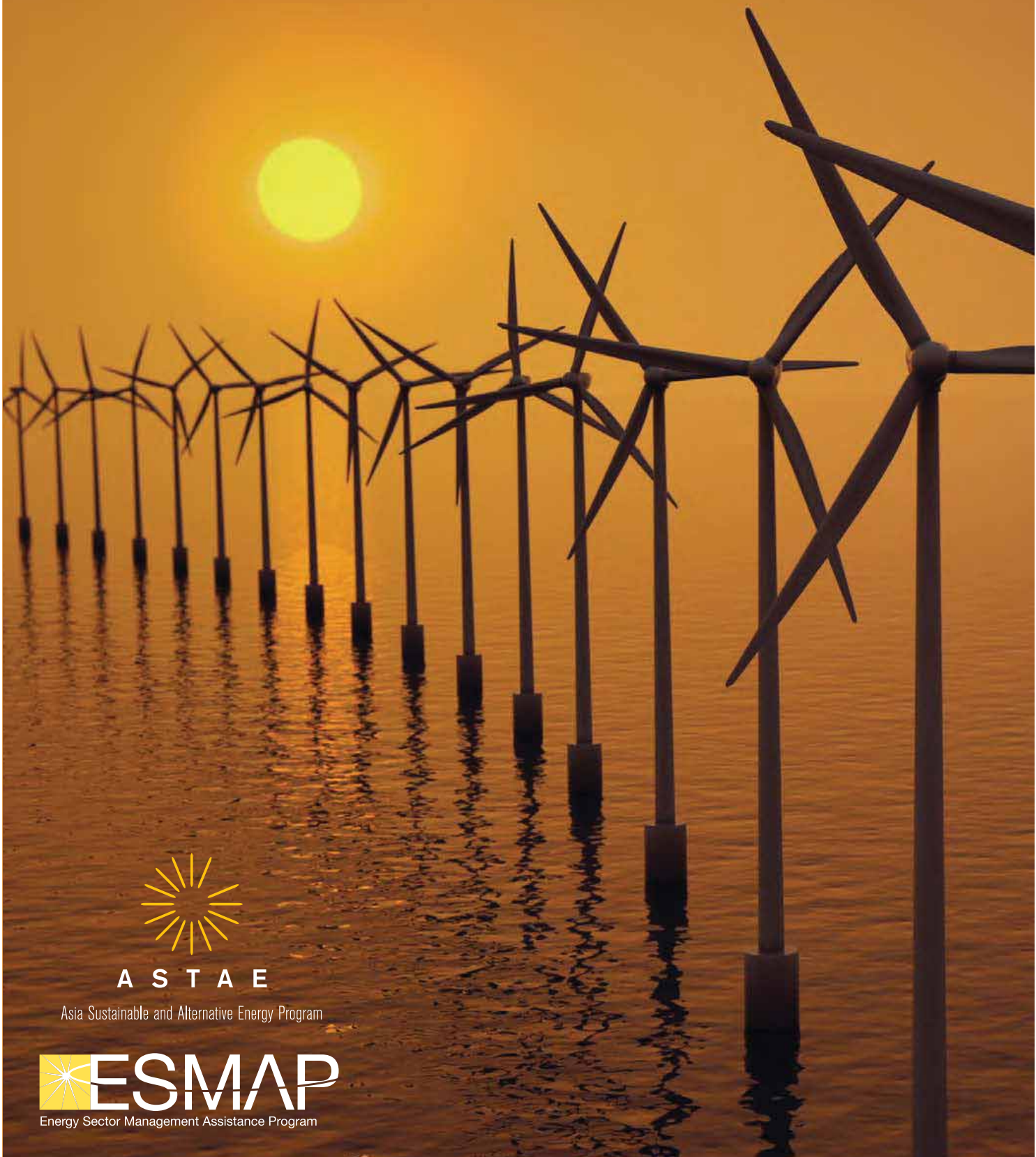


2015

ANNUAL REPORT



A S T A E

Asia Sustainable and Alternative Energy Program





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, Finland, France, Germany, Iceland, Japan, Lithuania, Norway, Sweden, the Netherlands, and the United Kingdom, as well as the World Bank.

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CHAPTER 1




COMPLEX CHALLENGES, DYNAMIC OPPORTUNITIES

Global energy development, as of 2015, presents a contradiction. On the one hand, new technologies and lower prices for renewable energy generation hold out new options for electricity planning and grid development, and lower global oil prices have created a window of opportunity to reform wasteful energy subsidies. On the other hand, 1.1 billion people live without access to any electricity at all, and 2.9 billion—40 percent of the world’s population—live without access to modern cooking and heating fuels.

Many countries are strengthening their transmission and distribution systems, implementing new energy efficiency measures and smart grid technologies, and starting to make a large-scale transition to renewable energy power generation.

Nevertheless, thousands of communities that are connected to the grid suffer from daily power cuts, constraining growth prospects of businesses and delivery of public services. Moreover, 4.3 million people die each year from pollution associated with cooking and heating with traditional biomass fuels.



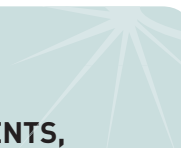
This is the global development context within which the Energy Trust Funds of the World Bank work.

These trust funds are the Energy Sector Management Assistance Program (ESMAP), the Asia Sustainable and Alternative Energy Program (ASTAE), and the SIDS DOCK Support Program for Small Island States. ESMAP, active since 1983, provides knowledge services and technical assistance to countries around the world to help find solutions to energy sector challenges that promote inclusive, sustainable growth. ASTAE was established in 1992 to help the East Asia and Pacific and South Asia regions transition to sustainable and low carbon growth paths. The SIDS DOCK Support Program was set up by ESMAP in 2011 to help small island states move towards a more sustainable and secure energy future.

Of these, ESMAP is the largest program, with disbursements of almost \$27 million and a portfolio of more than 200 activities in Fiscal Year 2015 (FY2015). ESMAP organizes its work into four main focus areas:

- Clean Energy (Chapter 2)
- Energy Access (Chapter 3)
- Energy Efficient Cities (Chapter 4)
- Energy Assessments & Strategies (Chapter 5)

Outside of these areas, ESMAP has also established specific cross-cutting programs in response to client needs. The largest of these is the Africa Renewable Energy and Access Program (AFREA), which was launched in 2008 to meet the unique clean energy and access challenges faced by



ESMAP KEY ACHIEVEMENTS, FY2015

- Launched the **Variable Renewable Energy Grid Integration Program** to help countries scale up grid-connected solar and wind generation while maintaining the stability of the grid and the reliability and affordability of electricity
- Helped develop the new **National Electrification Program for Myanmar**, which calls for universal access to electricity—7.2 million new household connections—by 2030
- Launched the **Efficient and Clean Cooking and Heating Program**, which aims to foster public and private partnerships to scale up access to cleaner and more efficient cooking and heating solutions
- Co-authored **Progress Toward Sustainable Energy: Global Tracking Framework 2015**, the second in a biennial report series that tracks the world's progress toward the three SE4All goals
- Published a series of energy efficiency guidance notes for mayors, covering procurement, financing, buildings, transport, energy assessments, and spatial planning
- Launched the **Energy Subsidy Reform Technical Assistance and Delivery Facility** in October 2014, with activity underway in 15 countries and a ministerial-level event in Washington, DC, at the IMF/WBG Spring Meetings
- Published **Power of the Mine: A Transformative Opportunity for Sub-Saharan Africa**, which calls on the mining industry to work with electricity utilities in the region to meet growing energy demand

Sub-Saharan Africa (Chapter 6). Two other special programs focus on Gender and Social Inclusion in the Energy Sector and Results-Based Approaches for Energy Sector Development (Chapters 7 and 8, respectively.)

ASTAE (Chapter 10), with disbursements of \$5 million and a portfolio of almost 60 activities in FY2015, focuses its work around three pillars: renewable energy, energy efficiency, and access to energy. The two trust funds have long complemented each other, with ASTAE concentrated on operations-oriented activities and project preparation, and ESMAP focused on upstream knowledge and technical assistance work.

Increasingly, ESMAP has organized a large part of its work program around special global initiatives that are designed to meet similar client needs in many countries. These include the Global Geothermal Development Plan (Chapter 2), Renewable Energy Resource Mapping (Chapter 2), and the Energy Subsidy Reform and Delivery Technical Assistance Facility (Chapter 5). These are joined in FY2015 by the new Variable Renewable Energy Integration Support Program (Chapter 2) and the Efficient and Clean Cooking and Heating Partnership (Chapter 3).

Similarly, ASTAE supports regional programs like the East Asia and Pacific Clean Stove Initiative as well as structural country-level engagements, such as work on expansion of the use of mini- and micro-hydropower in Nepal, geothermal development in Indonesia, and strengthening the institutional framework for on- and off-grid electrification in Myanmar.

Starting in FY2015, the administrative functions of ASTAE became the responsibility of the ESMAP program management unit. This is the second annual report to cover both ESMAP and ASTAE. The remainder of this chapter, and the following seven chapters, cover ESMAP, its main areas of focus, and its special programs. Chapter 9 looks at the work of the SIDS DOCK multi-donor trust fund (MDTF). Chapter 10 covers ASTAE and its highlights and achievements in FY2015. A final chapter presents the FY2015 financial review for all three trust funds.

