustaining														1,991.326	1,991.326	104.053	66.685	2,162.064
Total	5,107.210	466.764	418.001	6,197.156	726.427	446.588	371.247	1,405.042	28.326	4,577.255	2,562.125	5,478.048	3,560.214	4,621.750	35,966.152	5,575.386	2,035.281	43,576.819

*Other Programs include programs implemented by ESMAP unit and other departments that are not part of World Bank Regions (e.g., Gender, Climate, etc.).

ACRONYMS

ACCES	Africa Clean Cooking Energy Solutions Initiative
ADB	Asian Development Bank
AEI	African Electrification Initiative
AFD	Agence Française de Développement
AfDB	African Development Bank
AFREA	Africa Renewable Energy and Access Program
AGAT	Accelerating On-grid Access Team
ASTAE	Asia Sustainable and Alternative Energy Program
AusAid	Australian Aid
BMZ	German Federal Ministry for Economic Cooperation and Development
CARICOM	Caribbean Community
CEETI	City Energy Efficiency Transformation Initiative
CEM	Clean Energy Ministerial
CG	Consultative Group
CIF	Climate Investment Funds
COP21	21st Conference of the Parties
C-SERMS	Caribbean Sustainable Energy Roadmap and Strategy
CSI	Clean Stove Initiative
CTF	Clean Technology Fund
DFAT	Department of Foreign Affairs and Trade
DFID	Department for International Development (United Kingdom)
DPL	development policy loan
ECCH	Efficient, Clean Cooking and Heating
ENACAL	Empresa Nicaragüense de Acueductos y Alcantarillados
EnDev	Energising Development
ESCO	energy service company
ESROC	Energy Subsidy Reform Online Community
FCV	fragility, conflict, and violence
GEF	Global Environment Facility
GGDP	Global Geothermal Development Plan
GIS	geographic information system
GIZ	Gesellschaft für Internationale Zusammenarbeit (Germany)
GPOBA	Global Partnership on Output-Based Aid
GSEP	Global Sustainable Electricity Partnership
GTF	Global Tracking Framework (SE4All initiative)
IBRD	International Bank for Reconstruction and Development
IDA	International Development Association

IDB	Inter-American Development Bank	SENER	Mexican Energy Secretariat
IEA	International Energy Agency	SIDA	Swedish International Development Cooperation Agency
IFC	International Finance Corporation	SIDS	small island developing states
IPP	independent power producer	SIDS DOCK	Small Island Developing States Support Program
IRENA	International Renewable Energy Agency	SREP	Scaling-up Renewable Energy Program
JICA	Japan International Cooperation Agency	SUEEP	Sustainable Urban Energy and Emissions Planning
KfW	German government-owned development bank	TAG	Technical Advisory Group
LED	light-emitting diode	TRACE	Tool for Rapid Assessment of City Energy
M&E	monitoring and evaluation	UN	United Nations
MDTF	multi-donor trust fund	USAID	United States Agency for International Development
MTF	Multi-tier Framework (SE4All initiative)	VRE	variable renewable energy
NDC	Nationally Determined Contribution	WBG	World Bank Group
NREL	National Renewable Energy Laboratories	WBIF	Western Balkans Investment Framework
PforR	Program for Results (World Bank Group financing mechanism)		
PHRED	Philippines Renewable Energy Development		
PLN	Perusahaan Listrik Negara (Indonesia's state electric company)		
PPP	public-private partnership		
PV	photovoltaic		
RBF	results-based financing		
RISE	Readiness for Investment in Sustainable Energy (SE4All initiative)		
SDG7	Sustainable Development Goal 7		
SE4All	Sustainable Energy for All		
SEAR	State of Energy Access Report (SE4All initiative)		

Bold refers to ESMAP-managed initiatives or products.
All dollar figures (\$), unless otherwise specified, are in United States dollars.

WORLD BANK REGIONS

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

For the ESMAP-ASTAE 2015 Annual Report annexes, please go to:
<http://www.esmap.org/node/57633>



ANNEX I | PROCEEDINGS OF THE CONSULTATIVE GROUP MEETING FOR ENERGY TRUST-FUNDED PROGRAMS

20–22 April 2016, Washington, DC

SUMMARY OF THE CONSULTATIVE GROUP MEETING FOR ESMAP

The Consultative Group (CG) meeting for the Energy Sector Management Assistance Program (ESMAP) was held in Washington, DC, during April 20–22, 2016. This summary covers the discussions during the Open Sessions during April 20–21. Mr. Charles Feinstein, Acting Senior Director for the Energy and Extractives Global Practice (EEX) provided opening remarks. The Open Sessions included presentations and discussions of the External Evaluation, the Technical Advisory Group (TAG) report, and examples of ESMAP support in the major thematic and cross-cutting areas; and was chaired by Mr. Rohit Khanna, ESMAP Program Manager. Discussion highlights for each session are provided below. Separate minutes are provided for the Closed Session that was held on April 22, 2016.

Session 1: External Evaluation

ICF International conducted an external evaluation to review the performance of ESMAP and ASTAE against their respective business plans and results frameworks. The draft report was shared and presented in detail during the donors' special meeting in January 2016. The final report and management response were shared with the CG prior to the meeting. During the April CG session, Mr. Mark Wagner, Senior Vice President of ICF, presented updates

to the External Evaluation report based on comments received from the donors and TAG after the January special meeting. Several donors acknowledged the strong performance of ESMAP as reported in the external evaluation, but expressed the view that the report was less analytical than expected from an external evaluation; the evaluation team responded that the assessment represented a fair evaluation of ESMAP's performance.

The presentation highlighted five key recommendations:

1. **Program Growth:** ESMAP should pursue growth, while actively managing and monitoring threats to effectiveness associated with that growth.
2. **Outreach & Coordination:** To enhance effectiveness, ESMAP should strengthen outreach and coordination efforts at the World Bank Group and country levels.
3. **Monitoring & Evaluation:** ESMAP and ASTAE should continue to support and refine the M&E framework.
4. **ASTAE Institutional Arrangements:** The institutional arrangements for ASTAE should be finalized.
5. **Knowledge Management Strategy:** ESMAP should develop a knowledge management strategy.

The Q&A and discussion focused on the following areas:

- **Improved Communications on Results.** Following the January CG meeting, the donors requested the External Evaluation team and ESMAP management to address the issue of

improving communication on results and activities that could help CG members to support ESMAP during internal discussions and reporting within their organizations. ESMAP noted that this was an area the team is working on. Further discussion was deferred to the Knowledge Management and Communications session.

- **Comparative Advantage.** At the special CG meeting in January 2016, ESMAP donors expressed interest in the External Evaluation report assessing the program’s comparative advantage directly. It was noted that comparison of ESMAP with other donor-funded efforts was beyond the scope of the evaluation’s Terms of Reference as it would require detailed knowledge of comparators. However, the evaluation report was updated to reflect how ESMAP works with other development partners and internally across sectors to enhance its impact.
- **What Has Worked and What Has Not.** The country “Back-to-Office Reports” included as an annex to the evaluation report were noted as a good source of country-specific examples about what has and has not worked well.
- **Interaction with IFC.** The CG expressed interest in better understanding ESMAP’s relationship with IFC energy programs. Some examples of ESMAP-IFC partnerships are reflected in the evaluation report. This was noted as an area for further discussion during the CG meeting.
- **Soft Earmarking.** It was noted that for some donors the ability to soft earmark is helpful in raising funds internally. It was agreed that ESMAP would provide more information on the soft earmarking of funds received,


although soft earmarking would not be reflected in the Annual Report.

- **Refugee Situation.** The donors raised concern regarding the refugee situation in Europe—an issue on the top of many of their development agendas—and wanted to learn more about ESMAP and the World Bank’s work in this area. This was also considered beyond the scope of the external evaluation.
- **Gender.** CG members noted that as gender issues are mainstreamed across programs, ESMAP will need to ensure that gender funding and M&E focus are maintained. In parallel, or as part of the effort to mainstream gender in the energy agenda, consideration should be given to gender as a driver of transformation.
- **Program Expansion.** CG members expressed the need for caution about the number of new focus areas in the next business plan, and noted that a commensurate effort would be needed in improved reporting, M&E and communications to demonstrate impact. It was acknowledged that ESMAP has a role to play in forward-looking issues such as understanding the impact of new energy technologies and investment opportunities.

Session 2: Knowledge Management and Communications

New Knowledge Management (KM) Approach.

The KM lead presented the five components in the M&E process, namely the annual ESMAP Portfolio Review, operation and management, quality assurance process, input from TAG, and external evaluation. A new KM exercise has been launched with the aim of surveying all



ESMAP-generated knowledge and producing a strategy and action plan. It will help define new opportunities for KM in response to business goals and stakeholder needs and also consider linkages to World Bank Group initiatives. The CG stressed the importance of seeing a knowledge approach not just for the program but also for the whole sector and suggested that SE4All could be part of that approach. The focus will be about connecting people with ideas and knowledge rather than creating a library of reports. Optimized search tools will be considered.

Scaling Up Communications. The ESMAP Communications Officer presented a communications strategy to support the new business plan. The goal of the strategy is to increase ESMAP's impact by improving knowledge dissemination to key audiences and highlighting how the program is shaping the sector. The strategy outlined steps to achieve these goals, such as: i) producing more innovative communications products; ii) strengthening ESMAP's narrative with clear examples of results; iii) modernizing its website and publications dissemination; iv) strengthening the use of social media; and v) seizing more opportunities to integrate efforts with the World Bank's broader communications activities. The CG expressed a desire to see more and stronger linkages to results and a succinct storyline of the program's theory of change so they can convey these messages to their political leaders. They also suggested that the ESMAP communications team connect with their own communications units to better understand the scope of ESMAP communications most useful for donor purposes.

Session 3: TAG Report

TAG presented its report that recognized strong ESMAP performance over the past year. Recommendations and points for discussion included: i) strengthening the link with Sustainable Development Goals (SDG), including in the M&E framework; ii) giving the access agenda priority over the climate change mitigation agenda when there is competition for resources; iii) increasing focus on urban energy access, given urbanization trends; iv) promoting greater engagement with the private sector; and v) capacity to utilize an increased budget.

- **ESMAP's role in strengthening World Bank focus on access.** TAG noted that the findings from the IEG assessment of World Bank support for increasing access emphasized the importance of a sector-wide approach. This is consistent with the support under the SE4All Technical Assistance program. There was a suggestion for ESMAP to develop an energy access strategy and try to mainstream this in the World Bank's Energy Practice. ESMAP management clarified that ESMAP does not have this mandate within the World Bank but consideration could be given to developing an ESMAP strategy to strengthen focus on access within the World Bank's Energy Practice. In response to questions about the lack of reference to energy access in the World Bank's Climate Change Action Plan, ESMAP management clarified that the World Bank's energy agenda is guided by the Energy Directions Paper that has a strong emphasis on energy access.

- **Energy-water-food nexus.** The view that ESMAP could/should do more to generate demand in this area was balanced to some extent by a view that ESMAP should not allocate further resources unless there is a clear demand. ESMAP noted that the topic will be included in the “innovations lab,” providing some on-going support, if demand arises.
- **Disbursement of existing resources.** One CG member noted that as of the end of CY2015, only \$116 million was committed or disbursed, raising a question about how the rest will be spent and whether the funding will be committed in FY16. ESMAP clarified that by the end of FY16 \$127 million under the current business plan will be allocated, leaving only a minimal carryover budget to continue basic ESMAP operations until funding for the new business plan is received.
- **Results reporting.** CG members requested clearer reporting on results, both in terms of Impact stories and numerical results (e.g., number of households with access) that could be considered as influenced by ESMAP support. ESMAP management committed to at least four Impact stories in FY17 and improved reporting on results numbers and narrative in the Portfolio Review.
- **Structure of the TAG report.** There was a request that the TAG report include an overview/executive summary, and provide more analysis on the evolution of the ESMAP budget year to year.

Session 4: Annual Block Grants (ABGs)

The session focused on the importance of ABGs and provided examples of their impact. ABGs provide flexible resources that support studies and

technical assistance arising from World Bank teams’ dialogue with clients and typically cover topics that are broader than, as well as underpin, ESMAP’s focus areas, such as fixing sector fundamentals. Each region receives an annual allocation of about \$1million based on an allocation formula that takes into account performance and other factors.

Several presentations by World Bank Task Team Leaders (TTLs) illustrated the impact and role of ABGs in responding to county demand. The *Armenia Power Sector Financial Recovery Plan* was a critical contribution underpinning policy-based lending for the power sector. ABG support was also used to identify key policy actions as an input to the \$250 million *Development Policy Operation* in Jordan. In Niger, support was catalytic in improving the enabling environment to allow the country’s *Electricity Access Expansion Program* to succeed (including preparatory studies for the investment component). In India, ESMAP funded a report that informed power sector policies, particularly action on the financial viability of distribution utilities.

A presentation on “Rethinking Power Sector Reform” focused on how ESMAP is helping to assess the World Bank’s experience on energy sector reforms, filling knowledge gaps by producing evidence, and looking at country-specific analyses. In response to CG questions on support for hydropower, the World Bank’s Global Lead for hydropower discussed the importance of a thorough assessment of options in determining the optimal development of hydropower resources and highlighted the impact of upstream work in Asia and Africa.



Session 5: Gender

The presentation on gender focused on what has been accomplished so far in terms of mainstreaming gender across ESMAP work, and the proposed approach in the new business plan. Overall:

1. Knowledge products are being produced jointly with other stakeholders to draw on a wide range of experiences and to foster knowledge exchange.
2. Introduction of regional “gender and energy” programs. The regional model was developed under AFREA and was then replicated in EAP. Going forward, ESMAP will provide funding and technical support to all the regions.

Presentations on Liberia (LIRENAP—energy access) and examples from the EAP region illustrated how gender was mainstreamed into projects. For example, the Liberia team was able to analyze the outcomes of the project using a gender lens and the project is now providing recommendations to include female voices at the local levels. A gender minority report helped monitor users of solar lanterns to understand how lanterns affect women’s lives. ESMAP is also supporting the government with capacity building for gender mainstreaming.

In the Philippines, ESMAP support helped understand the market and demographics for electricity cooperatives from a gender perspective. In Vietnam, ESMAP funding helped hydropower companies to reach more women through appropriate channels and provide information to women on how to benefit from compensation and be engaged in livelihood programs associated with a hydropower project. The country’s hydropower company now has built capacity and

communication strategies to reach women. The CG recommended that experiences be captured from these projects and disseminated to demonstrate how investing in gender can lead to change.

Session 6: Energy Subsidy Reform

The ESMAP team presented the key highlights of ongoing activities under the energy subsidy reform facility, including South-South knowledge exchange and technical assistance. In China, ESMAP supported an assessment of approaches that formed the basis for recommendations for policy reform and strategy. Lessons were shared across countries such as Vietnam, Indonesia, Chile, and Nigeria. In Nigeria, the government requested a technical assistance lending project to strengthen capacity as a result of ESMAP-supported analytical work. In Egypt, ESMAP helped trigger an important subsidy reform and formed the groundwork for a Development Policy Lending series. In Ukraine, ESMAP supported reforms through communications and multi-sectoral studies and assessments.

The CG expressed appreciation of the progress of the Energy Subsidy Reform Facility. Questions centered on countries in the pipeline, ESMAP’s comparative advantage, how the World Bank is managing country demand, and ensuring sustainability of results. The ESMAP team noted that demand is growing and the focus going forward will be on strengthening the cross-sectoral approach within the World Bank Group.

Session 7: Renewable Energy (incl. ASTAE, SIDS DOCK, AFREA)

SIDS DOCK. Teams presented examples of SIDS DOCK support in São Tomé and Príncipe where ESMAP support contributed to the preparation of an investment operation and leveraged IDA funds

for rehabilitation of hydropower plant and grid upgrade. In Seychelles, ESMAP support resulted in technical assistance aiming to attract private sector investment. In Cape Verde, ESMAP supported development of an investment in solar rooftops and associated technical assistance. SIDS DOCK is included in the new ESMAP Business Plan but with funding that was pledged in prior years.

Global Geothermal Development Plan (GGDP).

The team highlighted the focus of GGDP on addressing risk mitigation issues in geothermal resource exploration. The plan has catalyzed about \$250 million in Clean Technology Fund (CTF) support and it is expected to leverage \$1.5 billion in public and private investment. Currently, ESMAP is supporting identification, preparation, and supervision of eight geothermal investment operations. In addition, 11 countries have benefited from technical assistance financed by ESMAP. The team emphasized the effort to gather and disseminate lessons learned on risk mitigation models in an effort to change appetite for investment and build capacity.