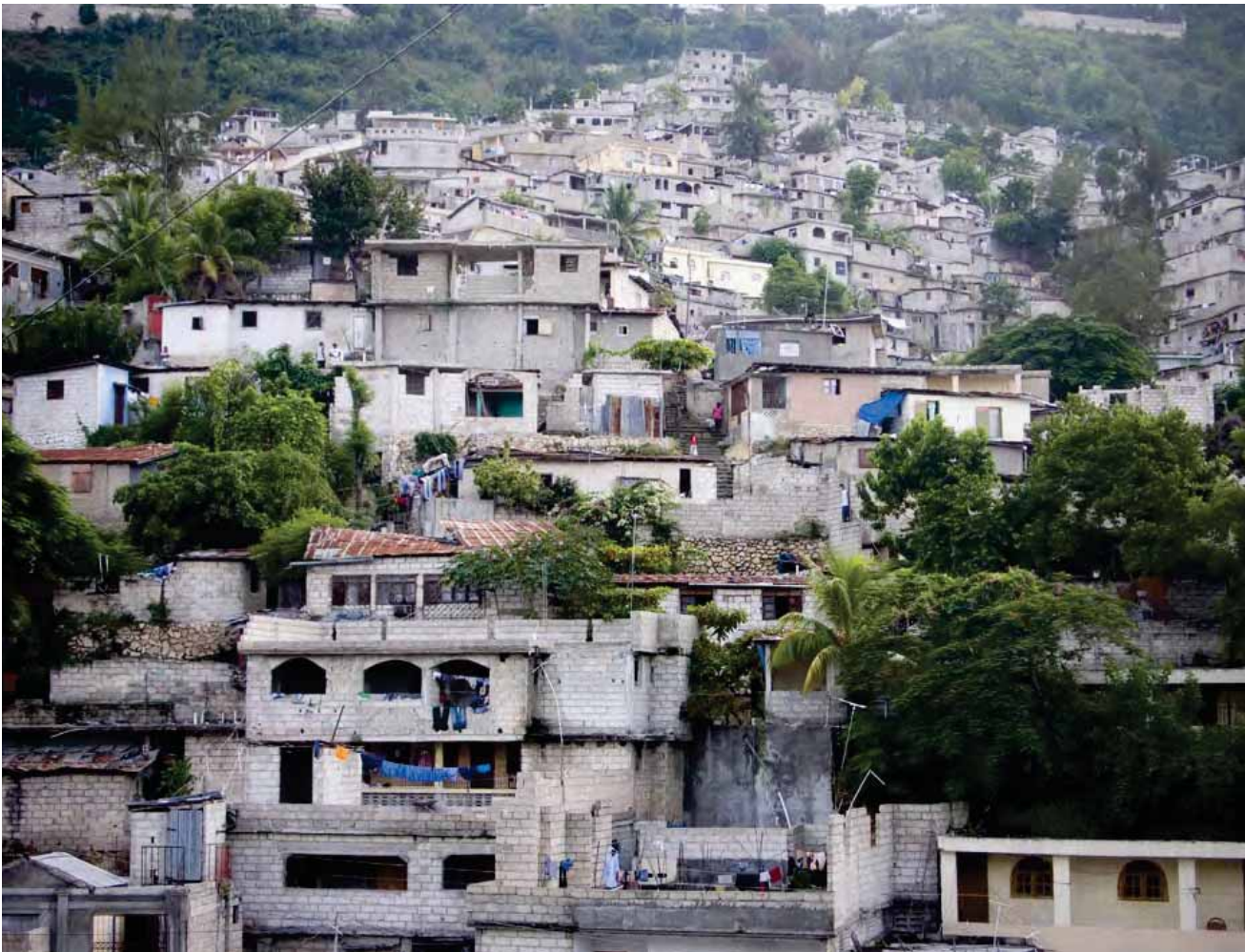
Client priorities are changing rapidly, in response to the new economics of renewable energy, emerging technologies and best practices, and the continuing volatility of fuel prices. As these needs change, so will the work programs, focus areas, and delivery models of the Energy Trust Funds of the World Bank.

LEVERAGE AND IMPACT

ESMAP is unique in its global reach, association with World Bank country-sector policy dialogue and financing, low operational overhead costs, and ability to help shape the future. The impact of ESMAP's work can be seen through a number of tangible results: better-informed policies, stronger institutions, expansion of energy access, robust datasets to inform governments and investors, and the exchange of knowledge among countries. One of ESMAP's primary indicators is the level of World Bank Group (WBG) financing that is informed by ESMAP's upstream knowledge and technical assistance work. In FY2015, ESMAP activities informed WBG operations worth \$1.59 billion.

Among the activities in FY2015 that led to follow-on WBG financing or new policies or programs in client countries were the following:

- In **Kenya**, ESMAP and the Global Partnership on Output-Based Aid (GPOBA) supported World Bank engagement with Kenya Power and Lighting Corporation, the national utility, that helped the company increase the number of connections under its slum electrification program from 5,000 households to over 150,000 households.
- In **Moldova**, ESMAP and the Public-Private Infrastructure Advisory Facility (PPIAF) co-financed an analysis that provided options for the institutional, corporate, and financial restructuring of the district heating sector in Chisinau. The analysis prompted the Government of Moldova to adopt a restructuring of the district heating sector, which led to the creation of a new consolidated company, Termoelectrica.
- In the **Philippines**, a project to improve the efficiency of electricity cooperatives resulted



in recommendations that were taken up by the Energy Regulatory Commission and led to follow-on funding from Japan International Cooperation Agency (JICA) and the European Commission.


- In **Turkey**, the ESMAP Global Geothermal Development Plan supported a policy dialogue to explore innovative financing mechanisms to share geothermal resource risk and, as a result, stimulate private investment in geothermal exploration activities. The support helped identify and prepare a project jointly financed by the Clean Technology Fund (CTF) and the World Bank.
- In **Egypt**, capacity development for the national gas regulator helped facilitate the preparation of the Household Natural Gas Connection Project, a \$500 million World Bank operation that has drawn \$1 billion in co-financing from the Egyptian government, the private sector, Agence Française de Développement (AFD), and the European Commission.
- In **Vietnam**, recommendations from a study on a divestiture strategy for the country's electricity generation companies are being implemented by the government. The study also informed a \$200 million World Bank loan with parallel financing by the Asian Development Bank (ADB).
- In **West Africa**, ESMAP research into natural gas options for regional countries informed a \$400 million International Development Association (IDA) grant to help Côte D'Ivoire strengthen energy security by building government capacity to undertake imports of liquefied natural gas.

SUPPORT TO REGIONS

The majority of ESMAP activities continue to be carried out by WBG teams working at the regional and country level. While some energy challenges are global in nature, regional needs and priorities vary widely.

Sub-Saharan African (AFR) governments face major energy supply challenges posed by both weak infrastructure and vast, untapped renewable energy resources. The continent provides a home to 600 million people with limited or no access to electricity. ESMAP's support to the WBG's \$12 billion Africa energy portfolio, primarily delivered through the AFREA program, covers country-specific activities, regional strategic studies, and regional initiatives, which enable WBG teams to provide just-in-time support to countries facing shared challenges. Examples of country-specific activities include support for independent power producers (IPPs) in Madagascar, rural electrification support in Gabon, and the SE4All Technical Assistance Program, which supported work in 10 countries in Africa, Central America, and South Asia to help expand and accelerate their national energy access programs. Strategic studies include new models to scale up power generation investments in Africa, the Africa power subsidy study, and a review of hydropower development in Africa. The regional initiatives consist of Lighting Africa, the Africa Clean Cooking Energy Solutions Initiative (ACCES), the Accelerating On-grid Access Team (AGAT), and Gender and Energy program.

In the **East Asia and Pacific** (EAP), the strategic priorities of the WBG's energy sector work



continue to focus on improving energy efficiency, scaling up renewable energy, increasing access to modern energy, promoting regional energy trade and market integration, and promoting new energy solutions and market reforms. ESMAP-supported work in the region has focused on energy efficiency with a number of activities in China such as on low carbon cities and on energy efficiency financing. Other activities have focused on renewable energy scale-up and access, including support to Indonesia's geothermal development.

The main challenges in **Europe and Central Asia (ECA)** can be grouped into three categories: deteriorating reliability of the energy supply, high energy subsidies yet low affordability, and high energy intensity. The WBG's work in the region focuses on increasing access to a reliable and efficient energy supply, designing and helping to implement socially and financially sustainable energy subsidy reform, and scaling up energy efficiency and renewable energy.

The **Latin American and Caribbean (LCR)** region, while experiencing high growth rates in recent decades, still faces a number of energy challenges, including inefficient and ageing infrastructure, incomplete market reforms, and insufficient access to energy in some countries. Among the priorities for the WBG's energy work in the region are supporting countries to strengthen their policymaking and institutions, addressing last mile and quality of access issues, and enhancing the climate resilience of energy systems.

In the **Middle East and North Africa (MNA)**, total consumption of energy has grown faster over the

past decades than any other region in the world. The region is approximately 60 percent more energy intensive than OECD countries, and the trend is increasing. However, consumption of energy per capita in non-Gulf states is still relatively low. At the same time, oil-exporting countries are facing significantly lower revenues due to the fall of oil prices. Energy subsidies are burdensome and pervasive, and many utilities are poorly performing, caught in a cycle of underpricing, underinvestment, systems losses, theft, and poor collection rates. The region offers a large renewable energy potential, but it is underexploited due to weak sector governance and fossil fuel subsidies.

In the **South Asia (SAR)** region, priorities include enhancing access to modern energy services, including through grid and off-grid electricity and clean cooking solutions; improving the quality and reliability of energy supply, including through strengthening networks and supporting regional trade; and ensuring long-term financial, environmental, and social sustainability, including strengthening utilities and promoting energy efficiency and renewable energy.

COLLABORATING WITH DEVELOPMENT PARTNERS

ESMAP works closely with development partners through global strategic initiatives and joint analytical work and by informing follow-on work done by partners at the country level. These development partners include international non-government organizations, bilateral development agencies (including ESMAP's donor agencies),

other multilateral institutions, and local and global think tanks.

Examples of country-level collaboration include:

- In **Armenia**, ESMAP financed preparation of the Power Sector Policy Note in 2014 to inform government thinking on key challenges facing the power sector and ways to overcome them. The activity helped the Government of Armenia prioritize investments in power generation and transmission assets, structure the programs of development partners (World Bank, ADB, and European Bank for Reconstruction and Development) in investments in power transmission network, and commit to improving the financial standing of the power sector.
- In the **Kyrgyz Republic**, a joint ESMAP/Central Asia Energy-Water Development Program-funded urban heating assessment and a related follow-up technical assistance activity provided the analytical basis for policy dialogue with the Kyrgyz government and other development partners focusing on economically viable and more sustainable heating options that would help the country address its recurrent winter energy shortages. The activity helped to identify a new IDA-financed investment lending project in the heating sector and to facilitate mobilization of resources from other development partners (e.g., European Bank for Reconstruction and Development).
- In **Vietnam**, ESMAP is financing the Renewable Energy Resource Mapping and Geospatial Planning project, which aims to increase the output and diversity of renewable electricity generation in the country by increasing

government and private sector awareness of the resource potential for biomass, small hydropower, solar, and wind and providing the government with a spatial planning framework to guide commercial investment in the sector. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) provided 20 years of wind measurement data from 10 wind masts and committed to retaining the operation of 5 wind masts in Vietnam that, without GIZ's commitment, would otherwise have been demolished. In preparation for potential biomass mapping, the World Bank has been working closely with GIZ by sharing information and jointly conducting a field survey spanning the country. The State Secretariat for Economic Affairs committed \$360,000 under their grant associated with the Renewable Energy Development Project to finance data collection activities (e.g., of wind, biomass, power network data). The Spanish Agencia Española de Cooperación Internacional para el Desarrollo (AECID) shared the results of the Solar Radiation and Solar Potential Maps study, which was financed by the Spanish Government through AECID. A number of joint workshops between AECID and the Bank have been organized.

- In **Indonesia**, ESMAP-funded support for Capacity Strengthening and Risk Mitigation for Geothermal Development complements coordinated donor technical assistance to the Government of Indonesia's geothermal power development plans. The agencies involved include: (i) JICA, which provides advisory services to the Ministry of Finance's PT Sarana Multi Infrastruktur on suitable business models for utilizing



geothermal development-dedicated funding; (ii) the Government of New Zealand, which is engaged with the development of geothermal resource mapping and estimation and prioritization methodologies; and (iii) AFD, which, backed by the UK's Department for International Development (DFID), supports the preparation of a pre-feasibility study for development prospects in Eastern Indonesia. These efforts inform the preparation and design of the World Bank Geothermal Energy Upstream Development Project, which is a CTF- and Global Environment Facility (GEF)-funded operation that focuses on risk mitigation of geothermal exploration drilling activities—the riskiest part of the geothermal development process.

- In the **Philippines**, ESMAP-financed technical economic regulation analyses on benchmarking, cost of capital, and asset valuation at the Energy Regulatory Commission was continued under JICA financing as a result of informal agreements among the Energy Regulatory Commission, JICA, and WBG. As JICA financing is now coming to a close, a European Union-funded grant is under discussion to continue the work. In addition, ESMAP supported a recent disaster risk mitigation workshop with cooperation and coordination between the World Bank team and counterparts at JICA, the International Finance Corporation (IFC), and United States Agency for International Development (USAID). ESMAP also coordinated with AFD on matters related to sustainable solar home system provision.
- In **Somalia**, the ESMAP-supported project, Power Master Plan Development for Somalia,

collaborates closely with the Ministry of Foreign Affairs of Denmark, with mutual assistance ranging from the provision of armored transport vehicles for the Bank to advice on renewable energy for the ministry's resident advisors in Hargeisa. This project is also financed from the World Bank Multi-Partner Fund for Somalia.


- In **Tanzania**, Lighting Africa is working closely with DFID and the Swedish International Development Cooperation Agency (SIDA) on the development of the new Tanzania Rural Electrification Expansion Project. As part of this endeavor, Lighting Africa is developing a jointly funded technical assistance component to facilitate access to financing for companies that sell Lighting Africa/Global quality, verified products and is also advising and collaborating with DFID and SIDA on the development of an off-grid solar home system results-based financing program.
- In **Liberia**, under the umbrella of the Scaling Up Renewable Energy Program and the Liberia Investment Plan for Rural and Renewable Energy, an African Electrification Initiative (AEI) study is ongoing to support Liberia's Rural and Renewable Energy Agency (RREA) project preparation to optimize the generation mix of a hybrid, isolated mini-grid in Lofa County. The Government of Norway, through the Energy+ initiative, is collaborating with RREA to provide technical assistance to conduct the technical studies related to the hydropower sites that will serve this mini-grid. It has also committed \$18 million to an investment project using a Payment-for-Results approach for the investment plan.



REACHING OUT TO OTHER SECTORS

In recent years, ESMAP has significantly increased its cross-sectoral work that looks at the intersection between energy and other development sectors such as food, water, transport, and health. Examples from FY2015 include:

- Launched in January 2014 with ESMAP support, the Thirsty Energy initiative (Chapter 5) helps countries to integrate water constraints into energy planning and to better address water-energy challenges. Thirsty Energy involves teams from the Energy and Extractives and Water Global Practices and also collaborates with international organizations working on the topic such as the International Energy Agency (IEA), International Renewable Energy Agency (IRENA), UN Water, and GIZ.
- The Brazil Energy Efficient Cities program, financed by the ESMAP City Energy Efficiency Transformation Initiative, focuses on city energy efficiency in four sectors: municipal street lighting, public buildings, transport, and urban industry. It has a cross-cutting component that addresses city-wide management of energy efficiency, and World Bank teams from the Social, Urban, Rural, and Resilience; Energy and Extractives; and Transport and Information and Communication Technologies (ICT) Global Practices as well as IFC are working on the project.
- The analytical and technical assistance work on energy tariff and subsidy reforms in the Kyrgyz Republic, Ukraine, Uzbekistan, Belarus, Moldova, and Armenia brought together teams from a wide range of World Bank practice areas, including Energy, Poverty, Social Protection, Macroeconomics and Fiscal Management, Social Development, and Communications to



support governments in designing and starting implementation of socially and financially sustainable energy tariff and subsidy reforms. In addition, ESMAP funds were leveraged in some countries by tapping into other trust fund resources such as PPIAF, the Poverty and Social Impact Analysis MDTF, and the Umbrella Facility for Gender Equality.

- With funding from ESMAP, the Philippines' Energy Development Corporation hosted a knowledge exchange event from September 14–18, 2015. A delegation of 15 Indonesian officials and representatives from government ministries and state-owned energy and forest enterprises met with Energy Development Corporation staff, academic partners, and representatives from local communities in the Philippines to gain practical knowledge on the integrated catchment management (ICM) approach, which aims to provide a framework to address social and environmental impacts from energy development projects, mitigate threats to biodiversity, and make improvements for local livelihoods. The experiences from this knowledge exchange will be used to further develop the ICM concept for use in ongoing and future geothermal and pumped storage hydropower projects across Indonesia.
- The *Low Water High Growth in South Asian Economies* study is informed by the work of and brings together teams from several World Bank practice areas, including Energy, Environment, Water, Agriculture, Climate Change, Social Protection, and Communications. The report examines the interactions between scarce water, capital requirements to remedy this shortfall, and overall economic growth. The study estimated that GDP growth rates through 2030 will be lower than a business-as-usual scenario for all South Asia nations if water productivity and supply do not grow. If countries do not invest in improving land and water productivity, countries in South Asia will lose between 7 and 45 percent of their GDP in 2030 compared to 2012.
- The *Power and Agriculture in Africa* regional strategic study involved collaboration between the Energy and Agriculture Global Practices in Sub-Saharan Africa as well as exchange of information with the Food and Agriculture Organization of the United Nations (FAO). FAO has agreed to peer review the draft report. The study identified potential synergies between agricultural value chains and rural electrification expansion and examined the challenges in harnessing this potential.
- The *Review of Hydropower Development in Africa* worked with the Water Global Practice to ensure incorporation of the water resource sectors into future hydropower opportunities. The objective of this regional study was to put World Bank involvement into the perspective of the overall sector transformation and identify opportunities to better support the client countries in developing their hydropower potential.
- Gender has been a key area of focus for many ESMAP donors, and the teams have collaborated on several initiatives. For example, the AFREA Gender and Energy program has worked with the Economic Community of West African States Gender and Energy program, which receives support from the Austrians, and ENERGIA, which receives research funding from DFID on areas such as access, subsidies, and monitoring and evaluation.

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 25 staff is responsible for the day-to-day management of the program, following the strategy detailed in ESMAP's Business Plan. The unit comprises teams working on energy access, clean energy, energy efficient cities, energy assessments and strategy, results-based approaches for energy sector development, gender, communications, and monitoring and evaluation. The ESMAP unit is also responsible for the management and administration of the ASTAE and SIDS DOCK Support Program MDTFs.

Consultative Group

ESMAP is governed by a Consultative Group (CG) made up of 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 in FY2015 were:

| | |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Australia | Department of Foreign Affairs and Trade |
| Austria | Federal Ministry of Finance of Austria |
| Denmark* | Royal Danish Ministry of Foreign Affairs (ESMAP and SIDS DOCK MDTFs) |
| Finland | Ministry for Foreign Affairs of Finland |
| 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 (SIDS DOCK MDTF only) |
| Lithuania | Ministry of Foreign Affairs; Ministry of the Environment |
| The Netherlands | Ministry of Foreign Affairs (ESMAP and ASTAE MDTFs) |
| Norway | Ministry of Foreign Affairs |
| Sweden | Swedish International Development Cooperation Agency (ESMAP and ASTAE MDTFs) |
| United Kingdom | Department for International Development (ESMAP and ASTAE MDTFs) |
| The World Bank Group | |

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

Technical Advisory Group

A Technical Advisory Group (TAG) consisting of three international experts 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.





CHAPTER 2



ACCELERATING THE TRANSITION TO CLEAN ENERGY AND LOW CARBON DEVELOPMENT



SCALING UP AND INTEGRATING VARIABLE RENEWABLE ENERGY

Over the past 10 years, the cost of technology for variable renewable energy (VRE) such as wind and solar energy has declined considerably, providing a cost-effective and sustainable means of meeting electricity demand in low- and middle-income countries. To assist countries in achieving a cost-efficient scale-up and reducing the adverse economic and operational impacts that integrating large shares of VRE in the power system can have, ESMAP launched the **Variable Renewable Energy Integration Support Program**. The program helps countries build capacity for long-term grid planning, market design, and renewable energy pricing, develop rules of access to electricity grids, improve electricity dispatch, and strengthen the transmission and distribution infrastructure.

An ESMAP report, *Bringing Variable Renewable Energy Up to Scale: Options for Grid Integration Using Natural Gas and Storage*, published in February 2015, looked at approaches countries can take to integrate VRE into their grids without compromising the adequacy, reliability, or affordability of electricity. These approaches include strengthening interconnections between areas, diversifying the contribution of different renewable energy sources from various locations, and building up complementary generation and demand response technologies. The report built upon previous reports on the topic published by WBG and other international organizations by focusing on the important role that natural gas and energy storage can play in integrating VRE sources.

In May 2015, ESMAP partnered with the Clean Energy Ministerial to deliver targeted technical