Solar Technical Assistance. Task Team Leaders presented how the program is addressing country barriers to developing solar technologies and stressed its complementarity with renewable energy mapping and VRE. The CG suggested the inclusion of solar thermal and the team indicated that it will consider the technology if it presents a good fit with the business plan.

Renewable Energy Resource Mapping. Task Team Leaders presented the progress and outcomes under this theme, which now includes


projects in 11 countries comprising 19 mapping activities. In Vietnam, existing wind power exploration by private developers has focused on coastal areas, but the ESMAP-funded preliminary mapping has identified new areas in the center and north of the country that may also be viable. In Tanzania, small hydropower mapping shows 70+ promising sites; pre-feasibility studies will be carried out on high priority sites which can then attract private developers. The ESMAP team is working closely with many partners on the ground, as well as IRENA.

VRE Integration. The session discussed the planning and integration studies, as well as operational support to utilities and grid codes, and the review of policy incentives. Central America and India were cited as examples where ESMAP support helped customize solutions and facilitated the preparation of projects. The CG stressed the importance of managing potential social and environmental issues; the team confirmed that it follows the World Bank guidelines and safeguard policies.

In conclusion, the CG requested a succinct summary of the overall effort on renewable energy to help them understand ESMAP's impact and comparative advantage. The ESMAP team agreed to respond to this request.

Session 8: SE4All Knowledge Hub

The ESMAP team's presentation focused on the progress and updates of the Hub in terms of the major knowledge products such as the Multi-Tier Framework, Global Tracking Framework, Readiness for Investment in Sustainable Energy, and State of Energy Access Report.



Global Tracking Framework (GTF) and Multi-Tier Framework (MTF).

Strong outreach for the GTF helped build consensus among key stakeholders to form a consortium. The team also created a global database with the ambition to update it on an annual basis to respond to the SDGs and policy makers' needs. The MTF has built a coalition of stakeholders and published its framework. The first national survey was completed in Guinea and next steps include implementing the MTF in 6–8 selected countries with the ambition of including another 10–15 high access deficit countries by 2017. On both GTF and MTF, the CG asked for more information to better understand interventions to improve indicators. In addition, the CG inquired into the timeline of integrating the MTF into the GTF, and the role of MTF in the SDG agenda. The team responded that there is broad support for the GTF to continue to evolve as an SDG instrument though some sensitivity exists among countries regarding ownership. In terms of how universal access is defined relative to the MTF, the team indicated that the value of the MTF is its flexibility to allow diversity and help countries to select the most strategic interventions and target the poor. With regard to the time frame of integration, data would need to be integrated in the household survey to achieve sustainability. The CG also inquired if heating and cooling could be potentially included to which the team responded positively.

Readiness for Investment in Sustainable Energy (RISE). The ESMAP team has created a database with data from 111 countries with a set of indicators to assess government support to sustainable energy investments. The data captures 96 percent of the population, 91 percent of global energy consumption and 97 percent of global access deficit.

Preliminary findings are available for access, efficiency and renewable energy. The report will be launched in late 2016 and the ambition is to expand its reach by adding other countries and dimensions such as technology, track policy support progress, and evaluate impact of policies. The CG recommended that clean cooking be included, and the team responded that it may be included in a second edition of the report. The CG also recommended testing of the robustness of indicators with actual performance/auction prices and to use the indicators to track project interventions supported by ESMAP and the ABGs. It also compared RISE to the World Bank's *Doing Business* report and suggested using it as a tool to promote competition on access. The CG also requested more information of how this work relates to the Climate Change Action Plan and the Intended Nationally Determined Contributions (INDCs). The ESMAP team referred to the fact that RISE also aspires to grasp Ministers' attention as much as the *Doing Business* report; however, the team also stressed the importance of being careful with ranking countries as it could lead to controversy that may overshadow the real impact RISE aims to have. RISE's relation to the INDCs and Climate Change Action Plan depends on whether it can provide useful input to enable countries to see where they stand and highlight where policies are needed to have maximum impact on global outcomes.

Status of Energy Access Report (SEAR). This report is being prepared by the ESMAP team in partnership with several international organizations, NGOs and bilateral and multilateral agencies. Partners have contributed specific pieces or special features on nexus topics with energy access development (i.e., energy access and food and

agriculture, energy access and gender). SEAR presents impact evaluations of energy projects in Bangladesh (productive use of energy), Bolivia (solar home system development), Kenya (improved cookstove penetration) and Laos (grid extension). It is now finalizing the case studies, developing videos on energy access stories in Bolivia, Kenya, Bangladesh, and India and focusing on strong outreach and communications efforts with the ambition to launch in the fall of 2016.

Session 9: Energy Access


In this session, the ESMAP team presented an overview of access activities and their strategic context as guided by the SDG7. The presentation highlighted the importance of partnership, innovation, programmatic and transformative approaches, transparency and flexibility. The team also stressed ESMAP's crucial role in this agenda in sharing knowledge and building capacity through its focal areas such as Energy Access for the Urban Poor, green mini grids, off-grid solar technical assistance, SE4All technical assistance program, and efficient and clean cooking and heating that have linkages to thematic areas such as renewable energy and efficiency. The team discussed ESCALATE as a cross-cutting theme focusing on the private sector, the role of ABGs in providing customized solutions to countries and regional initiatives such as ASTAE and AFREA supporting specific countries and regional issues.

Results Examples. Kenya Power has gone from 5,000 households to over 150,000 in just one year. The utility launched an informal urban settlements program, using a community-based approach to unlock large investments and resolve legal, social and affordability issues. The program was supported through GPOBA and ESMAP and

became part of a larger, \$330 million World Bank project to help Kenya Power expand and modernize the country's electricity sector. Other examples included the Ethiopia Market Development of Renewable Energy/Energy Efficient Products where ESMAP support initiated policy dialogue on Off-Grid Solar and informed preparation and implementation of concessional financing, and the support to Nigeria for Energy Access Enhancement, a multiyear program focusing on Northern Nigeria that helped to establish data driven national strategy for access rollout.

ESCALATE. The IFC team also discussed how ESCALATE works with ESMAP to bring in the private sector for more investment and innovation. The CG sought clarity regarding ESCALATE's relevance and ability to scale up rather than remaining a pilot. They also expressed their interest in learning more about the benefits and risks to countries. The ESMAP team explained that ESCALATE is complementary, on top of the main programs, and a response to the interest to look at commercial markets, more investment and innovation.

Clean Cooking. The team presented ESMAP's work in Clean Cooking highlighting its engagement in more than 20 countries with the aim to achieve scale through greater public awareness, innovation, and more public and private financing. ESMAP's support is also critical at monetizing climate, health, and gender co-benefits to drive support for this agenda. For example, in Lao PDR, where deteriorating health due to air pollution from cook stoves is impacting the country's gross domestic product, ESMAP is supporting an effort to monetize health benefits. In India, ESMAP and ASTAE resources helped to map the perspectives of civil society and stakeholders on



clean cooking which was then used to build consensus for a focused effort around public health benefits of clean cooking. In the Kyrgyz Republic, ESMAP supported an assessment to develop an action plan with recommended investments and implementation steps for clean and efficient heating solutions. This contributed to reforms and financing was sought for prioritized investment packages.

The CG emphasized that the access agenda is a key priority—especially with SDG7—and that it would like to see ESMAP and the World Bank significantly strengthen efforts in this area. The ESMAP Program Manager responded that increasing the level of ambition is feasible if the CG could also consider increasing resource allocation for access and rethink the balance of the overall Business Plan funding. ESMAP’s Business Plan responds to the IEG evaluation and aligned with the SE4All targets and ESMAP would be open to rebalancing if the CG gives a clear signal to reallocate already existing resources for access.

Partner Coordination. In addition, the CG discussed the importance of coordinating action with development partners on the ground to which the ESMAP team pointed out several examples of existing collaboration with bilateral agencies such as DFID, GIZ and USAID, and agreed to do more in terms of outreach.

Session 10: Energy Efficiency

The session focused on examples from the EAP, ECA and LCR regions to show ESMAP’s instrumental support in pioneering systemic approaches and encouraging dialogue to improve city services and sustainability through energy efficiency

interventions. In EAP, ESMAP support is helping the city of Surabaya in two parallel work streams: i) building local capacity to enable the city to develop a roadmap and pursue an energy efficiency and low carbon development agenda to meet the city’s energy challenges; and ii) developing an energy efficient streetlighting retrofit plan for implementation with private sector participation. In ECA, ESMAP is funding work that focuses on the public sector and markets, particularly in buildings and in creating sustainable financing mechanisms. In Mexico, the results of TRACE diagnostics in two cities led the Ministry of Energy to expand such diagnostics in another 30 cities across the country and rollout a National Energy Efficiency Plan. The city energy diagnostics built the foundation for Mexico’s municipal energy efficiency project, supported by a \$100 million IBRD loan (approved in March 2016). This national project has a cross-sectoral focus, supporting energy efficiency investments in public lighting, municipal buildings and water pumping. ESMAP continues to provide critical support throughout the preparation of the project. In Brazil, ESMAP is supporting the development of innovative and financially sustainable business models and financing mechanisms—particularly in public lighting and industrial energy efficiency—that have the potential to be significantly scaled up. To this end, and given the promising results obtained, the team will present a proposal to the Green Climate Fund to fully develop and implement these mechanisms. The IFC team presented the ESMAP-supported EDGE platform for promoting resource-efficient buildings and to identify commercially viable opportunities. To date, more than 800,000 square meters have been certified, and plans point to a significant increase globally.

CG members pointed out that energy efficiency should be linked to overall energy reform efforts, and asked about the impact of current low energy prices on countries' commitment to implement energy efficiency actions. The ESMAP team also recognized the strong link of energy efficiency to energy sector reform, for example, when implementing subsidy reform where energy efficiency can mitigate the negative impact of higher energy tariffs on households. The team acknowledged that low energy prices could reduce the attractiveness of energy efficiency, but highlighted that due to the many benefits of energy efficiency, governments can take normative action to promote it, such as building codes and labeling of appliances. CG members picked up on the importance of good governance, as highlighted by the case of Surabaya. They also noted the importance of providing municipal authorities with information and guidance, as well as raising their awareness on the available tools (e.g., Energy Efficiency Award,

TRACE, ISO 50,001 and others), to support and inform urban development decision making. They highlighted the broad scope for collaboration. The ESMAP team agreed with this and expressed its willingness to collaborate. In addition, CG members stressed the importance of working with other sectors to which the ESMAP team mentioned that this program had established connections with teams working on energy access and renewable energy, as well as with several World Bank Global Practices such as Urban, Transport and Water, in addition to the IFC. CG members also noted that the strong linkages with SE4All provides support in a number of energy efficiency activities such as workshops to build the roadmaps and institutional capacity. The SE4All Energy Efficiency Hub, in particular, was highlighted and the ESMAP team mentioned that it is already collaborating in a number of activities with SE4All.

ANNEX II | ESMAP RESULTS, FY2016: OUTCOMES, OUTPUTS, AND WORLD BANK OPERATIONS INFORMED

During FY2016, ESMAP activities have contributed to the identification and design of \$1.3 billion of World Bank IDA and IBRD financing, which, in turn, leveraged an additional \$370 million from other partners.

The following table gives a quantitative summary of ESMAP's results for fiscal year 2016. For the latest details of ESMAP's activities, development outcomes achieved, and monitoring and evaluation framework, go to www.esmap.org and click on the Results tab.

TABLE A2.1

Summary of ESMAP Results, FY2016					
	OBJECTIVE	INDICATOR	ACHIEVEMENTS	RELATED ESMAP ACTIVITIES	
Outcomes	Development Financing Informed	Existing operations informed	4 Existing operations informed		
			1 Electricity System Enhancement Project (Liberia, P120660)	1 AFREA II—Africa Electrification Initiative	
			2 Additional Financing for Energy Development and Access Project (Ghana, P147878)	2 AFREA II—Africa Electrification Initiative	
			3 Rural Electrification Hybrid System Project (Mali, P131084)	3 AFREA II—Mali: Support to Energy Services Access	
	Client countries provided with just-in-time technical assistance for pre-investment activities necessary to resolve program design issues and offer additional options	Government expenditure informed	Mobilization of non-Bank resources informed	4 Electric Power Project (Myanmar, P143988)	4 Development of Myanmar National Electrification Program
				10 New operations informed	
				5 First Programmatic Energy and Water Sector Reforms Developmental Policy Loan (Jordan, P154299)	5 Jordan Energy Sector Assistance: NEPCO Restructuring, Procurement Review, LNG Capacity Building
				6 Hubei Xiaogan Logistics Infrastructure (China, P132562)	6 China: Green logistics for Chinese municipalities: application in Xiaogan and beyond
				7 Wuhan Integrated Transport Development (China, P148294)	7 China: Wuhan integrated transport development project—learning from best international practice in smart transport and EE
				8 Urban Development Project (Kyrgyz Republic, P151416)	8 Kyrgyz Republic: Urban Development Project

TABLE A2.1 *Continued*

Summary of ESMAP Results, FY2016

OBJECTIVE	INDICATOR	ACHIEVEMENTS	RELATED ESMAP ACTIVITIES
		9 Electricity Network Reinforcement and Expansion Project (ENREP) Additional Financing (Ethiopia, P155563)	9 AFREA II—Lighting Africa Expansion
		10 Rural Electrification Expansion Program (Tanzania, P153781)	10 AFREA II—Lighting Africa Expansion
		11 Liberia Renewable Energy Access Project (Liberia, P149683)	11 AFREA II—Lighting Africa Expansion
		12 Electricity Access Expansion Project (Niger, P153743)	12 AFREA II—Niger Electricity Access Expansion
		13 Power Sector Financial Recovery Program (Armenia, P157571)	13 Armenia Financial recovery of the power sector
		14 Municipal Energy Efficiency Project (Mexico, P149872)	14 International Conference on Energy Efficiency In Cities
			15 Mexico Municipal Energy Efficiency Project
Policy & Strategy Informed and Client Capacity Increased	Government policy/strategy informed	24 outcomes	<ul style="list-style-type: none"> • Niger Electricity Access Expansion • South Sudan Energy Sector Technical Assistance Project • Seychelles: Improving Electricity Planning • Developing Low-Carbon Strategy for Shenzhen • Developing an Innovative Energy Efficiency Financing Mechanism in China • Philippines Power Sector Strategy—VRE Distribution Grid Code • Power Market Structure Options for Kazakhstan • Tariff Setting Methodology • Armenia: Financial Recovery of the Power Sector • Efficiency Improvements of the District Heating System in the Kyrgyz Republic • Georgia Power Sector Strategy • Ukraine: Moving Forward Energy Tariffs Reforms • Uzbekistan: Impact of Energy Subsidies—Way Forward
Increased institutional capacity of ESMAP client countries to plan, manage, and regulate the implementation of policies, strategies, and programs that deliver clean, reliable, and affordable energy services required by their citizens for poverty reduction and environmentally sustainable economic growth			



TABLE A2.1 *Continued*

Summary of ESMAP Results, FY2016

OBJECTIVE	INDICATOR	ACHIEVEMENTS	RELATED ESMAP ACTIVITIES
			<ul style="list-style-type: none"> • Deploying new solar technologies for isolated rural areas: supporting their adoption in LCR • Delivery of Technical Assistance to the Government of Panama to Reduce Barriers for the Development and Use of Renewable Energy and EE • Mexico: Supporting a low-carbon economy • Energy Efficiency Action Plan • Egypt: Phase II of Subsidy Reforms technical assistance from the Energy Subsidy Reform and Delivery Technical Assistance Facility • Afghanistan “Energy Security Trade-Offs under High Uncertainty” • Scaling Up Energy Efficiency and Demand-Side Management Business Line in South Asia • Open Accessibility Planning for Integrated and Inclusive Transport in Dhaka • Bangladesh: Energy Efficiency Improvement Program in Industries • International Experience with Private Sector Participation in Power Grids • Piloting Multi-Tier Energy Access Metric
	Public debate stimulated/initiated	3 outcomes	<ul style="list-style-type: none"> • China: Wuhan Integrated Transport Development Project—learning from best international practice in smart transport and EE • Ukraine: Moving Forward Energy Tariffs Reforms • India: State-Level Dissemination of India Power Sector Review