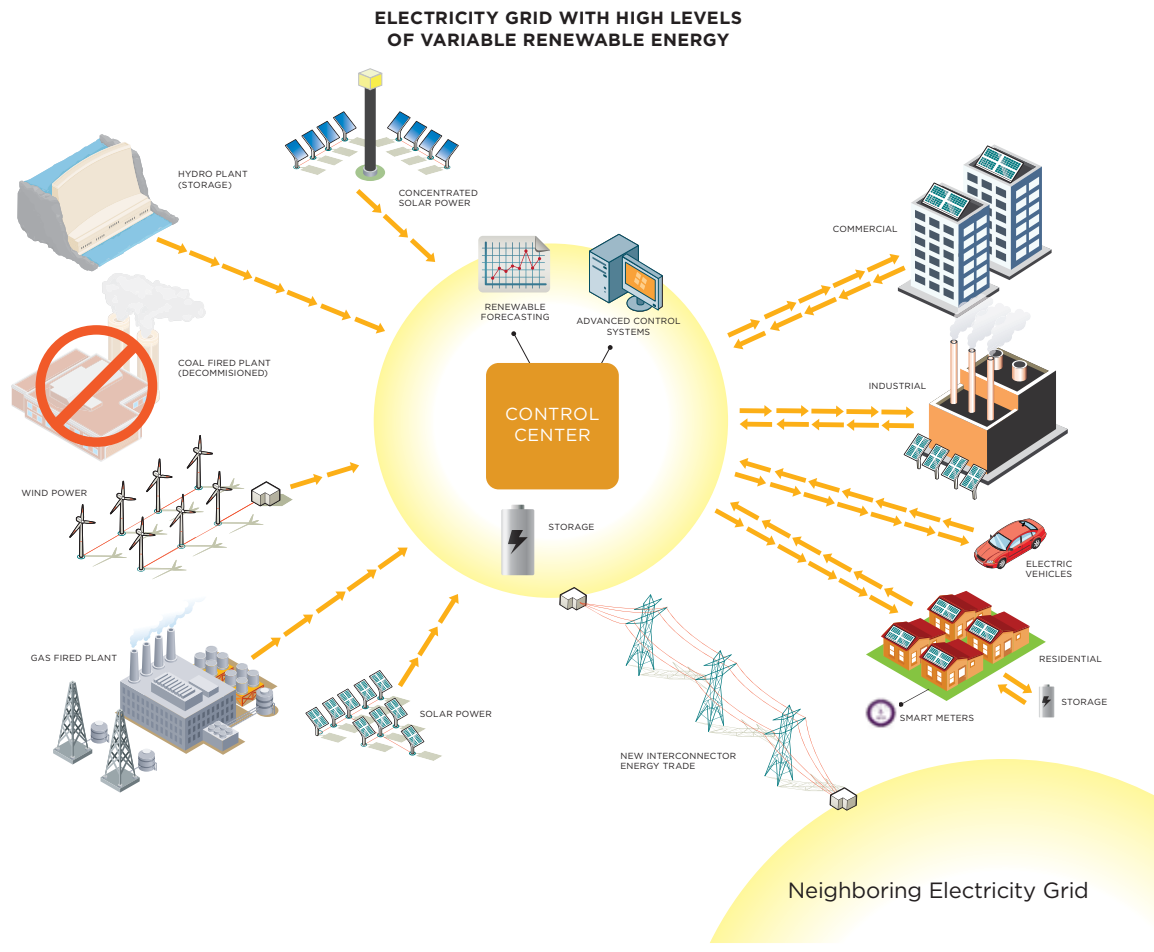
KEY CLEAN ENERGY ACHIEVEMENTS, FY2015

- Launch of the **Variable Renewable Energy Integration Support Program**, including publication of an ESMAP report on country approaches to integrating variable renewable energy, a partnership with the Clean Energy Ministerial, and several knowledge exchange events
- Under the **Global Geothermal Development Program**, development of a methodology for the Government of Indonesia's geothermal pricing policy to improve the country's geothermal regulatory framework, approval of technical assistance funding for geothermal development in Chile, and a three-day course on reducing geothermal drilling risk held in relation to the World Geothermal Congress in Melbourne, Australia
- Project delivery on **Renewable Energy Resource Mapping**, including preliminary mapping outputs in Malawi, Maldives, Pakistan, Papua New Guinea, Tanzania, Vietnam, and Zambia; the commissioning of solar measuring stations in Pakistan; dissemination of preliminary small hydro-power mapping results in Tanzania; start of biomass mapping in Pakistan and Vietnam; and commissioning of an open data platform for publication of ground-based measurement data

assistance that will help low- and middle-income countries address the challenges of connecting ever-growing shares of wind and solar energy to their electricity grids. Countries participating in ESMAP's Variable Renewable Energy Integration

FIGURE 2.1


Electricity Grid with High Levels of Variable Renewable Energy



Program will now have access to technical experts, knowledge and resources through the Clean Energy Ministerial’s 21st Century Power Partnership and Clean Energy Solutions Center. The services provided will help countries address immediate issues and increase their capacity for longer-term policy and investment planning.

In FY2015, ESMAP also supported several knowledge exchange events across the globe. On

October 21, 2014, ESMAP organized a knowledge exchange forum in Copenhagen, Denmark, which looked at the benefits, costs, and obstacles from the points of view of a range of stakeholders and considered the implications of new technologies and approaches available to planners and decision makers. ESMAP also organized a study tour to Energinet.dk, Denmark’s transmission system operator, for 26 participants—representatives of regulators, system operators, and utilities from



more than a dozen countries, including Chile, China, Morocco, Pakistan, South Africa, and Zambia.

From May 17–22, 2015, with support from ASTAE and ESMAP, an Indian delegation of senior power sector officials visited Brazil on a study tour to investigate the Brazilian experience of scaling up renewable energy in the power system. Brazil has for decades operated a power system with significant levels of renewable energy—mainly hydro, but in recent years with increasing amounts of wind—based on a unique planning and market model.

REMOVING BOTTLENECKS TO GEOTHERMAL ENERGY DEVELOPMENT

Geothermal energy is an underutilized resource with the potential to deliver renewable and reliable electricity and heat for many low- and middle-income countries. The **Global Geothermal Development Plan** (GGDP) is an initiative by ESMAP and other multilateral and bilateral development partners to transform the energy sector of developing countries by scaling up the use of geothermal power.

Indonesia's Ministry of Energy and Mineral Resources (MEMR) in October 2013 requested World Bank assistance in making revisions to the government's geothermal pricing policy. With support from ESMAP and ASTAE, an international advisory team of technical, economic, financial, and legal consultants from the World Bank and ADB worked with MEMR on a rationale and methodology for a new geothermal tariff.

A ministerial regulation on geothermal pricing and policy issued in June 2014 was the result of the work between MEMR and the World Bank and ADB and was viewed as a major step forward in improving Indonesia's geothermal regulatory framework. The new regulation has been widely accepted by the private sector and various government entities, including the Ministry of Finance. As a result of this collaborative process, the MEMR requested further World Bank assistance in preparing three additional regulations. Indonesia's Ministry of Finance has also requested assistance to improve the workings of the Geothermal Fund.

Other projects supported under the GGDP include the Geothermal Exploratory Drilling Project in Armenia, which was approved in FY2015. The project will help confirm whether the geothermal resource at the Karkar geothermal field is suitable for power generation and, if so, will support the Government of Armenia with transaction advisory services to design a public-private partnership scheme for construction of a geothermal power plant at the site. Construction of the access road to the drill site is underway, and drilling of slim wells will take place in the summer of 2016.

The GGDP has also provided support to a number of World Bank geothermal projects currently under preparation. Funding for Technical Assistance for Geothermal Development in Chile, which will leverage additional funds from CTF, was approved in FY2015 to assist the country in resolving specific barriers to improve the geothermal energy market conditions for mobilizing investments in the sector. Support is underway on reforming the policy and legal framework and

for greater engagement of stakeholders to raise broader awareness within the country. Through the Saint Lucia Geothermal Project, also funded by the SIDS DOCK Support Program (Chapter 9) and GEF, the World Bank team is coordinating and supporting activities related to surface reconnaissance, including magneto telluric tests and Light Detection and Ranging (LIDAR) surveys and strengthening the capacity of the Ministry of Sustainable Development, Energy, Science and Technology in Saint Lucia with geothermal advisory and project coordination expertise. In Turkey, the Geothermal Development Project, whose implementation is expected to begin in the first half of 2016, will capitalize a risk-sharing mechanism for resource confirmation and a loan facility for resource development.

In April 2015, ESMAP provided financial support to a three-day course on “Reducing Geothermal Drilling Risk,” which was held in relation to the World Geothermal Congress in Melbourne, Australia. The course was organized by the International Geothermal Association’s Academy and taught by seven high-level experts on geothermal conceptual modeling and drilling. A total of 43 students from all over the world participated, and 20 students from low- and middle-income countries received fellowships provided by ESMAP to cover part of the travel and accommodation costs.

ESMAP also provided financial and logistical support to a joint effort by the UN Economic Commission for Europe (UNECE) and the International Geothermal Association to develop International Standards for Classification of Geothermal Resources under the United Nations Framework Classification. A draft version of the

specifications will be submitted to the UNECE in March 2016, and the UNECE is anticipated to adopt the standards in April 2017. ESMAP’s support covered the costs of travel and accommodation for two sessions of the working group. At the first session, hosted by the World Bank in Washington, DC, ESMAP organized an open session at the working group meeting and invited a number of stakeholders to participate.

HELPING COUNTRIES UNDERSTAND THEIR RENEWABLE ENERGY POTENTIAL

During FY2015 ESMAP’s global initiative on **Renewable Energy Resource Mapping** was focused on project delivery, with substantive progress made in all of the 12 participating countries. This initiative is supporting client countries that want to develop or scale up power generation from domestic renewable energy resources, focusing on biomass, small hydropower, solar, and wind, by providing those countries with the data needed to analyze their renewable energy potential and guide their development. Resource assessment combines multiple sources of information, including satellite data, surveys, and specially commissioned meteorological measurements, to produce high quality maps and accompanying datasets that can be used for multiple purposes, including strategic planning, grid integration studies, and site assessment by commercial developers. As an open data initiative, all key outputs and datasets are made publicly available with the visual mapping outputs made accessible on the Global Atlas for Renewable Energy that has been developed by IRENA.

Preliminary mapping outputs for solar and wind resources from Phase 1 of the projects were presented during FY2015 in the following countries: Malawi (solar only), Maldives, Pakistan, Papua New Guinea (wind only), Tanzania (see Box 2.2), Vietnam (wind only), and Zambia. (As interim outputs, the information and data have not yet been subject to full peer review; final, validated, and peer-reviewed outputs will be made available once the projects are completed.) Preliminary small hydropower outputs were also presented in Madagascar and Tanzania, with work ongoing in Indonesia and Vietnam. ASTAE also provided funding for the activities in Maldives and Papua New Guinea (see Chapter 10).

In Pakistan, the first solar measuring stations to be commissioned under this initiative went live in November 2014. Data has since been uploaded

monthly to the Energy & Extractives Open Data Platform established by ESMAP under this initiative and subsequently made available to other World Bank project teams. The biomass mapping component was also initiated, with the design of a major program of field surveys to be carried out by a consortium of universities during FY2016 that will go farmer to farmer to assess surplus biomass from crop residues and other sources, with the results then combined with earth observation data.

In Vietnam, the World Bank team is partnering closely with GIZ to publish the country's ongoing wind measurement data, which will be incorporated into the wind mapping being carried out by the World Bank. The initial mapping highlighted a number of high potential zones that were not previously identified in the center and north of the country, as most existing measurement

TABLE 2.1

Renewable Energy Resource Mapping Activities

| COUNTRY | BIOMASS | SMALL HYDROPOWER | SOLAR | WIND |
|------------------|---------|------------------|-------|------|
| Ethiopia | | | | ✓ |
| Indonesia | | ✓ | | |
| Lesotho | | | | ✓ |
| Madagascar | | ✓ | | |
| Malawi | | | ✓ | |
| Maldives | | | ✓ | ✓ |
| Nepal | | | | ✓ |
| Pakistan | ✓ | | ✓ | ✓ |
| Papua New Guinea | | | | ✓ |
| Tanzania | | ✓ | ✓ | ✓ |
| Vietnam | ✓ | ✓ | | ✓ |
| Zambia | | | ✓ | ✓ |

sites are in the southeast of the country, so the project was restructured to include six new wind measurement sites and a LIDAR campaign that uses this remote sensing method to help validate these potentially significant resources. The use of LIDAR will be a first under this initiative and under any national wind mapping effort.

Early results from the small hydropower mapping work in Tanzania were disseminated to the national Rural Energy Agency, with analysis involving visits to over 200 potential sites across the country by motorbike. The detailed investigation unearthed some unknown sites in remote parts of the country that may have the potential to support mini-grids, thereby complementing a number of major donor-funded programs in the country, including Tanzania's Energy Development and Access Expansion Project.


BUILDING RESILIENCE IN THE ENERGY SECTOR

The widespread nature of power sector infrastructure makes it highly vulnerable to the effects of extreme weather and geological events. Extreme events can cause considerable damage to local physical assets, which in turn can have a major impact on overall networks and loss of service. Due to increasing concern in the ability to cope with numerous hazards and threats, there has been a recent focus on resilience—defined as the ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through the preservation, restoration, or improvement of its basic structures and functions. The ESMAP resilience program aims

to mainstream disaster risk management and resilience into energy operations, including knowledge curation and sharing, operational support, and screening tool development and dissemination.

ESMAP is undertaking a knowledge study on emerging practices in building power sector resilience to weather and geological risks. The objective is to collect global practices on addressing this challenge by surveying a wide range of power sector stakeholders in developed and developing countries, including regulators, utilities, insurance companies, financial institutions, and policy makers. This study is the first step towards identifying investment opportunities for managing weather and geological risks and mainstreaming natural disaster risk management in the energy sector. The study is a joint effort with the World Bank's Global Facility for Disaster Reduction and Recovery in coordination with the WBG's Treasury, Climate practice, and IFC. The results of this study are expected to be completed in December 2015.

Belize and the Philippines have requested World Bank technical assistance to improve the management of natural disasters in power utilities. In Belize, identified by the United Nations Framework Convention on Climate Change as among the most vulnerable to adverse impacts of climate change, ESMAP supported two analyses: one that provided a high-level diagnosis of issues and options for climate resilience in the country's energy sector and another on the impacts of extreme weather on the power system in Belize. The studies are informing the design and preparation of the World Bank's Energy Resilience for Climate Adaptation Project that is supported by GEF's Special Climate Change Fund.



Development of the Seventeenth Replenishment of the International Development Association (IDA 17) climate and disaster risk-screening tool drew on ESMAP's tool for screening energy sector vulnerability to climate change. As of July 1, 2014, IDA 17 requires all new operations funded by IDA to be screened for short- and long-term climate and disaster risks and provides a new

suite of online tools, including the climate and disaster risk screening tool, to help country teams identify potential risks to projects and country plans they are working on. The tool was also used by the World Bank's Africa regional team in Mozambique to inform development of that country's Second Climate Change Development Policy Operation.

BOX 2.1

SOLAR AND WIND POTENTIAL COULD HELP MEET FUTURE POWER GENERATION GOALS IN TANZANIA

To accelerate the expansion of renewable energy, the Government of Tanzania requested the support of the World Bank and ESMAP's Renewable Energy Resource Mapping Initiative to help improve the country's knowledge and awareness of small hydro, solar, and wind energy resources. The \$2.8 million program in Tanzania is one of the largest under this initiative.

According to preliminary findings, Tanzania has immense solar and wind power potential that could provide much-needed energy for the developing nation. The country's resources suitable for solar power generation were estimated to be equivalent to those of Spain, and areas of high wind power potential covered more than 10 percent of the country, an area the size of Malawi.

The initial results were based on global datasets and satellite analysis and involved six months of intensive number crunching by specialist wind and solar teams supported by ESMAP. Over the next two years, these findings will be validated by placing separate ground-based solar and wind measuring stations in approximately 20 locations—about 10 stations each for solar and wind—around the country.

This work will support and inform a long-term partnership between the World Bank and Tanzania Electric Supply Company, Ltd. (TANESCO) to expand and modernize the country's power sector.

One of the most interesting initial findings was that certain areas of Tanzania with high solar irradiation also have high wind speeds at night, raising the possibility of around-the-clock power generation.

All data from the initial results and from the next two years of ground-based measurements will be made available via the ESMAP website and on the Global Atlas for Renewable Energy that has been developed by IRENA.

The May 22 media briefing on the initial findings for Tanzania was followed by the inauguration of the country's first solar measuring station, on the rooftop of the Physics Department at the University of Dar es Salaam.



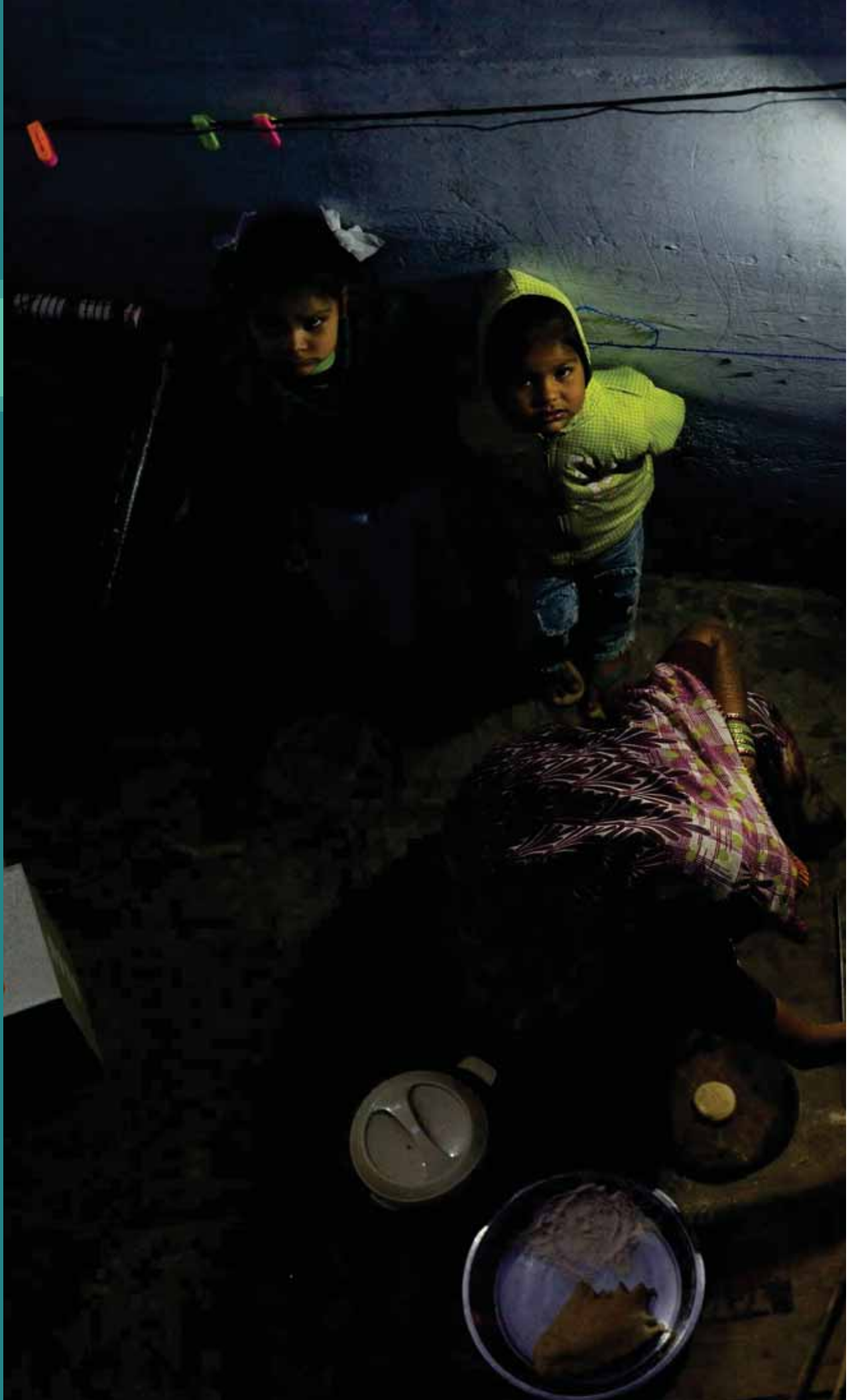
BOX 2.2

HIGHLIGHTS OF NEW ESMAP-SUPPORTED CLEAN ENERGY ACTIVITIES, FY2015

Indonesia | Capacity Strengthening and Risk Mitigation for Geothermal Development. Harnessing geothermal power is a key development priority for the Government of Indonesia and WBG. This joint effort has shed new light on tackling geothermal development challenges, first and foremost: resource risk. With funding from ESMAP, the World Bank is: (i) providing technical assistance and capturing lessons learned on resource estimation; (ii) providing capacity building to the Ministry of Finance and Ministry of Energy and Mineral Resources with the Geothermal Law and restructuring of the Geothermal Fund Facility; and (iii) developing key risk mitigation models for geothermal exploration and increased private sector participation. These efforts are geared to support the preparation of a CTF/GEF project for risk mitigation of geothermal exploration drilling with a focus on Eastern Indonesia, where electrification rates are lowest and poverty rates are highest.

The Philippines | Amendments to the Distribution Code for VRE. The objective of this activity is to provide advice to the Government of the Philippines on critical issues in the power sector, including VRE, Mindanao energy strategy, market development, and regulatory issues. There have been a number of recent positive developments in the Philippines' power sector: (i) most energy subsidies have been eliminated, (ii) energy access is 80 percent of the population and growing, and (iii) technical losses are decreasing. The purpose of World Bank assistance is to provide technical expertise and advice that will help facilitate the implementation of the remaining elements of the reform program.

Chile | Technical Assistance for Sustainable Geothermal Development. This activity aims to comprehensively address several key barriers to geothermal development and improve geothermal energy market conditions in Chile, by: (i) improving policy framework and strengthening management capabilities for mobilizing investments in geothermal and (ii) enhancing market conditions for promoting sustainable development of the sector. The World Bank will provide direct technical assistance by mobilizing and managing international specialists in geothermal energy development, carrying out analytical work to inform the relevant decisions of the Government of Chile, and providing just-in-time support. This operation is co-funded by ESMAP and the CTF and aims to support the Government of Chile in creating the legal framework and market conditions required for the geothermal sector to develop. Within this framework, the World Bank and the Inter-American Development Bank (IDB) are working together in the geothermal sector in Chile. IDB is currently implementing an operation in this sector, which may directly benefit from the outcomes of this activity, namely the new regulatory framework and market conditions.





CHAPTER 3



CREATING PATHWAYS TO SUSTAINABLE ENERGY FOR ALL



KNOWLEDGE TO HELP ACHIEVE UNIVERSAL ENERGY ACCESS

The three overarching goals of the Sustainable Energy for All Initiative (SE4All) to be achieved by 2030—universal access to modern energy services, doubling the share of renewable energy in the global energy mix, and doubling the rate of improvement of energy efficiency—have now been broadly accepted by a large and diverse global coalition of international organizations, the private and civil sectors, and over 80 developing countries.