TABLE A2.1 *Continued*

Summary of ESMAP Results, FY2016			
OBJECTIVE	INDICATOR	ACHIEVEMENTS	RELATED ESMAP ACTIVITIES
	Contributed to stakeholder involvement	1 outcome	<ul style="list-style-type: none"> Ukraine Moving Forward Energy Tariffs Reforms
	Development community/partner policy/strategy informed	2 outcomes	<ul style="list-style-type: none"> Uzbekistan Impact of Energy Subsidies—Way Forward New Models to Scale Up Power Generation Investments in Africa
	Bank country strategy informed/influenced	2 outcomes	<ul style="list-style-type: none"> West Bank and Gaza Energy Efficiency Action Plan Role of Subsidies: Financing Electricity Supply and Providing Affordable Access in Sub-Saharan Africa
	Bank sector strategy informed/influenced	1 outcome	<ul style="list-style-type: none"> Review of Hydropower Development in Africa
	Design capacity strengthened	9 outcomes	<ul style="list-style-type: none"> Niger Electricity Access Expansion Ukraine Moving Forward Energy Tariffs Reforms China Wuhan integrated transport development project—learning from best international practice in smart transport and EE Mali Support to Energy Services Access Thirsty Energy: The Case of China Moldova Power Sector Note Mexico Supporting a low-carbon economy Guatemala Wind and Solar Integration Study West Bank and Gaza Energy Efficiency Action Plan

TABLE A2.1 *Continued*

Summary of ESMAP Results, FY2016

OBJECTIVE	INDICATOR	ACHIEVEMENTS	RELATED ESMAP ACTIVITIES
	Implementation capacity strengthened	11 outcomes	<ul style="list-style-type: none"> • South Sudan Energy Sector Technical Assistance Project • China Fossil Fuel Subsidy Study • Myanmar Economic Cost of Natural Gas Study • Macedonia Municipal Energy Efficiency Promotion • Kyrgyz Republic Efficiency Improvements of the District Heating System • LCR Urban Energy Efficiency • Egypt: Phase II of Subsidy Reforms Technical Assistance from the Energy Subsidy Reform and Delivery Technical Assistance Facility • Iraq Best Practice: Public Investment in Power Infrastructure • Jordan Energy Sector Assistance: NEPCO Restructuring, Procurement Review, LNG Capacity Building • India: Efficient & Sustainable City Bus Services—Capacity Building Program in Fuel Efficiency • Data Analytics for Intelligent Energy Systems
	M&E capacity increased	1 outcome	<ul style="list-style-type: none"> • Georgia Power Sector Strategy
	Client is recognized with good practice or similar awards		

TABLE A2.1 *Continued*

Summary of ESMAP Results, FY2016

OBJECTIVE	INDICATOR	ACHIEVEMENTS	RELATED ESMAP ACTIVITIES
<p>Knowledge Increased/Deepened and Innovative Approaches & Solutions Generated</p> <p>ESMAP-supported research and analyses strengthen the sector's knowledge and evidence base to deliver improved clean energy access, energy efficiency, and generation in developing countries</p>	<p>Facilitated exchange of best practice with clients</p>	<p>13 outcomes</p>	<ul style="list-style-type: none"> • AFREA II: New Models to Scale Up Power Generation Investments in Africa • AFREA II: African Rural Electrification Concession • Electricity Market Simulation Model of Vietnam • Energy Reform Milestones and Challenges • Knowledge Sharing and EE Outreach • Kyrgyz Republic: Urban Development Project • Achieving Energy Efficient Urban Transport in Cities in Latin America • LCR Urban Energy Efficiency • International Conference on Energy Efficiency in Cities • Gender Mainstreaming in Energy Sector in South Asia • India: Efficient & Sustainable City Bus Services—Capacity Building Program in Fuel Efficiency • Bangladesh: Energy Efficiency Improvement Program in Industries • Enhancing Knowledge Sharing on Subsidy Reforms: Case Studies on Political Economy of Energy Subsidy Reform
	<p>Facilitated exchange of best practice with partners</p>	<p>2 outcomes</p>	<ul style="list-style-type: none"> • AFREA II: Mali Support to Energy Services Access • Ukraine: Moving Forward Energy Tariffs Reforms

TABLE A2.1 *Continued*

Summary of ESMAP Results, FY2016

	OBJECTIVE	INDICATOR	ACHIEVEMENTS	RELATED ESMAP ACTIVITIES
		Disseminated best practices	7 outcomes	<ul style="list-style-type: none"> • Piloting Multi-Tier Energy Access Metric • AFREA II: Power and Agriculture in Sub-Saharan Africa • Lighting Africa Expansion • Niger Electricity Access Expansion • AFREA II: Review of Hydropower Development in Africa • Scaling Up Energy Efficiency and Demand-Side Management Business Line in South Asia • International Experience with Private Sector Participation in Power Grids
		New innovative approach fostered		
		New innovative approach developed	7 outcomes	<ul style="list-style-type: none"> • India: State-Level Dissemination of India Power Sector Review • AFREA II: Power and Agriculture in Sub-Saharan Africa • Lighting Africa Expansion • AFREA II: Review of Hydropower Development in Africa • Tanzania: Cycle mapping for improved urban mobility • Inclusive Green Growth for EAP Cities • Data Analytics for Intelligent Energy Systems
		Other action/behavior adopted or observed		
Outputs	Analytical Services & Analytics (ASA)* and Knowledge Products**, Academic Mentions/References of ESMAP Products/ Knowledge, Impact Stories	# of Research (ASA) and Knowledge Products Published	Total # of Outputs: 164 ASA Outputs: 109 Knowledge Products: 55	
		# Academic Mentions	171	
		# Impact Stories Developed and Disseminated	2	
		# of Peer-Reviewed Research Published	1	

*Previously classified as Economic Sector Work (ESW) and Technical Assistance (TA) at The World Bank. The new Advisory Services & Analytics (ASA) product line was introduced July 2016; activities have been retroactively reclassified.

**Knowledge Products (not a part of ASA) are intended for Bank Staff and aim to support operations through production, retention, and dissemination of knowledge, often shared with external audiences, adding value to the product. (OPCS, World Bank)

TABLE A2.2

ESMAP Program Outputs, FY2016

AFRICA RENEWABLE ENERGY ACCESS PROGRAM (AFREA)

1	Analytical Services & Analytics*	Analytical Reports; Hands-On Advice and Technical Assistance; Policy Notes and Presentations; and Impact Evaluations
	Liberia	Pre-feasibility study on hybrid renewable energy-diesel isolated mini grids
	Liberia	Shield Wire Scheme: Manual for planning, design, construction and operation
	Ghana	Mini/micro grid business models and regulations workshop and assessment
	AFR	Revised TOR to hire an NGO/firm to assist in the implementation of the project component; Revised TOR to jumpstart the implementation by enabling cookstove producers/manufacturers to receive grants for advertisements, consumer outreach activities
	AFR	Study to develop strategic directions for interventions on solar energy in Sub-Saharan Africa by the Africa Energy Group
	AFR	Advisory and Operational Support on Gender Mainstreaming: PCN Screening Process, Program Management; Advisory Services for Projects; Operational Support for Projects
	Uganda	Uganda Capacity Building and National Policy proposal
	Cote d'Ivoire, Cameroon, Ethiopia, Ghana, Kenya, Mauritius, Nigeria, Senegal, South Africa, Tanzania, Togo, Uganda, Zambia	The case study series presents the experiences of countries where IPPs of the key typologies and major generation investments financed from Chinese sources are identified. Countries: Cote d'Ivoire, Cameroon, Ethiopia, Ghana, Kenya, Mauritius, Nigeria, Senegal, South Africa, Tanzania, Togo, Uganda and Zambia
	AFR	Africa-wide stocktaking of power demand of agriculture value chains
	Gabon	Inventory of infrastructure in the rural areas of Gabon and cost estimates
	Gabon	Organizational diagnosis and capacity building needs of the National Council for Water and Electricity
	Gabon	Benchmarking of costs of basic rural services and infrastructure
2	Knowledge Products**	Toolkits, Operational Guides, Models, Handbooks, Databases, Internal and External Trainings, Forums, and Workshops
	AFR	Study tour of key Zambian energy stakeholders to Namibia and Ghana, for learning from practitioners the benefits of low cost technologies for rural electrification
	AFR	Customizable Excel model designed to generate high-level projections to inform advocacy for lowering trade barriers to clean and improved cookstoves. WTP/CA assessment for Uganda
	AFR	Workshop and presentation on LPG Cooking in Sub-Saharan Africa
	Burkina Faso, Cote d'Ivoire, Liberia, Sierra Leone	Study tour in Burkina Faso and workshops in Cote d'Ivoire, Liberia and Sierra Leone to exchange experiences on Low Cost Electrification Technology support
	AFR	Dissemination: KP and presentation in Hydro 2015 conference
CLEAN ENERGY		
1	Analytical Services & Analytics*	Analytical Reports; Hands-On Advice and Technical Assistance; Policy Notes and Presentations; and Impact Evaluations
	Indonesia	Geospatial mapping, least cost electrification planning
	Papua New Guinea	Wind resource maps and associated datasets together with a final report that describes the resource methodology and results
	Philippines	Report and Workshop on the assessment of the impact of VRE systems



TABLE A2.2 *Continued*

ESMAP Program Outputs, FY2016	
Philippines	Report: Review of international experience in connecting VRE at distribution voltages
Philippines	Report and Workshop: Revised Grid Code for the connection of small-medium VRE systems to the distribution network
Argentina, Bolivia	Document summarizing the technical improvements required to meet the Lighting Global Minimum Quality Standards and advisory services to reach these
Argentina, Bolivia	Study: Deploying new solar technologies for isolated rural areas: supporting their adoption in the LCR region
Argentina, Bolivia	Surveys: Field surveys in different Eco-Regions of Bolivia and Argentina to determine consumer preference and field performance
Maldives	Preliminary Mesoscale maps: Existing data was gathered and preliminary Mesoscale maps were built using satellite data, atmospheric models and existing ground measurement
Pakistan	Biomass resource maps (GIS layers), associated datasets, final report describing resource potential, methodology and results; strategic environmental assessment
Nepal	Preliminary Mesoscale Mapping: Maps of satellite-derived wind data and map of Meteorological Stations/Wind Masts and Elevation at different resolutions
Sri Lanka	Review of the CEB 2015–2034 Long-Term Generation Expansion Plan
2	Knowledge Products Toolkits, Operational Guides, Models, Handbooks, Databases, Internal and External Trainings, Forums, and Workshops
Pakistan	Stakeholder workshops to present the methodology, results and the strategic environmental assessment
Global	Knowledge exchange events and BBLs
ENERGY ACCESS	
1	Analytical Services & Analytics* Analytical Reports; Hands-On Advice and Technical Assistance; Policy Notes and Presentations; and Impact Evaluations
Nigeria	Economic and Financial Analysis of Investment projects in Electricity Access
Nigeria	Analysis of average cost of electricity: (1) analysis of electricity average cost; (2) presentation and discussion with authorities of tariff setting options and principles; (3) capacity building of Ministry & Nigelec to set and review tariffs
Nigeria	Discussion with the Nigerian authorities on international best practices for structuring regulatory agency and drafting electricity law including regulatory aspects
Nigeria	Assessment of the supply options for the short and medium term
Nigeria	Technical preparation of investment program in selected sites
South Sudan	Terms of Reference and Related Preparation and Implementation Plans
South Sudan	Preparation of the Inception report for the Energy Sector Technical Assistance Project
Myanmar	A GIS-based least cost electrification planning system was put into place and an analytic basis for electrification planning was established
Myanmar	Universal access roadmap and investment prospectus developed for a national electrification program (URL)
El Salvador, Guatemala, Honduras, Nicaragua	Investment prospectus for Guatemala, Honduras, and Nicaragua: includes near- and medium-term implementation and financing plans
El Salvador, Guatemala, Honduras, Nicaragua	National cookstove standards and certification procedures: design of financing products for producers, distributors, and consumers

TABLE A2.2 *Continued*

ESMAP Program Outputs, FY2016		
	India	Assessment report for review of the SCADA and distribution control center, which enables the client to be well informed while determining technical specifications and costing of key equipment for use by the Andhra Discoms
	Global	Survey Questionnaires and Structure of Analytical Report was finalized based on feedback from early pilots in select countries
2	Knowledge Products	Toolkits, Operational Guides, Models, Handbooks, Databases, Internal and External Trainings, Forums, and Workshops
	South Sudan	Capacity Building: Support for the development of the program design as well as in the preparation of the TOR/RFP and bidding documents for carrying out capacity building activities, including in-house training, workshops and seminars
	South Sudan	Off-Grid Access: Support for the development of the program design as well as the TOR/RFP and bidding documents to launch an off-grid rural electrification program, including support for analytical approaches for gender targeting as well as selecting rural communities
	South Sudan	Inception workshop for the Energy Sector Technical Assistance Project
	Myanmar	Local media briefing and interaction in four cities accompanied by social media campaign
	Myanmar	Workshop: Understanding the energy sector and the topic of electricity access in Myanmar
	Myanmar	Building institutional capacity for national electrification: Policy consultants, training programs and study tours
ENERGY ASSESSMENTS AND STRATEGIES		
1	Analytical Services & Analytics*	Analytical Reports; Hands-On Advice and Technical Assistance; Policy Notes and Presentations; and Impact Evaluations
	Seychelles	Report ("Improving Electricity Planning—Least cost expansion plan") and workshop describing the least cost planning exercise methodology and recommendations
	Philippines	Report: Study of Regulatory Process Efficiency for EC Investment Plans and associated draft submission to ERC
	China	Technical Report: Taxonomy of fossil energy subsidies and quantification methods
	Vietnam	Development of computer models of Vietnam's power system and training clients in the use of that model
	Vietnam	Approach and methodology for subsidy quantification, international experience with fuel subsidies
	Myanmar	Report Economic Costs of Natural Gases: Review of Myanmar gas supply and demand balance
	Myanmar	Mathematical model for economic costs calculations and impact on Myanmar's exports and government revenue
	Turkey	Implementation of the User Association "Action Plans"
	Kazakhstan	Sector Issues Note which assesses the current state of the sector, its regulatory environment, operational and financial performance, the current and forecasted demand and supply balance of electricity
	Kyrgyz Republic	Design of a communication strategy and development of a performance accountability and feedback mechanism
	Kyrgyz Republic	Report defining the methodology for setting end-user power and heating tariffs for customer classes
	Kyrgyz Republic	Methodology to determine the revenue requirement for the regulated power and heating sector companies
	Kyrgyz Republic	Report defining the revenue requirement for the regulated power and heating sector companies.