Although the world is making progress towards the first SE4All goal, much more needs to be done. Greater effort is needed to address the barriers of affordability, access to financing, innovation and capacity, and policy environment. To this end, ESMAP has scaled up its support for the SE4All initiative through its own technical assistance program as well as by hosting the **SE4All Knowledge Hub**.

The Knowledge Hub, a joint effort of ESMAP and the World Bank's Energy and Extractives Global Practice, focuses on two areas: (i) research that supports implementation of SE4All initiatives through frameworks that track and monitor progress and (ii) knowledge management work that collects information and data around key policy experiences and cases to make it readily accessible to decision makers.

Four specific, but complementary initiatives are being implemented under the Knowledge Hub: the Global Tracking Framework (GTF) for SE4ALL; the Multi-tier Framework for Measuring Energy Access; Readiness for Investment in



KEY ENERGY ACCESS ACHIEVEMENTS, FY2015

- Helped develop the new **National Electrification Program for Myanmar**, which calls for universal access to electricity—7.2 million new household connections—by 2030
- Launched the **Efficient, Clean Cooking and Heating Program**, which aims to encourage and foster public and private partnerships to scale up access to cleaner and more efficient cooking and heating solutions
- Published two groundbreaking reports: (i) **Progress Toward Sustainable Energy: Global Tracking Framework 2015**, the second in a biennial report series that tracks the world's progress toward the three SE4All goals; (ii) **The State of the Global Clean and Improved Cooking Sector**, which provides a comprehensive picture of the current state of the clean cooking sector in the developing world
- As part of the **SE4All Technical Assistance Program**, supported work in 10 countries in Africa, Central America, and South Asia to help expand and accelerate their national energy access programs

Sustainable Energy (RISE); and the global State of the Energy Access Report.

In FY2015, ESMAP collaborated with the Energy and Extractives Global Practice of the World Bank and IEA—with the support of over 20 other partners—to produce **Progress toward Sustainable Energy: Global Tracking Framework 2015**, the second in a biennial report series that tracks the world's progress toward the three SE4All goals.

The report found that as of 2012, 1.1 billion people in the world still live without electricity and 2.9 billion people still cook using solid fuels like kerosene, wood, charcoal, and dung. Overall, the increase in the number of people gaining access to electricity is only just keeping pace with population growth, whereas the number of people gaining access to modern cooking fuels did not keep pace with population growth between 2010 and 2012. Meeting the universal energy access goal will require well-informed policy planning, putting in place new technologies and business models, and most of all, increased investment. Achieving universal access to electricity will require \$36 billion a year in additional investments between now and 2030. Meeting the clean cooking gap, by contrast, will only take an additional \$4.3 billion a year.

A number of organizations, including the Energising Development Program, GIZ, KfW Bankengruppe (KfW), Practical Action Consulting, and United Nations Development Programme (UNDP), among others, closely collaborated with ESMAP to help shape the Multi-tier Framework (MTF) approach. GIZ will support the implementation of the global rollout phase of the MTF survey in Bangladesh.

The World Bank Group and ESMAP have partnered with other stakeholders, including USAID and the Scaling Up Renewable Energy Program of the Climate Investment Funds, to develop RISE. RISE is a new initiative to develop global indicators across the three focus areas of SE4ALL—energy access, energy efficiency, and renewable energy. Specifically, RISE looks at a country’s planning, policies and regulations, and pricing and subsidies; assesses its readiness for investment in sustainable energy; and offers country-level interventions and policy inputs to foster

enabling environments. As a tool, RISE was initially piloted in 17 countries, and global rollout began in 2015 with a report expected in 2016.

Complementing the GTF, the Knowledge Hub will develop a periodic publication on the global state of energy access. The Global State of Energy Access Report will provide qualitative analysis, complementing the data-driven analysis in the GTF and the RISE indices. An important element of this report will be to capture actual impacts of energy access programs through specific case studies, the first of which is expected to be released in early 2016.

SCALING UP CLEAN COOKING AND HEATING

The cost of reliance on inefficient and polluting fuels and cooking and heating stoves can no longer be ignored. A staggering 4.3 million people die annually and millions more suffer from serious illnesses caused by air pollution from cooking and heating with traditional fuels such as wood, charcoal, coal, animal dung, and crop waste.

Yet, global engagement has been lackluster in recent decades due in part to market barriers that impede the production, deployment, and use of clean and improved cookstoves in the developing world. Recent developments, however, have the potential to transform the sector. New technologies, scientific linkages between emissions and health, and growing private sector engagement are beginning to make a difference.

Taking advantage of the significant momentum generated by SE4All and the upcoming Sustainable Development Goals, the World Bank is



ramping up its efforts to help countries find clean, efficient cooking and heating solutions and expand access to modern energy services. A new **Efficient, Clean Cooking and Heating Partnership**, proposed and managed by ESMAP, will use the comparative advantages of the World Bank Group and its partners, such as the Global Alliance for Clean Cookstoves, to foster public and private partnerships to scale up access to cleaner and more efficient cooking and heating solutions.

This new program, announced in October 2014, will initially focus activities in 10 countries where a foundation for cleaner and more efficient cooking and heating has already been established. The new program will build toward achieving health benefits, pinpointing approaches and technologies, such as more efficient stoves and cleaner burning fuels, which reduce exposure to cooking and heating-related pollutants.

This program will offer technical support to global activities and country programs that test innovative approaches to (i) speed the scaling up of product manufacturing capacity and delivery (which will increase affordability), and (ii) mobilize public and private sector resources (which will increase sustainability). Given the multi-disciplinary nature of the problem, ESMAP will draw on the WBG's expertise in poverty reduction, health, environment, household energy, forestry, natural resource management, climate change, gender, and finance.

THE STATE OF THE GLOBAL CLEAN COOKING SECTOR

A new report developed jointly by ESMAP and the Global Alliance for Clean Cookstoves, *The State of the Global Clean and Improved*

Cooking Sector, provides a comprehensive picture of the current state of the clean cooking sector in the developing world with a particular focus on low penetration in Sub-Saharan Africa and South Asia. Launched at the SE4All 2nd Annual Forum in New York in May 2015, the report builds on the latest literature and, using original research and analysis, the report updates the case for clean cooking; maps key sector demand and supply trends; and provides the first-ever global baseline and market forecast for clean and improved cooking solutions.

The central message from the report is that the clean cooking market has immense potential for growth, with over 700 million households, that together already spend over \$100 billion annually on cooking fuels and devices. While there remain formidable technical, institutional, and regulatory challenges to overcome, there is significant growth opportunity for early entrants, as well as existing players, in the large and expanding clean cooking market.

The report underscores that meeting the objective of universal clean cooking access requires a broad, multi-sectoral approach and, while different levels and types of solutions need to be promoted in the short run, only the cleanest solutions—clean fuels and advanced biomass stoves and electricity—hold the potential for a truly transformational impact on health.

TAKING ACTION AT THE COUNTRY LEVEL

As part of WBG's commitment to SE4All, ESMAP launched the **SE4All Technical Assistance Program** in 2013, to help countries develop the policy frameworks, strengthen the institutions, and

FIGURE 3.1

SE4All Technical Assistance Program Activities



mobilize the financing necessary to expand and accelerate their national energy access programs. Work initially began with activities in Burundi, Guatemala, Guinea, Honduras, Liberia, Mozambique, Myanmar, Nepal, Nicaragua, and Senegal as well as technical assistance and financing

studies to help strengthen regional power pools in Sub-Saharan Africa.

In Sub-Saharan Africa, most activities and development of roadmaps and investment prospectuses are well underway, although implementation has



been hampered by the 2014 Ebola crisis in Guinea and Liberia.

- In **Burundi**, the Masterplan and Pre-Feasibility Study for Network Extension as well as the Electricity Distribution Investment Plan, are underway.
- In **Guinea**, an energy sector working group has been established to coordinate SE4All activities and rollout of the multi-tier framework pilot has begun.
- 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 **Mozambique**, progress has been made in developing a roadmap for implementation of the country's new Energy Strategy 2014–23.
- In **Nigeria**, 2 of the country's 11 distribution zones have been covered through a geospatial planning approach to expand electrification and a detailed investment plan for extending the electricity network is under development.
- In **Senegal**, the first part of an audit of the rural electrification agency was completed and implementation of the investment prospectus on rural electrification is advancing.

Beyond rural electrification, the program has extended its services to clean cooking initiatives in Nepal—where the program to prepare the investment prospectus is underway—and three countries in Central America: Guatemala, Honduras, and Nicaragua. The Central American Clean Cooking Initiative successfully completed roadmaps and investment prospectuses for Guatemala and Nicaragua; and a gap assessment report for Honduras.

A number of early lessons have been learned from this first year of implementation in Central America. There must be a top-down and a bottom-up approach to this issue. Clean cooking solutions must be a national priority at the highest level of government for any program to have a chance at success. Simultaneously, awareness raising of the linkages between cooking with woodfuels in inefficient cookstoves and human health in the form of community cooking demonstrations are important to stimulate demand for clean cooking solutions. In each instance, significant staff time is needed to research, explore, coordinate, and build relationships as well as train small- and medium-size enterprises.

In FY2015, the SE4All Technical Assistance Program completed its first investment prospectus for the National Electrification Plan toward universal electricity access in Myanmar (see Box 3.1).

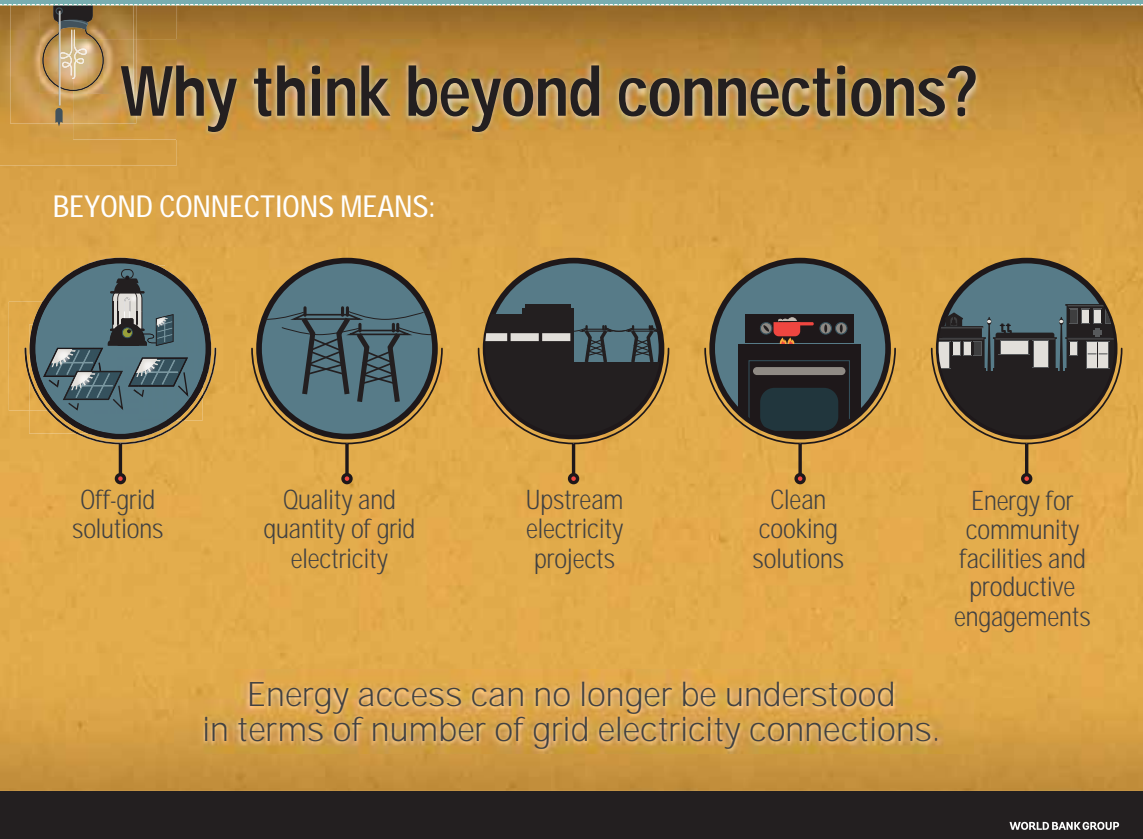
The SE4All Technical Assistance Program also financed technical and financing studies to help strengthen regional power pools in Sub-Saharan Africa. The activity has kicked off with a flagship report on regional power trade, exploring both the importance of regional integration and innovative financing options for transformative energy projects.