TABLE A2.2 *Continued*

ESMAP Program Outputs, FY2016

Albania, Bosnia and Herzegovina, Croatia, Kosovo, Macedonia, Montenegro, Serbia	Identification of Key Stakeholders: Stakeholder reference lists by country
Albania, Bosnia and Herzegovina, Croatia, Kosovo, Macedonia, Montenegro, Serbia	Activity reference database: Stocktaking of Biomass Heating Data, Assessments and Initiatives
Armenia	Financial diagnostics report: Includes analysis of the financial standing of the state-owned power companies, analysis of the causes of their financial distress with detailed focus on financial investments, payables and receivables, liquidity and overall solvency
Armenia	Financial recovery plan: Includes corporate-level recommendations on improvement of the financial standing as well as broader legal and regulatory improvements that may be needed to avoid financial distress in the future to ensure the sustainability of results
Moldova	Report on District Heating and Electricity Tariff and Affordability Analysis in Moldova
Georgia	Energy Sector Issues Paper which addresses high level strategic issues in the energy sector and builds on the existing Government's energy sector strategies and sector development plans
Ukraine	Communication plan: Support to the Government to develop the second phase of the information campaign
Uzbekistan	Least cost planning analysis: A model of the Uzbekistan system and a short report summarizing the key input assumptions and methodology on the least cost planning analysis
Uzbekistan	Diagnostic analysis of the sector: PPT presentation that covers the fiscal impact of energy subsidies in the gas, electricity and heat sectors, a sector tariff analysis for gas, electricity and heating, metering and consumption based billing
Guatemala	Report on best practices in sustainable hydropower development
Jamaica	Development of an Integrated Resource Plan and a road map for implementation that includes an assessment of the least cost electricity supply plan for Jamaica and options for reducing demand through energy efficiency
LCR	Regional Study to evaluate the effects of various energy pricing mechanisms used in Latin America and the Caribbean and analyze the extent to which they are aligned with poverty reduction and shared prosperity objectives
Honduras	Management support to ENEE for implementation of PROMEF IMS
LCR	An Excel-Based tool for Assessing Energy in Agriculture Value Chains was implemented. The tool is accompanied by a short guide on how to maximize the use of the tool
Guatemala	Three reports were prepared that present the techno-economic analysis made to evaluate the maximum penetration of wind & solar power in Guatemala's SNI for 2015, 2016 and 2018, and 2020
Belize	Analysis of energy system in Belize that evaluates vulnerabilities including identification of exposure to extreme weather events
Belize	Identification of sector specific interventions for initiating a process of engaging in national climate adaptation planning
Iraq	Indicative Project Pipeline, based on modern power system planning techniques, and economic and financial analysis of investments
Iraq	Standard Project Documentation: Feasibility Study, Environmental and Social Impact Assessment and Risk Mitigation, Procurement

TABLE A2.2 *Continued*

ESMAP Program Outputs, FY2016	
Jordan	Liquefied Natural Gas (LNG) Capacity Building/Training: Development of local capacity in the area of LNG market fundamentals, operations, contract management and utilization strategy
Nepal	Mechanism for NEA to manage and prevent conflicts with energy projects
Nepal	Review conflicts under transmission line and hydropower projects
Global	Executive summary and literature review: Synthesis of the results of case studies into a single chapter, which presents the analytical framework, includes a broader literature review, and provides lessons from the case studies
Global	Ghana Case Study: Documentation of the country context, including the macro-fiscal, social, and political setting in which the reforms took place as detailed in the conceptual framework
2	Knowledge Products Toolkits, Operational Guides, Models, Handbooks, Databases, Internal and External Trainings, Forums, and Workshops
Nigeria	Internal World Bank policy note
Vietnam	Stakeholder Workshops: Workshops for consultations with stakeholders on the output
Myanmar	Workshops on Economic Costs of Natural Gas: A series of workshops to consult with study counterparts, share the results, and provide trainings on economic modelling
Ukraine	Capacity building to design and implement targeted social protection programs: Workshop materials, workshop, study tour
Ukraine	Follow-up quantitative and qualitative impact assessment of the energy subsidies reforms: Presentation, short report, and workshop with the Government and donors, and a separate workshop with media and CSOs
Ukraine	Preliminary analysis of the performance of the new social protection program: PPT presentation, short report, workshop, adjusted operational manual for the social protection program
Ukraine	At least 15 regional trainings for journalists took place and training materials were provided
ECA	Organization of learning events such as BBLs and prepare knowledge briefs to showcase the successful operations and also to share the lessons learnt
Guatemala	Dissemination of report of best practices in sustainable hydropower development
Jamaica	Two sessions of consultative workshops
LCR	A workshop in Costa Rica and a workshop in Mexico to train client counterparts on the Excel tools, and present the case studies
Haiti	A note was prepared for presenting the estimations of the fiscal costs, the distributional effects, and the price effects of possible reform options
Nepal	Capacity building of NEA, Government agencies and CSOs in conflict management
Nepal	Special screenings and debates among key stakeholders
ENERGY EFFICIENCY	
1	Analytical Services & Analytics* Analytical Reports; Hands-On Advice and Technical Assistance; Policy Notes and Presentations; and Impact Evaluations
Tanzania	Cycle Mobility Dataset: This output provides for cycle routes in Dar es Salaam, both formal and informal. Data is published on Open Street Map and made available as GTFS datasets
China	For the development of Shenzhen Low-carbon City Road Map: Summary report on Shenzhen's existing studies and policies, MAC curve analysis and low-carbon development road map with policy options and mechanisms
Indonesia	Institutional and Industry Capacity Review of the Government's and industry's capability to fund, plan, regulate, and operate an integrated bus-based public transport network on a "buy-the-service" basis

TABLE A2.2 *Continued*

ESMAP Program Outputs, FY2016

Indonesia	Operator Contractual Arrangements Advisory: Assistance to the city to formulate an appropriate draft contract for Angkot operating services
Indonesia	Policy note and facilitated discussion on new vehicle financing options
Indonesia	Policy note on consultation strategy: Leveraging on existing capability, assistance to the city government to plan the development of the capabilities and resources needed
Indonesia	Assistance to the city government to review the details of the institutional structure and reforms, and contracting arrangements proposed in CDIA's Pre-Feasibility study
Indonesia	Progress report on outcome of discussions with stakeholders
China	Analysis and organization of the knowledge and information collected from the literature review, case studies, and interviews to build an analytical framework for Smart City and Intelligent Transportation System energy benefits
China	Literature review note for obtaining the state of the art of current research in this field
China	Report: Preliminary design of an energy efficiency or Green Fund that includes domestic experience of green fund and recommendations of innovative financing mechanism for China
China	Development of institutional capacity that enabled the city to develop its energy efficient and green growth business plan and using it to attract public private investments
Macedonia	Pilot for municipal energy efficiency action plans and projects
Belarus	Assessment of options for financing and delivery of large-scale building retrofit programs
Belarus	Baseline study, as part of the integrated study
Kyrgyz Republic	Development of a road map for scaling up investments: Study report in the form of a policy note which presents the main findings and recommendations, including sequencing of actions and timelines
Kyrgyz Republic	Detailed investment and implementation plan to improve efficiency and reliability of the DH network operated by Bishkekteploset
Kyrgyz Republic	Specific policy recommendations and time-bound transition plan to move towards consumption-based billing
Kyrgyz Republic	Pre-feasibility studies for the street lightning and water and sanitation systems in 3-4 towns
Kyrgyz Republic	TRACE studies completed in 3-4 towns in Kyrgyzstan
Ukraine	Assessment and benchmarking of the public transport systems of Kyiv
Ukraine	Recommendations to improve the public transport systems of Kyiv
West Bank & Gaza	Energy Efficiency Action Plan for West Bank and Gaza: Defines practical steps to promote wider implementation of the identified energy efficiency measures in the short to medium term
West Bank & Gaza	Energy Efficiency Potential in West Bank and Gaza: Assesses the potential benefits of energy efficiency measures, in terms of cost savings to the Palestinian Authority and emission savings to the environment
West Bank & Gaza	A summary report highlighting the support provided by the Energy Efficiency expert
Sri Lanka	Report- Assessment of greenhouse gas emissions from transport in the Colombo Metropolitan Region
Sri Lanka	A low carbon future scenario was developed for CMR's urban transport sector. Based on the scenario, greenhouse gas emissions are assessed and compared with the baseline scenario
Sri Lanka	A pre-feasibility study for one of the mode integration projects at railway stations in CMR was conducted
Bangladesh	Summary Report: Accessibility planning pilot on a BRT corridor
Bangladesh	Report: Assessment, Development and Overall Design of Energy Efficiency Improvement Implementation Program in Industries

TABLE A2.2 *Continued*

ESMAP Program Outputs, FY2016

	Afghanistan, Bangladesh, India, Nepal, Pakistan, Sri Lanka	Preparation of Country Energy Efficiency Strategic Road Map: Delivery of solutions and business models for implementing energy efficiency in South Asia
	Afghanistan, Bangladesh, India, Nepal, Pakistan, Sri Lanka	Report: Strengthening the Energy Efficiency Institutional Architecture for Industry and Capacity Building
	Global	Efficient Street Lighting case studies: Series of 6 case studies on public lighting LED delivery models
	Global	Design and implementation of four pilot projects demonstrating the use cases of open source models of advanced data analytics
	Global	Research and documentation of opportunities and challenges related to advanced data analytics for urban energy efficiency
2	Knowledge Products	Toolkits, Operational Guides, Models, Handbooks, Databases, Internal and External Trainings, Forums, and Workshops
	Tanzania	Cycle Data Training and Community Engagement
	China	Report, workshop, journal article for submission: This component completes the final report and carries out its dissemination; Workshops for disseminating the study findings within and outside China
	Macedonia	Information dissemination: Two case studies, two guidance notes, options paper for financing municipal energy efficiency beyond MSIP
	Kyrgyz Republic	City workshops: To present preliminary results and main recommendations from the TRACE studies
	ECA	Awareness raising products: High-level policy note and flagship presentation on energy efficiency
	ECA	Knowledge sharing: Two Live Wires, one on industrial energy efficiency programs and the other on ESCO market development
	Jamaica, Brazil	National Urban Energy Efficiency Workshop in Colombia
	Jamaica, Brazil	National-level workshop for Secondary Cities in Mexico together with input to a Guidebook of Best Practices of Urban Energy Use in LCR
	Brazil	Energy Efficiency in Public Street Lighting: Several business models were prepared for at least two configurations of public street lighting at municipal levels
	Mexico	Clean energy and energy efficiency workshop and conference on topics related to clean energy and energy efficiency
	Mexico	Knowledge exchanges with other countries which have successfully expanded renewable energy in their matrix, for instance: Brazil, Colombia and Peru
	Mexico	International Conference on Energy Efficiency in Cities
	Brazil	Dissemination events
	West Bank & Gaza	The final dissemination workshop was financed and organized by the French Development Agency (AFD) in coordination with PENRA and the World Bank
		Supporting knowledge exchange on the water-energy nexus: A summary report from the workshop, detailing lessons learned and experiences exchanged
	Sri Lanka	Dissemination workshop: The output of the activities was presented to the stakeholders and further steps were discussed



TABLE A2.2 *Continued*

ESMAP Program Outputs, FY2016

Bangladesh	Data sharing, knowledge exchange and training for the presentation of the technical notes acquired during the project
India	Performance Reports: Review of available Guidelines and Materials and practices for Fuel Efficiency in Bus Operations and development of standard materials for the Indian context; the draft guidelines and manuals were tested on 3 pilot cities
India	Workshops and Training events organized with Ministry of Urban Development to propagate the use of and assist with adoption of fuel conserving techniques to State Transport Undertakings (STUs) and private operators across India.
Afghanistan, Bangladesh, India, Nepal, Pakistan, Sri Lanka	Workshop: Review of the work done in South Asia and review of Global Energy Efficiency Experience and applicability to South Asia
Bangladesh	Workshop: Strengthening the Energy Efficiency Institutional Architecture for Industry and Capacity Building
Global	E-learning course on Energy Efficiency in Cities
Global	Streetlighting LED BBL—half-day learning event on Scaling-up LED Lighting Deployment: Implementation and Financial Solutions
Global	Dissemination and knowledge exchange of experiences and insights from the research, the online survey and the pilot projects

GENDER AND SOCIAL INCLUSION**2 Knowledge Products Toolkits, Operational Guides, Models, Handbooks, Databases, Internal and External Trainings, Forums, and Workshops**

Global	Self-paced course designed and completed and can be accessed through the ESMAP website and the World Bank's On-Line Training Campus. Course materials (presentations, speaking points, resources) used as inputs into various face-to-face trainings and events
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RESULTS-BASED FINANCING**1 Analytical Services & Analytics* Analytical Reports; Hands-On Advice and Technical Assistance; Policy Notes and Presentations; and Impact Evaluations**

Lao People's Democratic Republic	Design of Health Impact Result Based Financing Mechanism and Final Reports including academic journal publications
Lao People's Democratic Republic	Health Impact Study Report
Lao People's Democratic Republic	Social Acceptability Study Report: Field trials of sample households with selected improved high efficiency wood burning cookstoves

*Previously classified as Economic Sector Work (ESW) and Technical Assistance (TA) at The World Bank. The new Advisory Services & Analytics (ASA) product line was introduced July 2016; activities have been retroactively reclassified.

TABLE A2.3

ESMAP Lending Operations Informed and Related World Bank Corporate and Project Results Indicators, FY2014–16

		FY2016				TARGET INDICATORS				
ESMAP ACTIVITY	WORLD BANK PROJECT (IDA/IBRD/GEF)	INVESTMENT LEVERAGED (\$ MILLION)			RENEWABLE ENERGY	ENERGY EFFICIENCY	ENERGY ACCESS	CO ₂ MITIGATION	DIRECT BENEFICIARIES	
		WB	OTHER FINANCIERS	TOTAL					BENEFICIARIES	OTHER
AFREA II— Africa Electrification Initiative	Electricity System Enhancement Project (Liberia, P120660)	10	USAID 2 Norad 20 GPOBA 10	53	✓		✓		113,700	
					People provided with access to electricity by HHs connections: 113,700 Average interruption frequency per year in the project area: 15% Connections to electricity grid: 26,100					
AFREA II— Africa Electrification Initiative	Additional Financing for Energy Development and Access Project (Ghana, P147878)	60	—	60	✓		✓	✓	1,950,000	
					Electricity losses per year in the project area: 20% Tones of CO ₂ Avoided through the adoption of Renewable Energy: 250,000					
AFREA II— Mali: Support to Energy Services Access	Rural Electrification Hybrid System Project (Mali, P131084)	25	GPOBA 5 Strategic Climate Fund Grant 15.4	45.4	✓		✓	✓	1,060,000	
					People provided with access to electricity by HHs connections (Off-grid): 681,000 Generation Capacity of Renewable Energy (solar) constructed: 4.8 MW Greenhouse gas emission reductions: 21,900 Tons/year					
Development of Myanmar National Electrification Program	Electric Power Project (Myanmar, P143988)	140	—	140			✓	✓	n/a	✓
					Increase in electricity generation: 770 GWh Reduction of CO ₂ emissions per output generated: 400 g CO ₂ eq/kWh MOEP/MEPE staff involved in training and capacity building activities: 100					
Jordan Energy Sector Assistance: NEPCO Restructuring, Procurement Review, LNG Capacity Building	First Programmatic Energy and Water Sector Reforms Developmental Policy Loan (Jordan, P154299)	250	—	250	✓	✓			n/a	✓
					Share of MW renewable power in the generation mix: 10% Increase in energy efficiency savings in the water sector as per the implementation of the Action Plan accompanying the Energy Efficiency and Renewable Energy Policy: 50 GWh Cost recovery of the end user electricity tariffs: 100%					
China: Green Logistics for Chinese Municipalities: Application in Xiaogan and Beyond	Hubei Xiaogan Logistics Infrastructure (China, P132562)	100	Borrower: PEOPLE'S REPUBLIC OF CHINA 51.02	152.02	<i>Project Results Framework not publicly available as of December 2016 (in draft)</i>					
China: Wuhan Integrated Transport Development Project— Learning from Best International Practice in Smart Transport and Energy Efficiency	Wuhan Integrated Transport Development (China, P148294)	120	Borrower: PEOPLE'S REPUBLIC OF CHINA 87.91	207.91		✓			n/a	✓
					Percentage of users satisfied with public transport service at the terminals of targeted corridors in Anlu: 60% Percentage of pedestrians satisfied with the walking environment in the Anlu downtown area: 60% Bus ridership in Anlu: 27,397					



TABLE A2.3 Continued

FY2016										
ESMAP ACTIVITY	WORLD BANK PROJECT (IDA/IBRD/GEF)	INVESTMENT LEVERAGED (\$ MILLION)			TARGET INDICATORS					
		WB	OTHER FINANCIERS	TOTAL	RENEWABLE ENERGY	ENERGY EFFICIENCY	ENERGY ACCESS	CO ₂ MITIGATION	DIRECT BENEFICIARIES	OTHER
Kyrgyz Republic: Urban Development Project	Urban Development Project (Kyrgyz Republic, P151416)	12	Borrower: KYRGYZ REPUBLIC 2.4	14.4		✓				59,327
						Projected lifetime energy savings: 16414 MWh Number of municipal infrastructure assets and facilities with increased Energy Efficiency: 6 Streets with improved streetlighting: 14 km Number of towns with Energy Saving Plans: 2				
AFREA II— Lighting Africa Expansion	Electricity Network Reinforcement and Expansion Project (Ethiopia, P155563)	200	Borrower: GOVERNMENT OF ETHIOPIA 43 Energy SME Support to Sub-Saharan Africa, 5	248		✓				9,675,000
						Number of HHs connected to the grid: 150,000 Number of HHs with access to modern energy services (off-grid): 2,000,000				
AFREA II— Lighting Africa Expansion	Rural Electrification Expansion Program (Tanzania, P153781)	200	CIF 25	225		<i>Project Results Framework not publicly available as of December 2016 (in draft)</i>				
AFREA II— Lighting Africa Expansion	Liberia Renewable Energy Access Project (Liberia, P149683)	2	Strategic Climate Fund Grant 25	27	✓		✓			150,000
						People provided with access to electricity by HHs connections (Off-grid): 50,000 Distribution lines constructed or rehabilitated under the project: 58 km People with access to modern energy services under the project through stand-alone solar PV systems: 100,000 Annual electricity output from renewable energy as a result of SREP interventions: 5.8 GWh				
AFREA II— Niger Electricity Access Expansion	Electricity Access Expansion Project (Niger, P153743)	65	—	65			✓			326,400
						People provided with access to electricity by HHs connections: 326,400 Distribution lines constructed or rehabilitated under the project: 695 km				
Armenia Financial Recovery of the Power Sector	Power Sector Financial Recovery Program (Armenia, P157571)	30	Borrower: MINISTRY OF FINANCE OF THE REPUBLIC OF ARMENIA 0.5 Private sector: 10	40.5						3,038,000 ✓
						Percent of tariff-setting related questions and inquiries (gender-disaggregated) responded to by PSRC within stipulated service standards for response time: 100% Total annual electricity supply by ANPP is maintained				
International Conference on Energy Efficiency in Cities	Municipal Energy Efficiency Project (Mexico, P149872)	100	Borrower: MINISTRY OF FINANCE (SHCP) 56	156		✓		✓		n/a
						Projected lifetime energy savings: 1,020,714 MWh Framework to scale up municipal energy efficiency in the country: Framework accepted by the SENER Projected lifetime greenhouse gas emission reductions (tCO ₂ e): 463,405 Tons/year				
TOTAL		1,314	370	1,684						