BEYOND CONNECTIONS: ENERGY ACCESS REDEFINED

Energy is needed for various applications across households, businesses, and communities; and access to energy is a key enabler of socioeconomic development. To be meaningful, access to energy must be adequate in quantity, available when

FIGURE 3.2

Beyond Connections: Energy Access Redefined



needed, and of good quality. It should also be affordable, reliable, convenient, legal, healthy, and safe. Energy access may be secured through a range of technologies, including grid and off-grid electricity, as well as through the use of conventional fuels and renewable energy.

A new ESMAP report, *Beyond Connections: Energy Access Redefined*, offers a paradigm shift from a binary definition of energy access that measures whether a household has an electrical connection or not to a multi-tier approach that assesses energy access from the perspective of

usability, specifically how and what kind of energy is used to accomplish an array of tasks.

The report divides energy use into three broad categories—household, productive enterprises, and community facilities. At the household level, energy access encompasses electricity as well as cooking and heating solutions. For productive engagement, energy access involves any activity that increases income, productivity, and/or employment while delivering higher quality or lower priced goods. Energy access for community use includes improvements in infrastructure and

services such as schools, health facilities, government offices, and street lighting.

The report proposes a multi-tier framework for each area. This approach embraces all aspects of energy access, including adequacy, availability, reliability, affordability, quality, legality, health impacts, safety, and convenience. Tracking how people are using energy and for what purposes can inform investments in energy projects to strengthen the overall energy delivery system

from physical infrastructure to policy and regulation.

Introduced at the Vienna Energy Forum in June, the full report will be published in late 2015. Subsequent reports will suggest methodological approaches and analyze on-the-ground results from data collected in Democratic Republic of Congo (Kinshasa), Uganda, Ethiopia, Rwanda, and India (Bihar) where the new framework has been tested.



BOX 3.1

POWERING UP MYANMAR: MORE THAN 7 MILLION NEW ELECTRICITY CONNECTIONS NEEDED BY 2030

Myanmar has one of the lowest electrification rates in the world. Even with gains in recent years, only 33 percent of the population has an electricity connection. While this rate is higher for urban areas, large parts of rural Myanmar have almost no electricity at all.

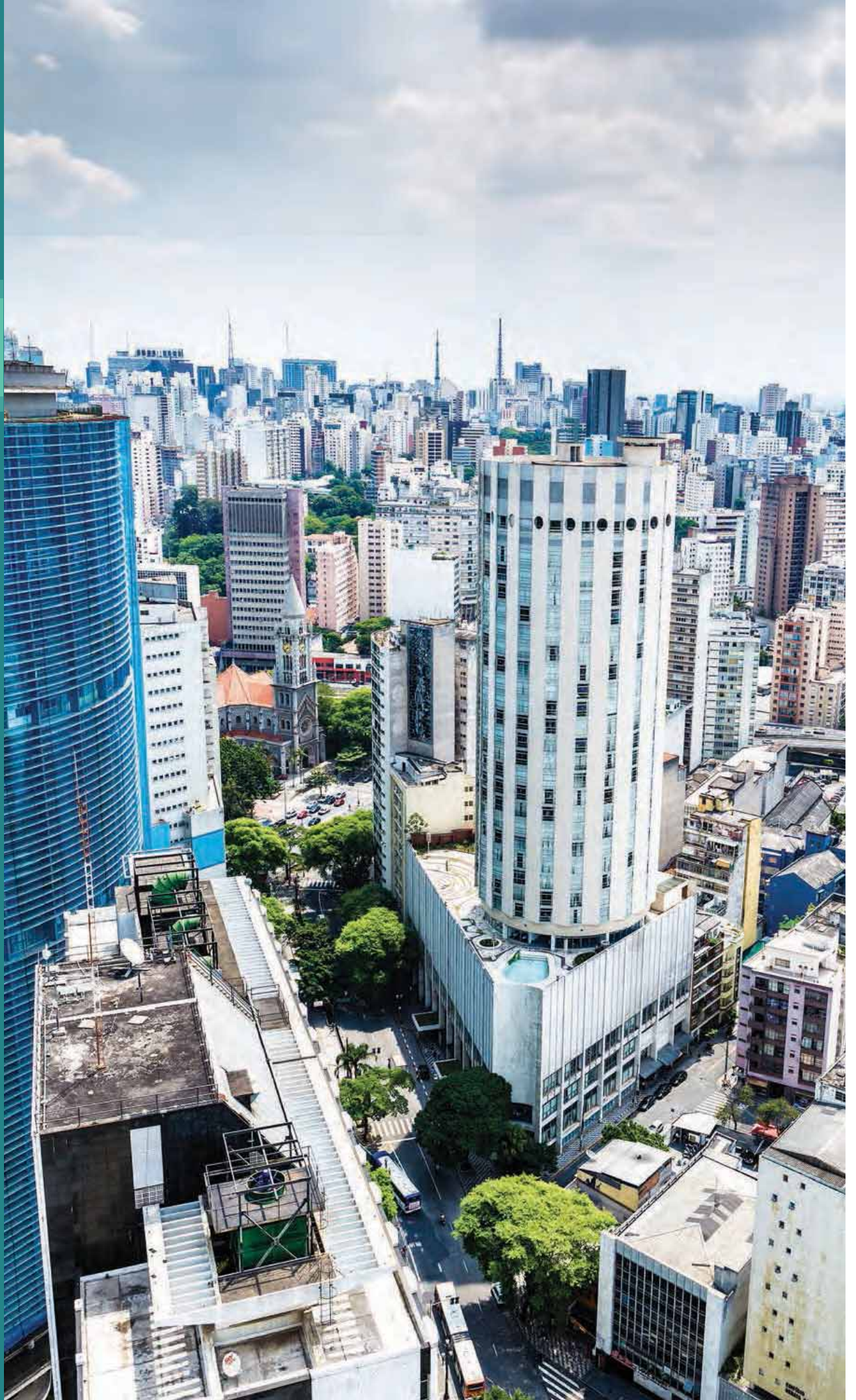
Lack of power threatens Myanmar's economic transition by restricting the expansion of infrastructure projects, putting industrial development on hold, and slowing down job growth. In rural areas, schools and clinics operate with little to no power.

In January 2014, the World Bank committed \$1 billion in financial support to expand electricity generation, transmission, and distribution in Myanmar. As part of this effort, a joint WBG team, with technical and financial support from ESMAP, worked closely with Myanmar's government in FY2015 to develop and implement a National Electrification Plan. The goal: universal electricity access by the year 2030.

Universal electricity access for Myanmar will not be a small feat. Approximately 7.2 million new household electricity connections will be required by 2030. Achieving this will require an average of 450,000 new connections per year—more than double the current rate of expansion. Additionally, the total cost of the 16-year rollout is estimated at \$5.8 billion, in addition to the generation and transmission investments required to meet the resulting energy demand.

Using geospatial mapping techniques, the National Electrification Plan details the expansion of Myanmar's electricity grid and use of mini-grids and off-grid solutions. The investment prospectus recommends 1.7 million new electricity connections to be created during the first five-year period, with \$700 million in investment and technical assistance from development partners, government, and the private sector.

The National Electrification Plan makes clear, with continued government commitment, targeted sector policies, and financial support from donors, universal electricity access in Myanmar is both achievable and affordable.





CHAPTER 4



FOSTERING ENERGY EFFICIENT CITIES



COLLABORATIVE SOLUTIONS FOR URBAN ENERGY CHALLENGES

The United Nations forecasts that the world's urban population will increase to 64 percent by 2050, with 94 percent of that increase occurring in developing countries. Cities are proving to be the primary drivers of economic growth and innovation. But rapid urbanization, together with rising incomes, has led to massive new demand for energy to power economic activity and expand basic infrastructure as well as deliver municipal services. Energy efficiency can offer practical, cost-effective solutions to expand and improve urban services, while contributing to cities' efforts to be more competitive and address climate change. It can also contribute to meeting countries' energy security and energy access objectives.

Today's increasingly urban world requires collaborative solutions. ESMAP's **City Energy Efficiency Transformation Initiative (CEETI)** has been assisting municipalities address some of their most pressing economic, social, and environmental challenges, since its inception in 2013. With a continued focus on technical assistance, capacity building, and knowledge creation and dissemination, the initiative significantly increased its work program in collaboration with the World Bank Social, Urban, Rural and Resilience Global Practice in FY2015.

Through grant allocations totaling over \$5 million, the initiative has provided support to cities in 12 countries. Among the ongoing activities are municipal energy efficiency action plans for cities in Macedonia; support to the city of Shenzhen, China, to develop a low carbon strategy and



KEY ENERGY EFFICIENT CITIES ACHIEVEMENTS, FY2015

- Allocation of over \$6 million to 17 countries under **City Energy Efficiency Transformation Initiative** grants, Energy Efficient Urban Transport grants, and Energy Efficient Urban, Water and Sanitation Services grants, in collaboration with World Bank's Social, Urban, Rural and Resilience Global Practice; Water; and Transport and ICT Global Practices, to perform city energy diagnostics, conduct pre-feasibility studies in key energy-using urban sector (e.g., street lighting and buildings), improve capacity in transport planning, develop municipal action plans, design business models, and support investment plans
- Raised awareness and informed policy dialogues on municipal energy efficiency through the use of the **TRACE** to more than 30 new cities, including municipalities in India, the Kyrgyz Republic, Mexico, and Ukraine
- Publication of a series of energy efficiency guidance notes for mayors, covering procurement, financing, buildings, transport, energy assessments, and spatial planning
- Launch of the **Energy Efficiency Project Resource Center** in partnership with Energypedia to provide easy access to working-level energy efficiency project documents to experts worldwide

investment program; assessments to determine the energy efficiency potential across sectors in Egypt's two largest cities—Cairo and Alexandria; and a sustainable urban energy and emissions plan in Surabaya, Indonesia, which includes a

street lighting pilot project. CEETI also supported IFC's green building program (EDGE) in developing a publicly available software tool as well as building certification in a number of countries.