TABLE A2.3 *Continued*

FY2015											
ESMAP ACTIVITY	WORLD BANK PROJECT (IDA/IBRD/GEF)	INVESTMENT LEVERAGED (\$ MILLION)			TARGET INDICATORS						
		WB	OTHER FINANCIERS	TOTAL	RENEWABLE ENERGY	ENERGY EFFICIENCY	ENERGY ACCESS	CO ₂ MITIGATION	DIRECT BENEFICIARIES	OTHER	
Energy Efficiency in Water and Wastewater Utilities in LCR	Brazil Espirito Santo Integrated Sustainable Water Management Project (Brazil, P130682)	225	Borrower: STATE OF ESPIRITO SANTO 98.1	323.1		✓				2,630,000	✓
					New household sewer connections constructed under the project: 32,897 People provided with access to "improved sanitation facilities" under the project: 164,485						
Papua New Guinea (PNG) Renewable Energy (RE) Resource Mapping and Geospatial Planning	PNG Energy Sector Development Project (PNG, P101578)	7.3	Borrower: GOVERNMENT OF PAPUA NEW GUINEA 1.05	8.35	✓		✓			n/a	✓
					Improved GoPNG institutional capacity in the energy sector to support future investment in rural and renewable energy: Yes Rural and Renewable energy policies submitted to Cabinet and rural electrification strategy completed following participatory process: Yes Planning study is completed as a key input to preparing future hydropower projects for investment: Yes						
Local Benefit Sharing for Hydropower Projects in Indonesia	Upper Cisokan Pumped Storage Hydro-Electrical Power (1040 MW) Project (Indonesia, P112158)	640	Borrower: REPUBLIC OF INDONESIA 160	800	✓					n/a	✓
					Generation Capacity of Hydropower constructed or rehabilitated under the project: 1040 MW Construction of 500 kV transmission line: 100% Improved capability of PLN in planning, development and operation of hydropower pump storage power projects in accordance with international practice: PLN fully capable						
Gender and Energy Program	Comoros Electricity Sector Recovery Project (Comoros, P131659)	5	—	5			✓			200,000	✓
					Female beneficiaries: 50% Electricity losses per year in the project area: 37.5%						
Egypt Gas Regulator Capacity Building	Household Natural Gas Connection Project (Egypt, P146007)	500	Borrower: MINISTRY OF INTERNATIONAL COOPERATION 473 French Agency for Development 96 European Neighborhood Instrument 78.9 Private sector: 326	1,473.9			✓			6,750,000	✓
					Establishment of a Gas Regulator: Yes Customer service centers in targeted areas established and operational: 11 Natural gas household connections financed by the project in targeted areas: 1,500,000						



TABLE A2.3 Continued

		FY2015								
ESMAP ACTIVITY	WORLD BANK PROJECT (IDA/IBRD/GEF)	INVESTMENT LEVERAGED (\$ MILLION)			TARGET INDICATORS					
		WB	OTHER FINANCIERS	TOTAL	RENEWABLE ENERGY	ENERGY EFFICIENCY	ENERGY ACCESS	CO ₂ MITIGATION	DIRECT BENEFICIARIES	OTHER
India: Efficient & Sustainable City Bus Services— Capacity Building Program in Fuel Efficiency (P132418)	Efficient & Sustainable City Bus Services (India, P132418)	9.2	—	9.2		✓		✓	235,000,000	
					Reduction in greenhouse gas emissions in project cities over a period of 10 years as a result of adoption of modernization initiatives from the Business as Usual (BAU) scenario: 230,000					
					Improvement in bus fuel efficiency in demo cities by at least 15% relative to business as usual: 15%					
					Demo cities have institutional systems in place for M&E of bus fuel efficiency program: Yes					
					At least 50% NURM cities out of a total 67 cities are trained in/exposed to best practices in low-carbon programs including improved fuel efficiency techniques: 33%					
Results-Based Funding for Energy Sector Development (P127532)	Lao PDR Health Governance and Nutrition Development Project (Lao PDR, P151425)	26.4	—	26.4			n/a		1,400,000	
Energy Subsidy Reform and Delivery: Safeguarding the Poor and Vulnerable; Tariff Setting Methodology	Energy Sector Development Policy Operation (Kyrgyz Republic, P152440)	24	—	24					n/a	✓
					Power sector revenue allocated based on the tariffs for power sector companies set according to the approved methodology: Yes					
					Cash collected per kWh of power generated increased from 0.59 Som/kWh to 0.64 Som/kWh					
					Public awareness about the country's energy sector challenges and reforms increased from 17% to 27% and the State Regulatory Agency of the Fuel and Energy Complex holds at least two public hearings					
Lighting Africa Expansion; Gender and Energy Program	Uganda Energy for Rural Transformation, III (Uganda, P133312)	135	Borrower: GOVERNMENT OF REPUBLIC OF UGANDA 33.2	168.2	✓		✓		7,600,000	✓
					People provided with access to electricity by household connections: 1,021,000					
					Female beneficiaries: 50%					
					Number of off-grid household solar system installations made under the project: 30,000					
Geothermal Scale-up Investment Plan	Geothermal Exploratory Drilling Project (Armenia, P152039)	—	Strategic Climate Fund Grant 8.55 Borrower: REPUBLIC OF ARMENIA 2.13	10.68					n/a	
					If geothermal resource is confirmed, power plant development is competitively awarded to qualified private developer(s): Yes					
					Feasibility study for a potential power plant completed: Yes					
					Tendering for private sector involvement in construction of a geothermal power plant completed if results from the feasibility study confirm technical and economic/financial viability of such a plant: Yes					
Total		1,572	1,277	2,849						

TABLE A2.3 *Continued*

FY2014										
ESMAP ACTIVITY	WORLD BANK PROJECT (IDA/IBRD/GEF)	INVESTMENT LEVERAGED (\$ MILLION)			TARGET INDICATORS					
		WB	OTHER FINANCIERS	TOTAL	RENEWABLE ENERGY	ENERGY EFFICIENCY	ENERGY ACCESS	CO ₂ MITIGATION	DIRECT BENEFICIARIES	OTHER
Model for Electricity Technology Assessment (META): Dissemination and Knowledge Sharing	Support to ONEE—Office National de l'Electricite (Morocco, P104265) Additional Financing for ONEE Project Support (Morocco, P145649)	150	—	150		✓				31,000,000
										Reduction in electric transmission losses: 4.3% Electricity savings due to CFLs deployment: 345 GWh Reduction of unserved energy: 230 MWh Peak power savings due to CFLs deployment: 0.2 GW
Peru Second Rural Electrification	Second Rural Electrification (Peru, P117864)	82.7	Borrower: GOVERNMENT OF PERU 10.6 Private sector: 22.1	50			✓		n/a	People provided with access to electricity by household connections: 140,000 Number of new connections: 34,000
Energy Access for the Peri-Urban/Urban poor	GPOBA W3 Kenya Electricity (Kenya, P125388)	—	GPOBA	5.15			✓		200,000	People provided with access to electricity by HHs connections: 40,000 Female beneficiaries: 50%
Biomass-based District Heating	Belarus Biomass District Heating Project (Belarus, P146194)	90	—	90	✓	✓		✓	n/a	Projected lifetime energy savings: 1,180,000 MWh Heat and electricity generated from renewable biomass associated with investments financed under the project: 8,300,000 MWh Projected lifetime reduction in CO ₂ emissions due to investments financed under the project: 2,100,000 metric tons Generation Capacity of Renewable Energy constructed: 106 MW
Luhri Hydro Electric Project	Development Policy Loan 2 to Promote Inclusive Green Growth and Sustainable Development in Himachal Pradesh (India, P143032)	—	CTF 100	100	✓				n/a	✓
										Percentage of operational hydropower projects that have the minimum environmental flow policy applicable and have adopted real-time monitoring: 84% Number of departments which begin integrating the State Climate Change Strategy and Action Plan in development plans and Payment for Ecological Services (PES) in their operational strategy: 11
District Heating AAA—Belarus and Ukraine	District Heating Energy Efficiency Project (Ukraine, P132741)	332	CTF 50	382		✓	✓	✓	n/a	
										Projected lifetime fuel savings: 2,602,600,000 MJ Energy savings of participating DH companies: 524 GWh Avoided CO ₂ emissions of participating DH companies: 261,850 tons/y People that gained access to more energy-efficient cooking and/or heating facilities: 721,400

TABLE A2.3 Continued

FY2014										
ESMAP ACTIVITY	WORLD BANK PROJECT (IDA/IBRD/GEF)	INVESTMENT LEVERAGED (\$ MILLION)			TARGET INDICATORS					
		WB	OTHER FINANCIERS	TOTAL	RENEWABLE ENERGY	ENERGY EFFICIENCY	ENERGY ACCESS	CO ₂ MITIGATION	DIRECT BENEFICIARIES	OTHER
Household Energy Guidance Note	DRC FIP Improved Forested Landscape Management (Congo DRC, P128887)	—	Strategic Climate Fund Grant 36.9	36.9	✓	✓	✓	✓	n/a	✓
					Greenhouse gas emission reductions (and removals) generated under the project: 3,250,000 metric tons Production of improved cookstoves: Yes Biomass energy produced in a sustainable manner: 802,500 metric tons					
Developing a Regulatory Framework for Maldives Energy Sector	Accelerating Sustainable Private Investment in Renewable Energy Project (Maldives, P145482)	16	Strategic Climate Fund Grant 11.68	27.68	✓	✓	✓	✓	n/a	✓
					Cumulative Installed Capacity of Solar Energy Constructed: 20 MW Private Capital Mobilized: 42 million					
Energy Sector Low Carbon Development Operational Support	Vietnam Climate Change Development Policy Loan 3 (Vietnam, P127201)	70	—	70	✓	✓	✓	✓	n/a	✓
					100 energy auditors completed training courses to support energy efficiency practices in industrial sector, of which 50 fully certified and 50 doing on the job training to become fully certified. 1,000 energy managers certified to support energy efficiency practices in industrial sector. 1,000 energy efficiency plans and implementation reports of large energy end users of the industrial sector are received by MOIT or provincial DOITs, of which 600 have been prepared by certified energy managers. Low carbon development assessment initiated.					
TOTAL		782	170	952						

Definitions and Disclaimers

- Total project cost includes funding from World Bank and non-bank sources in \$ millions. Active and Closed projects show commitment at Board approval. It does not reflect any cancellations.
- Borrower refers to the Borrower of a Loan or Recipient of a Grant
- Additional Financing projects do not report results separately; results are reported at the parent project level.
- Corporate Result Indicators are used by task teams to monitor the results of operations and are aggregated to report IBRD and IDA results to internal and external stakeholders. When drafting the Corporate Result Indicators, Task teams are advised to seek specific guidance from the GP Strategy and Operations team.
- The Corporate Result Indicators for the Energy and Extractives Global Practice (GP) are
 - Generation capacity of energy constructed or rehabilitated, with underlying indicators on: thermal power generation capacity constructed or rehabilitated under the project; hydropower generation capacity constructed or rehabilitated under the project; renewable energy generation capacity (other than hydropower) constructed under the project; and renewable energy generation capacity (other than hydropower) rehabilitated under the project.
 - Projected energy or fuel savings, with underlying indicators on projected lifetime energy savings; projected lifetime fuel savings; projected electricity generation savings.
 - People provided with new or improved electricity service, with underlying indicators on people provided with access to electricity services under the project by household connections (grid or off-grid); new community electricity services under the project; additional generation capacity under the project.
- Global Practices and Strategy and Operations teams are responsible for ensuring that relevant Result Indicators are used in the results frameworks during preparation and reported in the Implementation Status Reports (ISR) throughout the life of all operations.
- Corporate Result Indicators are complemented by intermediate and final outcome indicators in the form of Project Results Indicators and custom indicators which are chosen by the task teams in the Global Practice/Cross Cutting Solution Area (CCSA).
- The tables report both Corporate Result Indicators and Project Results Indicators, as relevant to the ESMAP objectives.
- Most of the reported projects above are still ongoing, therefore the table reports primarily target values for both Corporate Result Indicators and Project Results Indicators. Actual results will be reported once the project is closed, in the Implementation and Completion Report (ICR).

ANNEX III | ASTAE RESULTS, FY2016: INDICATORS ACHIEVED AND WORLD BANK GROUP OPERATIONS INFLUENCED

By providing advisory services and technical assistance, ASTAE supports the preparation, execution, and evaluation of World Bank energy projects in East and South Asia. ASTAE's result indicators include only IDA/IBRD/GEF-CTF financed projects that are approved by the Board. Eight

ASTAE-supported IDA/IBRD/GEF-CTF projects were approved by the Board for a total of 1.05 billion in FY2016. The cumulative FY2012–16 total is \$6.282 billion, exceeding the target for the current Business Plan. Physical target indicators are obtained from the Project Appraisal Documents of IDA/IBRD/GEF-CTF projects that ASTAE supported.

Table A3.2 links the ASTAE activities and the IDA/IBRD/GEF-CTF projects that contributed to the above ASTAE indicators during FY2016.

TABLE A3.1

ASTAE Business Plan Result Framework, FY2012–16 ¹						
DIRECT INDICATORS	UNIT	VALUE PLEDGED FY2015	VALUE ACHIEVED FY2012–15	VALUE ACHIEVED FY2016	VALUE ACHIEVED FY2012–16	PROGRESS (%)
1. Total World Bank Lending Catalyzed by ASTAE Activities						
Project and Program Lending	US\$ million	3,200	5,232	1,050	6,282	194%
2. New Capacity and Increased Generation of Renewable Electricity						
Renewable Energy, Capacity	MW	1,500	1,372	112	1,484	99%
Renewable Energy, Generation	GWh/yr	3,000	2,868	344	3,212	107%
3. Electricity Savings Resulting from Efficiency Improvements						
Energy Savings, Capacity	MWe	1,000	351	25	376	38%
Energy Savings, Generation	GWh/yr	2,000	2,829	162	2,991	150%
4. Households with Access to Modern Energy Services						
Access to Electricity (new)	households	2,000,000	558,000	4,802,500	5,360,500	268%
Access to Electricity (improved)	households	1,000,000	313,000	—	313,000	31%
Improved Stoves for Heating (cooking & space)	households	5,000,000	1,195,000	800,000	1,995,000	40%
5. Avoided Greenhouse Gas Emissions						
Direct CO ₂ Avoided over 20 Years	million tons	200	379	32	411	205%
6. Countries Benefiting from ASTAE Support						
Number of Countries	countries	15	21	21	21	140%

Note: *Direct* refers to values achieved, or expected to be achieved, in the course of World Bank-funded projects that benefited from ASTAE support.

¹These numbers have been updated since the publication of the previous Annual Report.

TABLE A3.2

Link between ASTAE Activities, Bank Projects FY2016

ASTAE ACTIVITY (FISCAL YEAR WHEN ACTIVE)	WORLD BANK PROJECT (IDA/IBRD/GEF) (FISCAL YEAR APPROVED)	INDICATORS					SOURCE OF INDICATOR
		INVESTMENT LEVERAGE (\$ MILLION)	RENEWABLE ENERGY PILLAR	ENERGY EFFICIENCY PILLAR	ACCESS PILLAR	CO ₂ MITIGATION	
AFGHANISTAN							
Solar Market Development for Off-grid Access in Pakistan and Afghanistan (FY13) The original activity was re-structured to focus in Afghanistan only and to include grid-connections. The activity supports gathering and analyzing data on rural and urban off- or on-grid energy connectivity, capacity, delivery mechanisms, lessons learnt for Afghanistan	Afghanistan Power System Development Project Additional Financing (P152975; FY16)	15.0			18,000 households connected		World Bank Project Paper
CHINA							
EAP-Clean Stoves Initiative (FY13) The regional CSI supported discussion and integration of lessons from RBF pilots in two villages to support drafting an implementation plan using the RBF approach for at state and national levels.	Hebei Air Pollution Prevention and Control Program (P154672; FY16)	80.0			800,000 stoves		World Bank Project Appraisal Document. Annex 2: Result Framework
INDIA							
Support to 24x7 Power for All Program in India: The states of Andhra Pradesh & Rajasthan (FY16) Activities in Rajasthan include a diagnostic study covering aspects of feeder metering, consumer indexing, energy audits, and IT systems and commercial processes, among others, and assistance for improving the action plan for turnaround and implementation support.	First Programmatic Electricity Distribution Reform Development Policy Loan for Rajasthan (P157224; FY16)	250.0			2,550,00 new connections	LEDs 0.71mt/year 14.7 mt over 20y	World Bank Project Appraisal Document and state electrification plans (for DPL)
INDONESIA							
Renewable Energy Access Improvement (FY12) Initially focused on supporting PLN, the national power utility in preparing and implementing its 1,000 islands electrification program, it was refocused on helping preparing the Program for Result project.	Power Distribution Development Program-for-Results (P154805; FY16)	215.0 (Access part only)			390,000 direct new connections; 3.2 million indirect		World Bank Project Appraisal Document. Annex 2: Result Framework

TABLE A3.2 *Continued*

Link between ASTAE Activities, Bank Projects FY2015

ASTAE ACTIVITY (FISCAL YEAR WHEN ACTIVE)	WORLD BANK PROJECT (IDA/IBRD/GEF) (FISCAL YEAR APPROVED)	INDICATORS					SOURCE OF INDICATOR
		INVESTMENT LEVERAGE (\$ MILLION)	RENEWABLE ENERGY PILLAR	ENERGY EFFICIENCY PILLAR	ACCESS PILLAR	CO ₂ MITIGATION	
MYANMAR							
<p>Strengthening Institutions for On- and Off-Grid Electrification in Myanmar (FY14) The activities strengthened the institutional capacity for on- and off-grid electrification in Myanmar and supported the implementation of the Myanmar National Electrification Plan.</p>	National Electrification Project (P152936; FY16)	400.0	27 MW (SHS)		1.242 million new connections by 2021	7.1 mt over lifetime	World Bank Project Appraisal Document. Annex 2: Result Framework
NEPAL							
<p>Support to Sustainable Hydropower Development in Nepal (FY13) Technical assistance for capacity building for hydropower projects development and management including financial, environmental, and engineering issues</p>	Nepal: Power Sector Reform and Sustainable Hydropower Development (P152936; FY16)	22.5					World Bank Project Appraisal Document
PHILIPPINES							
<p>Capacity Strengthening of the National Electrification Administration, Department of Energy and the Energy Regulatory Commission (FY15) The activity supported the strengthening of key agencies in the Philippines so as to be able to access an EU, grant-financed technical assistance and subsidy funding project.</p>	Access to Sustainable Energy Project (P153268; FY16)	23.4	14MW		202,500		World Bank Project Appraisal Document Annex 1: Result Framework
<p>Electric Cooperatives Reform and Restructuring, Phases I and II (FY13, FY14) To ensure that Energy Cooperatives can rise to the challenge of accelerating investment in generation, networks and new connections, the activity supported sorting critical institutional issues during the final preparation and initial implementation of CTF, and helped ensure a higher level of readiness when it became effective.</p>	Philippines Renewable Energy Development (P147646; FY16)	44.0	75MW and 344GWh/year	25MWe 162 GWh/year	400,000	10.4 mt over 20y	World Bank Project Appraisal Document Annex 5: Result Indicators



ANNEX IV | COMPLETED, NEW, AND ONGOING ACTIVITIES, FY2016

TABLE A4.1

ESMAP Completed, New, and Ongoing Activities, FY2016			
COMPLETED ACTIVITIES			
Project ID	Country/Region	Activity	Task Manager
AFRICA RENEWABLE ENERGY ACCESS PROGRAM (AFREA)			
P149492	AFR	AFREA II: Review of Hydropower Development in Africa	Catherine Tovey
P147765	AFR	AFREA II: Road Map for Energy Access Program for Results	Manuel Berlingiero
P147750	Niger	Electricity Access Expansion	Pedro Sanchez
CLEAN ENERGY			
P146364	Global	Turn Down the Heat—Phase 3	Kanta Rigaud
P113078	Indonesia	Geothermal Clean Energy Investment Project	Anh Pham
P147643	Lebanon	Lebanon—Wind Energy Resource Mapping	Daniel Daurella
P077717	Mexico	Renewable Energy Forum	Karen Bazex
P124181	Uruguay	Low Carbon Study	Holger Kray
ENERGY ACCESS			
P127837	Bolivia	Deploying new solar technologies for isolated rural areas: supporting their adoption in LAC	Lucia Spinelli
P146792	Global	Piloting Multi-Tier Energy Access Metric	Mikul Bhatia
	India	India: State-Level Dissemination of India Power Sector Review	Mohua Mukherjee
P151986	South Asia	Strategic Communication for Improving Governance and Efficiency in the Power Sector	Ashish Khanna
ENERGY EFFICIENCY			
P146249	Belarus	Heat Tariff Reform and Social Impact Mitigation	Fan Zhang
P152143	Belarus	Scaling Up Energy Efficiency in the Building Sector	Feng Liu
P098916	China	GEF FSP—CHINA: ENERGY EFFICIENCY FINANCING PROJECT	Xiaodong Wang
P152761	ECA	Knowledge Sharing and Energy Efficiency Outreach	Kathrin Hofer
P128416	ECA	Wholesaling Energy Efficiency in Water Utilities in the Danube Region	David Michaud
P148192	Egypt, Arab Republic of	Data Analytics for Urban Transport to Mitigate Climate Change: Cairo	Isabelle Ngoc Dung Huynh
P146468	Global	Capacity Building for Leaders in Energy Efficient Urban Transport Planning	Marc Shotten
TF015405	Global	MACTool: China	Victor Loksha
P146316	Indonesia	Reforming the Minibuses in Surabaya	Reindert Westra
P147640	Iraq	Iraq Energy Efficiency Action Plan	Ferhat Esen
P146986	LCR	Energy Efficiency in Water and Wastewater Utilities in Latin America and Caribbean	Carmen Yee-Batista
P110092	Nicaragua	ENACAL Master Plan for Operational Efficiency in Managua/Nicaragua	Lilian Weiss
P153321	Panama	Delivery of Technical Assistance to the Government of Panama to Reduce Barriers for the Development and Use of Renewable Energy and Energy Efficiency	Mark Lambrides

TABLE A4.1 *Continued*

ESMAP Completed, New, and Ongoing Activities, FY2016			
P132401	Philippines	Metro Manila Bus Network Optimization Plan	Ajay Kumar
P132250	Sri Lanka	Colombo Low Carbon Urban Transport Technical Assistance	Zhiyu Chen
P146501	Turkey	Energy Efficiency Institutional Review	Jasneet Singh
P152325	Ukraine	Sustainable Urban Transport for the City of Kyiv	Jung Oh
P150553	Ukraine	Energy Efficiency Transformation in Cities	Tamar Sulukhia
P146206	Uzbekistan	Least Cost Assessment for the Heating Sector of Uzbekistan	Pekka Salminen
P101289	West Bank and Gaza	Energy Management for Water Utility Program	Iyad Rammal
ENERGY ASSESSMENTS AND STRATEGIES			
P148096	AFR	Assessment of the Interactions between the Power and Water Supply Sectors in Kenya and Malawi and their Operational, Economic and Environmental Implications	Andreas Rohde
P154276	Armenia	Armenia: Financial recovery of the power sector	Artur Kochnakyan
P146249	Belarus	Belarus Heat Tariff Reform and Social Impact Mitigation	Fan Zhang
P149893	Burkina Faso	Energy Mix Diversification in Burkina Faso	Jan Kappen
P147772	Dominican Republic	Strengthening Capacity for Commodity Risk Management in the Energy Sector in the Dominican Republic	David Reinstein
P150205	ECA	ECA Energy Subsidy Core Group	Ani Balabanyan
P129680	Egypt, Arab Republic of	Egypt Energy Pricing and Subsidy Technical Assistance	Sudeshna Banerjee
P148325	EU Accession Countries	Western Balkans Biomass Heating Study	Jari Vayrynen
	Global	International Experience with Private Sector Participation in Power Grids	Victor Loksha
	Global	Operational Support—EASP	Sameer Shukla
P144921	Guatemala	Best practices for sustainable hydropower development	Ernesto Sanchez-Triana
	Haiti	Distributional Analyses and Reform Options for Petroleum Price Reforms	Raju Singh
P104034	Honduras	Strategic Engagement in the Power Sector	Koffi Ekouevi
P154859	Iraq	Iraq Best Practice: Public Investment in Power Infrastructure	Paul Baringanire
P112780	Jamaica	Jamaica Emergency Integrated Resource Plan	Todd Johnson
P154684	Kyrgyz Republic	Tariff Setting Methodology	Ani Balabanyan
P147007	LCR	Pricing Policies in the Energy Sector	Koffi Ekouevi
P151113	Moldova	District Heating and Electricity Tariff and Affordability Analysis	Shinya Nishimura
P146401	Moldova	Moldova Power Sector Note	Sandu Ghidirim
P123636	Philippines	Electric Cooperative Regulatory Efficiency	Alan Townsend
P149638	Turkey	Energy Reform Milestones and Challenges	Kari Nyman
P147492	Turkey	Social Compact in Electricity Privatization in Southeastern Turkey	Zeynep Darendeliler
P147355	Western Africa	Liquefied Natural Gas Import Options for West Africa	Sunil Mathrani
NEW ACTIVITIES			
Project ID	Country/Region	Activity	Task Manager
AFRICA RENEWABLE ENERGY ACCESS PROGRAM (AFREA)			
P155061	Botswana	Renewable Energy and Energy Efficiency Strategies	Joseph Kapika
P157240	Congo, Democratic Republic of	AFREA II: Scaling Up Electricity Access	Alain Ouedraogo

TABLE A4.1 *Continued*

ESMAP Completed, New, and Ongoing Activities, FY2016			
P155065	Cote d'Ivoire	Electricity Access Scale-Up Program	Sunil Mathrani
CLEAN ENERGY			
P158461	Costa Rica	Scaling Up Distributed Generation with Roof-top Solar PV	Mariano Serrano
P159698	Fiji	Pre-feasibility study and road map for development geothermal power in the Republic of Fiji	Kamleshwar Khelawan
P157434	Global	ESMAP Variable Renewable Energy Grid Integration Support Program	Silvia Romero
P154681	Guatemala	Wind and Solar Integration Study	Mariano Serrano
P156974	India	Solar Parks: Grid Integration Study and Capacity Building	Demetrios Papathanasiou
P112158	Indonesia	Indonesia—Philippines South—South Knowledge Exchange event	Peter Johansen
P112158	Indonesia	Support to the Integrated Catchment Management—informed project preparation of Matenggeng Pumped Storage Hydro-Electrical Project	Peter Johansen
P153179	Kenya	Geothermal Strategy	Sudeshna Banerjee
P157685	Kyrgyz Republic	Improving Enabling Environment for Small Hydropower in Kyrgyzstan	Kathrin Hofer
P152653	Pacific Islands	Variable Renewable Energy Grid Integration for Pacific Islands Sustainable Energy Industry Development Project	Leopold Sedogo
P157023	Sri Lanka	Capacity Building for Planning and VRE Grid Integration	Zhuo Cheng
ENERGY ACCESS			
P127837	Bolivia	International Workshop on Deploying New Solar Technologies in Isolated Rural Areas: Supporting their Adoption in the LCR Region	Lucia Spinelli
P154672	China	Clean Stoves Initiative in Supporting Hebei Pollution Prevention and Control Program	Garo Batmanian
P155065	Cote D'ivoire	Electricity Access Scale-Up Program	Sunil Mathrani
P156948	Global	Efficient, Clean Cooking and Heating (ECCH) Program	Wendy Hughes
P156666	Global	Global Survey for Multi-Tier Energy Access Tracking	Dana Rysankova
P127974	India	North East Region Assessment of Transmission & Distribution Projects Impact on Access to Electricity	Rohit Mittal
P155038	India	Support to Electricity Distribution System Strengthening and Modernization in Andhra Pradesh	Mani Khurana
P144213	Indonesia	Supervision and Preparation of Scale-Up of Indonesia CSI Pilot	Yabei Zhang
P151425	Lao People's Democratic Republic	Lao PDR Cookstove Initiative	Somil Nagpal
P149683	Liberia	Renewable Energy Access Project	David Vilar Ferrenbach
P150382	Mali	Rural Electrification Hybrid System: CEMG Initiative	Manuel Berlengiero
P152936	Myanmar	National Electrification Project: Inclusive Community Participation	Dejan R. Ostojic
ENERGY EFFICIENCY			
P156861	Bangladesh	Bangladesh: Energy Efficiency Improvement Program in Industries	Ashok Sarkar
P158862	Belarus	Belarus: End User Heat Control and Cost Allocation Project	Feng Liu
P156612	Brazil	Energy Efficiency and Wastewater Re-use Recommendations for Espirito Santo's Water and Sewerage Utility (CESAN)	Jean-Martin Brault
P132562	China	China: Green Logistics for Chinese Municipalities	Reda Hamedoun
P133017	China	Energy Saving Management Action Plan for Water and Wastewater Utilities in Guilin	Sing Cho

TABLE A4.1 *Continued*

ESMAP Completed, New, and Ongoing Activities, FY2016			
P149499	EAP	Green Transport Information and Communication Technology	Holly Krambeck
P157135	ECA	Energy Efficiency Financing Option Papers for Kosovo, Turkey and Georgia	Jasneet Singh
P154867	Egypt, Arab Republic of	Towards Energy Efficiency Implementation in Cities in Egypt	Pedzisayi Makumbe
P119063	Ghana	Exploring the Potential for the Application of Solar PV Pumping Technologies in the Water Supply Sector—Utility Energy Efficiency Business Model	Sanyu Sarah Senkatuka Lutalo
P154030	Global	Capacity Building for Leaders in Energy Efficient Urban Transport Planning—2	Thierry Desclos
P158386	Kyrgyz Republic	Improving Efficiency of Individual Heating Solutions	Kathrin Hofer
P157566	LCR	Achieving energy efficient transport in cities in Latin America	Camila Adriana Rodriguez Hernandez
P146691	Lebanon	Promoting Energy Efficiency in Bus Rapid Transit	Ziad Salim EL Nakat
P149872	Mexico	International Conference on Energy Efficiency in Cities	Karen Bazex
P157932	Mexico	Sustainable Land Use for Energy Efficient Cities	Angelica Nunez del Campo
P156179	Morocco	Morocco City Energy Efficiency	Manaf Touati
P150361	Tanzania	Dar es Salaam City Water and Sewerage Services Energy Efficiency Review	Yitbarek Tessema
P151006	Tanzania	Cycle Mapping for Improved Urban Mobility	Edward Anderson
P159268	Uzbekistan	Towards Energy Efficient Resilient Cities in Uzbekistan	Rosanna Nitti
P116846	Vietnam	Support the MOIT to finalize the design of next phase of the Vietnam National Energy Efficiency Program, 2016–20	Ky Hong Tran
ENERGY ASSESSMENTS AND STRATEGIES			
P158632	Algeria	Energy Subsidies and Price Reform in Algeria	Moez Cherif
P160031	Armenia	Improvement of Power—Tariff Setting and Addressing of Social Impacts of Tariff Increases	Nistha Sinha
P158671	Azerbaijan	Poverty and Social Impacts of Improving Fiscal Sustainability and Quality of Power Distribution in Azerbaijan	Nistha Sinha
P150086	Bangladesh	Policy and System Requirements for Scaling Up Power Trade in Bangladesh	Sheoli Pargal
P157714	Bosnia & Herzegovina	Bosnia & Herzegovina Power Sector Note	Jari Vayrynen
P156023	Egypt, Arab Republic of	Programmatic Energy Reforms in Egypt—Technical Assistance	Ashish Khanna
P146616	Ethiopia	Energy Sector Review and Strategy	Issa Diaw
P157812	Global	Energy Subsidy Reform Assessment Framework	Praveen Kumar
P156184	Global	Energy Subsidy Reform Knowledge Events	Victor Loksha
P155434	Global	Energy Subsidy Reform Knowledge Products	Bipulendu Singh
P147403	Global	Enhancing Knowledge Sharing on Subsidy Reforms: Case Studies on Political Economy of Energy Subsidy Reform	Maria Gabriela Inchauste Comboni
P157376	Global	Rethinking Power Sector Reform	Vivien Foster
P155903	Global	Energy Subsidy Reform Experts—Peer Panel	Thomas Flochel
P156185	Global	ESMAP Energy Subsidy Reform Online Community	Thomas Flochel

TABLE A4.1 *Continued*

ESMAP Completed, New, and Ongoing Activities, FY2016			
P155192	Haiti	Distributional Analyses and Reform Options for Petroleum Price Reforms in Haiti, Phase II	Evans Jadotte
P155966	Iraq	Energy Subsidies and Tariff Reform	Sheoli Pargal
P151876	Jordan	Energy Sector Assistance: NEPCO Restructuring, Procurement Review, Liquefied Natural Gas Capacity Building	Ferhat Esen
P120014	Kenya	Implementation Road Map of Energy Bill	Sudeshna Ghosh Banerjee
P158942	Latin America	Challenges and Opportunities in the Energy Sector	Gabriela Elizondo Azuela
P156222	Lebanon	Assessment of the legal and administrative barriers for the development of the national hydropower market for Lebanon	Manaf Touati
P153084	Madagascar	Pump Fuel Price Subsidy Removal Technical Assistance	Faniry Nantenaina Razafimanantsoa Harivelo
P151457	Mekong	Greater Mekong Sub-Region Power Market Development Programmatic Technical Assistance	Dejan R. Ostojic
P157697	MNA	Support to MENA Countries Preparedness of Social Safety Nets for Subsidy Reform—Algeria, Djibouti, Jordan, Morocco, Tunisia, Yemen	Amr Moubarak
P159050	Moldova	Power System Interconnection Analysis	Sandu Ghidirim
P143988	Myanmar	Economic Cost of Natural Gas Study	Dejan R. Ostojic
P150066	Nepal	Conflict Management and Prevention for Energy Projects	Jie Tang
P159271	Serbia	Natural Gas Sector Analysis	Katharina Gassner
P158779	South Eastern Europe & Balkans	Supporting Energy Subsidy Reform In Southeast Europe	Trang Van Nguyen
P155872	Turkey	Sustainability of Electricity Distribution Companies	Kari Nyman
P158496	Ukraine	Facilitating Electricity and Gas Market Reforms in Ukraine	Ani Balabanyan
P159624	Ukraine	Advice to the Design of Energy Efficiency Fund	Feng Liu
P157758	Ukraine	Advancing Energy Tariff and Subsidy Reforms	Ani Balabanyan
P157270	Uzbekistan	Power Sector Planning Study	Samuel Oguah
P153801	Uzbekistan	Impact of Energy Subsidies—Way Forward	Yadviga Semikolenova
P147685	Vietnam	Electricity Market Simulation Model of Vietnam	Aidan Gregan
P157760	Vietnam	Electricity Vietnam: Communications Strategy for Tariff Reform	Mai Thi Hong Bo
P157552	Vietnam	Road Map for Natural Gas Market Development	Alan Townsend
P157852	Vietnam	Energy Subsidy Reform Phase 1	Masami Kojima
P157348	West Bank & Gaza	Securing Energy for Development in West Bank and Gaza	Roger Coma Cunill
ONGOING ACTIVITIES			
Project ID	Country/Region	Activity	Task Manager
AFRICA RENEWABLE ENERGY ACCESS PROGRAM (AFREA)			
P149497	AFR	AFREA II: Africa Region Solar Strategy	Christopher Saunders
P149119	AFR	AFREA II: Gender and Energy Program	Awa Seck
P146987	AFR	AFREA II: Lighting Africa Expansion	Raihan Elahi
P146621	AFR	AFREA II: Africa Clean Cooking Energy Solutions (ACCES)	Jan Kappen
P150241	AFR	AFREA II: African Rural Electrification Concession	Richard Hosier
P150323	AFR	AFREA II: Power and Agriculture in Sub-Saharan Africa	Sudeshna Banerjee

TABLE A4.1 *Continued***ESMAP Completed, New, and Ongoing Activities, FY2016**

P146443	AFR	AFREA II: Africa Electrification Initiative	David Ferrenbach
P146263	AFR	AFREA II: New Models to Scale Up Power Generation Investments in Africa	Elvira Morella
P149441	AFR	Increased Electricity Access Support Program	David Ferrenbach
P146627	AFR	Role of Subsidies: Financing Electricity Supply and Providing Affordable Access in Sub-Saharan Africa	Christopher Trimble
P152126	Gabon	AFREA II: Rural Electrification and Water Services Sustainability Mechanism	Stephan Garnier
P153220	Madagascar	Support for the development of small hydropower IPP	Vonjy Rakotondramanana
P150382	Mali	AFREA II: Support to Energy Services Access	Thierno Bah
P147397	Nigeria	AFREA II: Electrification Access Program Development Technical Assistance	Rahul Kitchlu
P146618	Somalia	AFREA II: Power Sector Development Plan	Anders Pedersen
P145581	South Sudan	Energy Sector Technical Assistance Project	Rahul Kitchlu
CLEAN ENERGY			
P149522	Belize	Energy Resilience for Climate Adapt	Migara Jayawardena
P146371	Brazil	Interface between Carbon and Energy Pricing Policy	Christophe de Gouvello
P152820	Chile	Technical Assistance for Sustainable Geothermal Development in Chile	Migara Jayawardena
P151309	Ethiopia	Renewable Energy Resource Mapping and Geospatial Planning: Ethiopia	Issa Diaw
P148174	Global	World Bank Staff Training on VRE Integration as part of the Power System Planning Program	Rhonda Antoine
P155047	Indonesia	Capacity Strengthening and Risk Mitigation for Geothermal Development	Peter Johansen
P145273	Indonesia	Renewable Energy Resource Mapping and Geospatial Planning: Indonesia	Aidan Gregan
P144569	LCR	Technical Assistance for Geothermal Project Preparation in LCR	Migara Jayawardena
P145350	Madagascar	Renewable Energy Resource Mapping and Geospatial Planning: Madagascar	Vonjy Miarintsoa Rakotondramanana
P151289	Malawi	Renewable Energy Resource Mapping and Geospatial Planning: Malawi	Maria Isabel Neto
P146018	Maldives	Renewable Energy Resource Mapping and Geospatial Planning: Maldives	Abdulaziz Faghi
P150328	Nepal	Renewable Energy Resource Mapping: Nepal	Tomoyuki Yamashita
P146140	Pakistan	Renewable Energy Resource Mapping and Geospatial Planning: Pakistan	Anjum Ahmad
P145864	Papua New Guinea	Renewable Energy Resource Mapping and Geospatial Planning: Papua New Guinea	Gerard Fae
P123636	Philippines	Philippines Power Sector Strategy: VRE Distribution Grid Code	Alan Townsend
P154048	Seychelles	Improving Electricity Planning	Maria Isabel Neto
P145287	Tanzania	Renewable Energy Resource Mapping and Geospatial Planning: Tanzania	Anders Pedersen
P145513	Vietnam	Renewable Energy Resource Mapping and Geospatial Planning: Vietnam	Ky Hong Tran
P145271	Zambia	Renewable Energy Resource Mapping Initiative	Raihan Elahi



TABLE A4.1 *Continued*

ESMAP Completed, New, and Ongoing Activities, FY2016

ENERGY ACCESS			
P152376	AFR	Uganda-DRC 220kV Interconnector	Mbuso Gwafila
	Global	Energy Access for the Peri-urban/Urban Poor	Alain Ouedraogo
P154383	Global	Global Facility for Promotion of Green Mini Grids	Johannes C. Exel
P130355	Lao People's Democratic Republic	Background Analysis & Design of Health Impact Results-Based Financing Mechanism for Clean Stove Initiative	Rutu Dave
P146805	LCR	Central America Clean Cooking Initiative	Koffi Ekouevi
P143988	Myanmar	Development of Myanmar National Electrification Program	Dejan R. Ostojic
P149764	South Asia	Nepal: Developing Improved Solutions for Cooking	Sandeep Kohli
ENERGY EFFICIENCY			
P151756	Bangladesh	Open Accessibility Planning for Integrated and Inclusive Transport in Dhaka	Ke Fang
P152139	China	Wuhan Integrated Transport Development Project: Learning from Best International Practice in Smart Transport & Energy Efficiency	Arturo Gomez
P152109	China	Developing an Innovative Energy Efficiency Financing Mechanism in China	Xiaodong Wang
P150222	China	Developing Low-Carbon Strategy for Shenzhen	Ximing Peng
P146777	EAP	Inclusive Green Growth for EAP Cities Caca Boudin	Judy Baker
P152431	Global	Capacity Building	Martina Bosi
P145972	Global	City Energy Efficiency Transformation Initiative: Low Carbon Growth for Cities through Energy Efficiency	Ivan Jaques Goldenberg
P152356	Global	Data Analytics for Intelligent Energy Systems	Karin Anna Maria Lerner
IFC-00599988	Global	EDGE Green Building Market Transformation Program	Prashant Kapoor
P132418	India	Efficient & Sustainable City Bus Services: Capacity Building Program in Fuel Efficiency	Nupur Gupta
P151970	Kyrgyz Republic	Efficiency Improvements of the District Heating System in the Kyrgyz Republic	Kathrin Hofer
P151416	Kyrgyz Republic	Urban Development Project	Kremena Ionkova
P144262	LCR	Achieving Energy Efficient Urban Transport in Cities in Latin America	Felipe Rodriguez
P150942	LCR	Brazil Energy Efficient Cities Program	Christophe de Gouvello
P148297	LCR	LCR Urban Energy Efficiency	Janina Franco Salazar
P150863	Macedonia	Municipal Energy Efficiency Promotion	Jasneet Singh
P149872	Mexico	Municipal Energy Efficiency Project	Janina Franco Salazar
P077717	Mexico	Supporting a low-carbon economy	Karen Bazex
P147807	South Asia	Scaling Up Energy Efficiency and Demand-Side Management Business Line in South Asia	Ashok Sarkar
P152135	Uzbekistan	Scaling Up Energy Efficiency in Buildings in Uzbekistan	Feng Liu
P147961	West Bank & Gaza	Energy Efficiency Action Plan	Roger Cunill
ENERGY ASSESSMENTS AND STRATEGIES			
P146259	Afghanistan	Energy Security Trade-Offs under High Uncertainty	Richard Spencer
P152329	AFR	Cost Review of Transmission Development in Africa	Jianping Zhao

TABLE A4.1 *Continued*

ESMAP Completed, New, and Ongoing Activities, FY2016			
P152434	AFR	Regional Study on the Performance of Distribution Utilities in Sub-Saharan Africa	Pedro Antmann
P150086	Bangladesh	Analysis of Economy-wide Impact of Energy Sector Reforms in Bangladesh	Sheoli Pargal
P147077	Central America	Energy Subsidy Reform in Central America	Marco Antonio Hernandez Ore
P151404	China	Fossil Fuel Subsidy Study	Yanqin Song
P127033	China	Promotion of Power Sector Reform to Unlock Renewable Energy Development	Xiaodong Wang
P151293	China	Urumqi District Heating Pricing Technical Assistance	Todd Johnson
P133231	ECA	Directions for the Energy Sector in the Western Balkans	Claudia Ines Vasquez Suarez
P146007	Egypt, Arab Republic of	Gas Regulator Capacity Building	Ashish Khanna
P155336	Egypt, Arab Republic of	Phase II of Subsidy Reforms Technical Assistance from the Energy Subsidy Reform and Delivery Technical Assistance Facility	Joern Huenteler
P147865	Georgia	Power Sector Strategy	Joseph Melitauri
P144930	Global	Thirsty Energy: The Case of China	Diego Rodriguez
P152585	Indonesia	Local Benefit Sharing for Hydropower Projects in Indonesia	Gailius Draugelis
P146035	Kazakhstan	Power Market Structure Options for Kazakhstan	Mirlan Aldayarov
P155769	LCR	Energizing Agriculture: Enhancing Efficiency in Agriculture in Latin America & the Caribbean	Katie Kennedy Freeman
P146656	MNA	Benchmarking Electricity Utilities Performance in the Middle East & North Africa Region	Daniel Daurella
P151162	Nigeria	Unlocking Nigeria's Potential for Gas	Masami Kojima
P148147	Tunisia	Strategic Development of Energy Sector in Tunisia, Phase II	Anas Benbarka
P152745	Tunisia	Tunisia-Italy Electricity Transmission Interconnection Project	Sameh Mobarek
P152593	Ukraine	Moving Forward Energy Tariffs Reforms	Yadviga Semikolenova
P149628	Vietnam	Equitization and Divestiture Strategy for the Vietnam Electricity's Generation Companies	Joel Maweni

TABLE A4.2

SIDS DOCK Completed, New, and Ongoing Activities, FY2016

COMPLETED ACTIVITIES			
Project ID	Country/Region	Activity	Task Manager
P101414	OECS Countries	Eastern Caribbean Energy Regional Authority Project	Mark Lambrides
NEW ACTIVITIES			
P151979	Cabo Verde	Cabo Verde Distributed Solar Energy Systems Project	Karen Bazex
P153404	OECS Countries	Solar PV Demonstration Project in the OECS countries	Mark Lambrides
P152653	Pacific Islands	Pacific Islands Sustainable Energy Industry Development Project Implementation Support SIDS DOCK	Leopold Sedogo
ONGOING ACTIVITIES			
P151979	Cabo Verde	Preparation & SPN of Cabo Verde Distributed Solar Energy Systems Project	Fabrice Karl Bertholet
P149959	St. Lucia	Geothermal Resource Development in Saint Lucia SIDS DOCK BETF	Migara Jayawardena
P144573	Tuvalu	Energy Sector Development Project	Leopold Sedogo
P145311	Vanuatu	Energy Sector Development Project	Kamleshwar Prasad Khelawan

TABLE A4.3

ASTAE Completed, New, and Ongoing Activities, FY2016

COMPLETED ACTIVITIES			
Project ID	Country/Region	Activity	Task Manager
P131263	Bangladesh	Household Energy in South Asia Region	Zubair Sadeque
P071794	Bangladesh	Showcasing Results in World Bank Supported Intervention in Bangladesh Rural Electrification	Zubair Sadeque
P144091	EAP	Integration of Social Dimension in Energy Access Projects	Helene Monika Carlsson Rex
P129830	EAP	East Asia & Pacific Clean Stoves Initiative Forum	Yabei Zhang
P145887	India	Access to electricity solutions in South Asia Region	Sheoli Pargal
P121842	Indonesia	Building Innovation Capacity in Clean Energy in Indonesia	Ratna Kesuma
P113078	Indonesia	Geothermal Power Development Program II	Peter Johansen
P148620	Indonesia	Large Enterprises Energy Efficiency Project	Dhruva Sahai
P150457	Mekong	East Asia & Pacific-South Asia Renewable Energy and Energy Efficiency South-South Knowledge Exchange	Dejan Ostojic
P099321	Mongolia	Enhance Awareness of Effort at Electrification of Rural Herders through Solar Home Systems in Mongolia	Peter Johansen

TABLE A4.3 *Continued*

ASTAE Completed, New, and Ongoing Activities, FY2016			
P040907	Mongolia	Evaluation of Social Impacts of Mongolia Renewable Energy and Rural Electricity Access Project	Peter Johansen
P144683	Nepal	Scaling up Decentralized Energy Access in Nepal	Priti Kumar
P146344	Nepal	Photovoltaic Technology Workshop in Kathmandu	Jie Tang
P120589	Pakistan	Natural Gas Loss Reduction	Bjorn Hamso
P101578	Papua New Guinea	Assessing the Key Elements for the Development of a Third Party Access Code for the Transmission and Distribution Networks in Papua New Guinea	Roberto Aiello
P145864	Papua New Guinea	Renewable Energy Resource Mapping and Geospatial Planning: Papua New Guinea	Gerard Fae
P147646	Philippines	Electric Cooperatives Reform and Restructuring, Phase II	Alan Townsend
P147646	Philippines	Renewable Energy Policy Implementation Support	Alan Townsend
P147646	Philippines	Energy Regulatory Commission Capacity Strengthening	Alan Townsend
P149462	SAR	Impacts of Climate Change on Water	Pravin Karki
P150207	SAR	Renewable Energy Training for South Asia Region Officials	Laurent Durix
P131250	Tonga	Fundamentals of an Energy Road Map in Small Island Developing States: Experiences from the Pacific	Roberto Aiello
P131250	Tonga	Implementation Support for the Tonga TERM-IU	Roberto Aiello
P131250	Tonga	Renewable Energy and Energy Efficiency Knowledge Exchange for Pacific Island Countries	Roberto Aiello
P144573	Tuvalu	Preparation and Early Implementation Support for the Tuvalu Energy Sector Development Project	Roberto Aiello
P143390	Vietnam	Greenhouse Gas Emission Mitigation in Road Transport: Toolkit Implementation and Life-Cycle Analysis	Holly Krambeck
P103238	Vietnam	Cumulative Impact Assessment on Small Hydropower Projects on River Cascades	Franz Gerner
P084773	Vietnam	Capacity Building Support to Vietnam Pumped Storage Power Program	Franz Gerner
P131558	Vietnam	Renewable Energy Integration and System Efficiency and Reliability Enhancement	Peter Johansen
NEW ACTIVITIES			
P156263	Bhutan	Supporting Environmentally and Socially Sustainable Hydropower Development	Mats Johan Rikard Liden
P155038	India	Support to 24x7 Power for All Program in India: The States of Andhra Pradesh & Rajasthan	Mani Khurana
P151425	Lao PDR	Lao PDR Cook Stove Initiative	Somil Nagpal
P152343	Mongolia	Support to the Preparation of the Second Energy Sector Project	Peter Johansen
P152936	Myanmar	National Electrification Project: Impact evaluation baseline based on geographic information system	Dejan R. Ostojic
P146140	Pakistan	Renewable Energy Resource Mapping and Geospatial Planning: Pakistan	Anjum Ahmad
P154033	Vietnam	International Financial Reporting Standards Gap Analysis	Christopher Robert Fabling

TABLE A4.3 *Continued*

ASTAE Completed, New, and Ongoing Activities, FY2016			
ONGOING ACTIVITIES			
P144130	Asia	Using Satellite Imagery to Monitor Progress of Rural Electrification	Kwawu Mensan Gaba
P151262	Global	East Asia & Pacific Gender and Energy Facility	Helene Monika Carlsson Rex
P144678	India	Prepare for Energy Access in UP and Bihar	Mani Khurana
P154283	India	Program for Grid Based Solar Sector	Demetrios Papathanasiou
P154805	Indonesia	Indonesia—Renewable Energy Access Improvement	Joel J. Maweni
P144213	Indonesia	Clean Stove Initiative, Support to the Emergence of Scalable Biomass Stoves Markets	Yabei Zhang
P149098	Indonesia	Support for Preparation of Indonesia Hydropower Project	Gailius J. Draugelis
P112158	Indonesia	Support to Integrated Catchment Program for Upper Cisokan Pumped Storage Project	Peter Johansen
P109736	Lao PDR	Strategic Advisory for the Lao Power Sector Reform	Franz Gerner
P130355	Lao PR	Clean Stove Initiative Phase 2 (Bank-executed)	Rutu Dave
P145482	Maldives	Clean Energy Development and Regulatory Support	Sandeep Kohli
P146018	Maldives	Renewable Energy Resource Mapping and Geospatial Planning	Abdulaziz Faghi
P152936	Myanmar	Strengthening Institutions for On- and Off-Grid Electrification in Myanmar	Dejan R. Ostojic
P152653	Pacific Islands	Implementation Support for the Pacific Energy Program	Leopold Sedogo
P146251	Pakistan	Strategy to Scale Up Renewable Energy: Pakistan	Oliver Knight
P153268	Philippines	Capacity Strengthening of the National Electrification Administration, Department of Energy and the Energy Regulatory Commission in the Philippines	Alan F. Townsend
P146366	SAR	Mitigation Options for Short-Lived Climate Pollutants in South Asia	Chandra Shekhar Sinha
P154290	SAR	Solar Market Development for Off-Grid Access in Pakistan and Afghanistan	Fanny Kathinka Missfeldt-Ringius
P146107	SAR	Development of Private Sector Models for Off-Grid Electrification in South Asia	Sandeep Kohli
P146366	SAR	Clean Cooking in South Asia (India): Options and Strategies	Chandra Shekhar Sinha
P152779	Solomon Islands	Tina River Hydropower Development Project: Benefit Sharing and Technical Quality Assurance	Takafumi Kadono
P153258	Vietnam	Pumped Storage Hydropower Development Strategy	Franz Gerner
P146777	Vietnam	Sustainable Urban Energy and Emissions Planning, Phase 3: Energizing Green Growth of Da Nang City in Vietnam	Dejan R. Ostojic

ANNEX V | PUBLICATIONS, FY2016

TABLE A5.1

ESMAP Publications, FY2016

ISBN, PUB. NO., OR Project ID	COUNTRY/ REGION	TITLE	AUTHOR/TTL
WB Directions in Development 978-1-4648-0800-5	AFR	Independent Power Projects in Sub-Saharan Africa: Lessons from Five Key Countries (https://openknowledge.worldbank.org/handle/10986/23970)	Anton Eberhard, Katharine Gratwick, Elvira Morella, and Pedro Antmann
P152143	Belarus	Belarus: Scaling Up Energy Efficiency Retrofit of Residential and Public Buildings: Assessment of Investment Needs, Implementation Constraints, Financing Options, and Delivery Models	Feng Liu, Irina Voitekhovitch, Denzel J. Hankinson, Chris Parcels, Joshua Morrison, and Deborah Ong
P152422 ESMAP Knowledge Series (026/16, Case Study #3)	Canada	Proven Delivery Models for LED Public Lighting: Joint Procurement Delivery Model—Ontario, Canada	Pedzisayi Makumbe, Debbie K. Weyl, Andrew Eli, and Jie Li
	China	City Energy Efficiency Report: Transport Sector Wuhan	Li Qu, Arturo Ardila Gomez, G. Frame, and Yang Chen
P113684 MENA Energy Series (95144-EG)	Egypt	Local Manufacturing Potential for Solar Technology Components in Egypt	
P151309	Ethiopia	Wind resource Mapping: Mesoscale Wind Modeling Report	Oliver Knight (TTL)
P131926 ESMAP Knowledge Series (025/16)	Global	Assessing and Mapping Renewable Energy Resources	Oliver Knight
P148200 ESMAP Technical Report (008/15)	Global	Beyond Connections: Energy Access Redefined	Mikul Bhatia and Nicolina Angelou
P144569 ESMAP Knowledge Series (024/16)	Global	Comparative Analysis of Approaches to Geothermal Resource Risk Mitigation: A Global Survey (English, Spanish)	Subir Kumar Sanyal, Ann Robertson-Tait, Migara Jayawardena, Gerry Hutterer, and Laura Wendell Berman
Administrative Report	Global	ESMAP-ASTAE Annual Report 2015	Nick Keyes
P130625 ESMAP Technical Report (009/16)	Global	Greenhouse Gases from Geothermal Power Production	Thráinn Fridriksson, Almudena Mateos, Pierre Audinet, and Yasemin Orucu
P152422 ESMAP Knowledge Series (026/16)	Global	Proven Delivery Models for LED Public Lighting: Synthesis of Six Case Studies	Pedzisayi Makumbe, Debbie K. Weyl, Andrew Eli, and Jie Li

TABLE A5.1 *Continued*

ESMAP Publications, FY2016			
P152422 ESMAP Knowledge Series (026/16; Case Study #1)	India	Proven Delivery Models for LED Public Lighting: ESCO Delivery Model in Central and Northwestern India	Pedzisayi Makumbe, Debbie K. Weyl, Andrew Eli, and Jie Li
P152422 ESMAP Knowledge Series (026/16, Case Study #2)	India	Proven Delivery Models for LED Public Lighting: Super-ESCO Delivery Model in Vizag, India	Pedzisayi Makumbe, Debbie K. Weyl, Andrew Eli, and Jie Li
ESMAP IMPACT 09	Kenya	Bringing Global Best Practices to Transform Kenya's Slum Electrification Program	
P152325	Kyiv	Sustainable Urban Transport for Kyiv: Towards a Sustainable and Competitive City Built upon the Legacy System and Innovations	Jung Eun Oh and Antonio Benigno Nunez
P145350	Madagascar	Small Hydro Resource Mapping: Site Investigation Report (Eng/Fr)	Oliver Knight (TTL)
P146018	Maldives	Solar Resource Mapping in the Maldives: Implementation Plan, Phase 2 Wind Resource Mapping in the Maldives: Mesoscale Wind Modeling Report Wind Resource Mapping in the Maldives: Site Identification Report	Oliver Knight (TTL)
P152422 ESMAP Knowledge Series (026/16; Case Study #5)	Mexico	Proven Delivery Models for LED Public Lighting: Lease-to-Own Delivery Model in Guadalajara, Mexico	Pedzisayi Makumbe, Debbie K. Weyl, Andrew Eli, and Jie Li
P148222	MNA	Delivering Energy Efficiency in the Middle East and North Africa: Achieving Energy Efficiency Potential in the Industry, Services and Residential Sectors (English, Arabic, French)	Jonathan Edwards Sinton and Rutu Dave
P150328	Nepal	Wind Resource Mapping: Mesoscale Modelling Report	Oliver Knight (TTL)
P149219	North Africa	Energy-Efficient Air Conditioning: A Case Study of the Maghreb (English, French)	Ezzedine Khalfallah, Rafik Missaoui, Samira El Khamlichi, and Hassen Ben Hassine
P146140	Pakistan	Biomass Resource Mapping: Implementation Report	Oliver Knight (TTL)
P145864	Papua New Guinea	Wind Resource Mapping in Papua New Guinea: Mesoscale Modelling Report Wind Resource Mapping: Site Identification Report	Oliver Knight (TTL)

TABLE A5.1 *Continued*

ESMAP Publications, FY2016			
P152422 ESMAP Knowledge Series (026/16; Case Study #6)	Philippines	Proven Delivery Models for LED Public Lighting: Municipal Financing Delivery Model in Quezon City, Philippines	Pedzisayi Makumbe, Debbie K. Weyl, Andrew Eli, and Jie Li
Livewire 2015/40	Senegal	Improving Gender Equality and Rural Livelihoods in Senegal	Alicia Hammond, Inka Schomer, Alassane Ngom, Awa Seck, and Vanessa Lopes Janik
P145287	Tanzania	Solar Resource Mapping: Implementation Plan, Phase 2 Wind Resource Mapping in Tanzania: Site Identification Report	Oliver Knight (TTL)
ESMAP IMPACT 10	Turkey	Listening to Client Needs: ESMAP Support to Turkey's Energy Transition, 2007–15	
P149638	Turkey	Turkey's Energy Transition: Milestones and Challenges	Budak Dilli and Kari J. Nyman
P151927	Ukraine	Analysis of the restructuring options of NJSC Naftogaz (English, Ukrainian)	
P150553	Ukraine	Ukraine—Facilitating Municipal Energy Efficiency Finance: Policy Paper	Dilip R. Limaye and Feng Liu
P152422 ESMAP Knowledge Series (026/16, Case Study #4)	United Kingdom	Proven Delivery Models for LED Public Lighting: Public-Private Partnership Delivery Model—Birmingham, United Kingdom	Pedzisayi Makumbe, Debbie K. Weyl, Andrew Eli, and Jie Li
P145513	Vietnam	Biomass Resource Mapping In Vietnam: Implementation Plan, Phase 2 Wind Resource Mapping: Implementation Plan, Phase 2 Small Hydro Mapping: Working Report on the Design of the GIS Database	Oliver Knight (TTL)
P145271	Zambia	Solar Resource Mapping: Implementation Plan, Phase 2 Wind Resource Mapping: Mesoscale Modelling Report Wind Resource Mapping: Site Identification Report Wind Resource Mapping: Implementation Plan, Phase 2	Oliver Knight (TTL)

TABLE A5.2

List of ASTAE Publication FY16

ISBN, PUB. NO., OR Project ID	COUNTRY/ REGION	TITLE	AUTHOR/TTL
P156263	Bhutan	Managing and Environmental and Social Impacts of Hydropower in Bhutan*	
LiveWire 2016/62	EAP	Toward Universal Access to Clean Cooking and Heating: Early Lessons from the East Asia and Pacific Clean Stove Initiative	Yabei Zhang
P144091	Indonesia	Social Gender Support to Indonesia Clean Stove Initiative	
LiveWire 2016/63	Lao PDR	The Lao Cookstove Experience: Redefining Health through Cleaner Energy Solutions	Rutu Dave
LiveWire 2016/61	Maldives	Rooftop Solar in Maldives: A World Bank Guarantee and SREP Facilitate Private Investment in Clean and Affordable Energy	Sandeep Kohli
P144683	Nepal	Nepal: Scaling Up Electricity Access through Mini and Micro Hydropower Applications	Priti Kumar; Tomoyuki Yamashita; Ajoy Karki; SC Rajshekar; Ashish Shrestha; Abhishek Yadav; and Priti Kumar
P146251	Pakistan	Electricity Access in Pakistan, Methodological Report	Knight, Oliver; Ahmad, Anjum; Hussain, Hassam
P146251	Pakistan	Demand for Renewable Energy Generation in Pakistan	Oliver Knight and Anjum Ahmad
P149462	Regional	South Asia Region Programmatic Approach to Impacts of Climate Risks on Water: Hydropower, and Dams	Pravin Karki and Julia Bucknall
LiveWire 2016/60	SAR	Toward Climate-Resilient Hydropower in South Asia	Pravin Karki
P131558	Vietnam	Smart Grid to Enhance Power Transmission in Vietnam	

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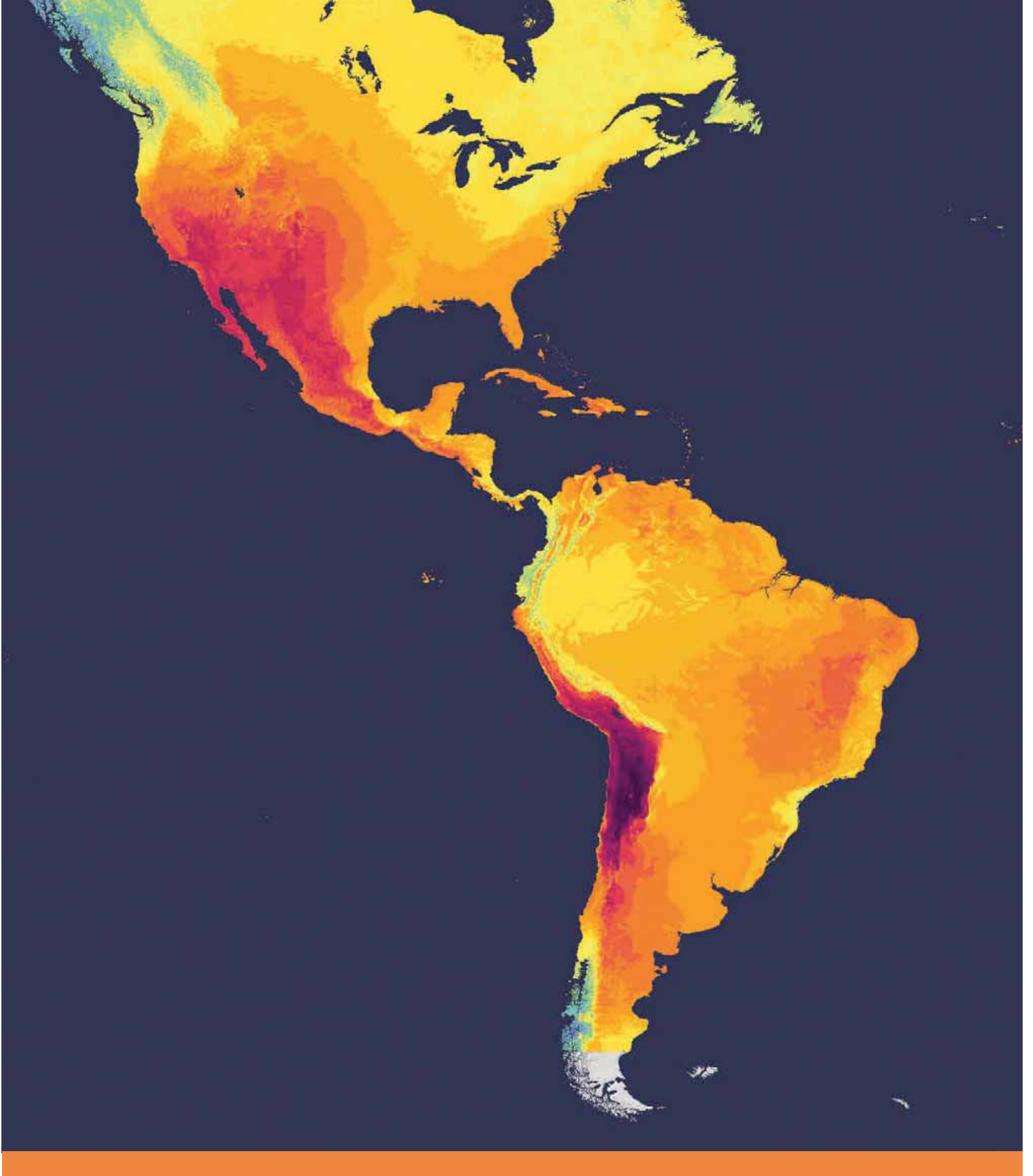
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