The initiative also provided over \$1 million in grants to the World Bank's Transport and Water Global Practice Groups. Among the transport activities were programs to strengthen public transport in Latin America and improve bus operational efficiency in India. On the water side, grants were used for technical training of water utilities in the Danube Region and scaling up energy management in water and sanitation operation in Latin America, particularly Nicaragua.

At the same time, ESMAP developed a robust pipeline of city energy efficiency diagnostic activities, many involving the **Tool for Rapid Assessment of City Energy** (TRACE). For instance, two TRACE-enabled diagnostics conducted in Mexico in 2013 (Leon and Puebla) have expanded into a program of energy efficiency assessments in 30+ cities nationwide, providing the foundation for the development of a national program on energy efficiency in cities led by the Mexican Ministry of Energy.

In Ukraine, a diagnostic of energy efficiency potential has led to the development of a sustainable urban energy efficiency program with investment plans for three cities—Kiev, Ternopil, and Kamianets-Podilskyi. The use of TRACE to identify energy efficiency potential was only the first step in a larger energy efficiency transformation program. Additional outputs include an investment pipeline as well


as a pre-feasibility study for each of the three cities. In the Odisha state of India, TRACE was used in the three cities of Bhubaneswar, Cuttack, and Puri as part of a larger urban resilience non-lending technical assistance that will inform a development policy lending operation that is currently being prepared.

In Brazil, the LED Lighting Program has advanced since the first TRACE deployment in 2012 in Belo Horizonte and Rio de Janeiro. The deployments were followed by pre-feasibility studies in both cities. As a result, Belo Horizonte decided to replace its 178,000 lighting points with LEDs using a public-private partnership. Rio de Janeiro has included the replacement of its 400,000 lighting points in its 2017 infrastructure plan in order to focus on the 2016 Olympics. The World Bank is finishing a survey of lighting systems in 300 Brazilian cities and launching a study of the most appropriate business models to help the cities transition to LED lighting, which is roughly 60 percent more efficient.

Altogether, TRACE was used in more than 30 cities in FY2015, bringing the total number of cities that the tool has been implemented in to over 60.

STRATEGIC GUIDANCE NOTES FOR CITY OFFICIALS

For cities that want to take concrete actions on improving energy efficiency, it is essential for city leaders to understand what, where, and how big the potential energy-saving opportunities are for their city; how to capture these savings; the



implementation costs and constraints; and how to set priorities given local capacity and resources.

To help municipalities tackle these tough questions, ESMAP has published a series of guidance notes covering urban energy efficiency topics such as procurement, financing, buildings, transport, energy assessments, and spatial planning. The notes are directed towards mayors to help them set a forward-looking, sustainable strategic vision for their municipality. Each note provides practical options, global lessons, and examples from successful programs worldwide.

The first in the Mayoral Guidance Note series, *Driving Energy Efficiency Markets through Municipal Procurement*, outlines the opportunities and barriers to adopting procurement strategies and offers step-by-step guidance on how cities can get started with energy efficient purchasing policies. *Financing Municipal Energy Efficiency Projects* focuses on how municipalities can access financing for energy efficiency investments, particularly for projects in indoor lighting, building retrofits, public lighting, and municipal utilities. *Improving Energy Efficiency in Buildings* offers city leaders advice on how to introduce energy efficiency measures and tap into a wide array of proven technologies, policies, and financing mechanisms.

Toward Sustainable and Energy Efficient Urban Transport presents a systematic, practical, and comprehensive approach—a framework of possible interventions—to deal with the problems of urban transport and demonstrates how such interventions relate to the overall objectives of improving mobility and energy efficiency, reducing air pollution, and increasing road safety. *City Energy*

Efficiency Assessments serves as a general reference for defining and choosing the three types of energy efficiency assessments—multi-sector rapid, single-sector in-depth, or multi-sector comprehensive assessments—that a city might pursue as well as the basic steps for conducting each. Finally, *Planning Energy Efficient and Livable Cities* advises city leaders on how to manage the growth and transformation of urban forms through planning policies, zoning regulations, and design guidelines.

Cities have to make hard decisions on energy efficiency investments. The burden for mayors is to discern where the opportunities are, what measures offer the greatest potential for energy efficiency improvements, which sectors to prioritize, and what the implementation constraints are for one's own city. By building upon the TRACE assessments, these guidance notes are designed to facilitate the decision-making process.

A GROWING KNOWLEDGE BASE

As part of its commitment to support the scale-up of energy efficiency in developing countries, ESMAP has developed an **Energy Efficiency Project Resource Center** in partnership with Energypedia, an independent non-profit energy information resource.

The Energy Efficiency Project Resource Center went live in April 2015 and is currently hosting around 130 working-level documents on energy efficiency—such as sample terms of reference, procurement documents, case studies, and training material, among others—which are key to help officials from cities and countries around the




world inform and implement urban energy efficiency actions. Documents are tagged by sector (e.g., buildings, solid waste, transport, etc.), language, and region/country. Energypedia's open wiki-based platform allows any user to both easily locate documents and add new ones. Having such documents readily available can reduce transaction costs associated with creating new templates from scratch. Also, the platform facilitates interaction through dedicated spaces for discussion and private messages to other users. The target users are energy efficiency professionals seeking guidance on project planning and implementation as well as organizations that want to facilitate knowledge exchange.

The Energy Efficiency Project Resource Center builds on the successful experience of the Renewable Energy Project Resource Center launched with Energypedia in FY2014; the two platforms now have a common landing page, known collectively as the Clean Energy Project Resource Center, allowing users to easily access

project-related resources in the clean energy sector. Current partners include the Public-Private Partnership in Infrastructure Resource Center, GIZ, the Renewable Energy and Energy Efficiency Partnership, openei.org, the Wuppertal Institute for Climate, Environment and Energy, and Natural Resources Canada.

LEARNING LESSONS IN A LIVABLE CITY

Vienna—selected the world's most livable city in 2015—became the setting for ESMAP's **Knowledge Exchange Forum on Livable and Energy Efficient Cities** in June 2015. This event was organized by ESMAP and hosted by the Government of Austria with support from the Austrian Development Agency and United Nations Industrial Development Organization (UNIDO). The event brought together stakeholders from around the world who received CEETI grants—including representatives from 14 developing



countries—to exchange experience and lessons learned on the development of livable and energy efficient cities. Through brief presentations and moderated discussions, participants were encouraged to actively learn from their peers.

Presentations were paired with guidance from urban planning experts and commentary from city administrators on the ground. For instance, the opening session featured a presentation from a Californian urban design expert who brought examples of urban revitalization in numerous cities in China, Mexico, and the United States, where the emphasis was on transportation planning, community livability, multi-modal street function,

and economic growth. The former General Manager of Transmilenio in Bogota, Colombia, guided forum participants through Bogota’s challenging process of transforming a once chaotic public transport system into a model for the world. The Director General of Environmental Management in Leon, Mexico, outlined the 13 energy efficiency measures already identified to increase livability for its nearly 1.5 million residents spread across 456 square miles. Other topics of discussion included institutional, financial, and regulatory barriers to development of urban energy efficiency; successful delivery models; aligning national and local priorities; and the roles of civil society and the private sector.

BOX 4.1

DEVELOPING SUSTAINABLE URBAN TRANSPORT IN COLOMBO

In Colombo, Sri Lanka, the proportion of the population using private transportation surged from 26 percent in 1985 to 42 percent in 2013. Travel speed at peak hours is mostly less than 20 km per hour and even less than 10 km per hour in some sections. Without energy efficient transport solutions, the problem will just get worse as the population of Western Province, the country’s capital region, is expected to increase from 5.8 million to 8.7 million by 2035.

The core railway network in the heart of Colombo holds great potential for transit-oriented development. With funding from ESMAP, the World Bank’s South Asia Transport Unit conducted a low carbon urban transport study for Colombo to explore the potential for optimizing the use of public transport.

The study assessed current and future levels of greenhouse gas emissions from Colombo’s urban transport sector, using a transport demand simulation model from JICA that drew from an extensive survey of 44,000 households in Colombo. Analyses on the potential impacts found that better connections between Sri Lanka’s existing railway and bus networks would attract more people to use public transportation and reduce carbon emissions from private vehicle usage by an estimated 18,000 tons of carbon dioxide in 20 years.



BOX 4.1 *Continued*

The study proposes the development of “multi-modal centers” (MMCs) that would integrate bus, railway, and other public transport services; car and motorcycle parking; and non-motorized transport such as walking or bicycling. Bus bays, taxi stands, and motorcycle parking will be arranged so that people can walk to and from stations safely on pedestrian bridges.

Ragama, a key junction of the Sri Lankan Railway’s network where two lines merge, was selected as one of the pilot stations to determine the impact of improved connectivity on public transport usage and carbon emissions. Near the railway station, Ragama now has two separate bus terminals, one right next to the station and the other across the tracks. About 25 buses arrive per hour at Ragama station during morning peak times. With the busy movement of buses, cars, tuk-tuks—three-wheeled motorcycle taxis—and pedestrians, the area has a high risk of traffic accidents.

The development of an MMC at Ragama would also focus on operational aspects such as synchronizing the timetable between bus and rail and a common ticket system for smooth transfers.

With the new proposed layout and operational measures for integration, public transport passengers would benefit from fast, comfortable, and safe transfers at the pilot stations. At Ragama, the development of the MMC would increase the number of passengers transferring from bus to rail from a projected 1,650 per hour at peak times in 2035 to 2,140, a 30 percent increase. The study estimates that the economic internal rate of return of the proposed MMC development in Ragama is 18.6 percent, which shows high economic viability of the project.

Based on the recommendations of the study, Sri Lanka’s Ministry of Internal Transport, in cooperation with the Ministry of Urban Development, Water Supply and Drainage, will further explore the feasibility of the Ragama MMC through detailed design and analysis. Particular areas to be researched are mechanisms to enhance cross-sector government coordination and a detailed financial scheme to implement the project through public-private partnerships.

In April 2015, the methodology and results of this study were reported at the Climate Change Targets and Urban Transport Policy conference in Malta, held in collaboration with the World Conference on Transport Research, and accepted for publication by the journal *Climate Change Targets and Urban Transport Policy*.



BOX 4.2

HIGHLIGHTS OF NEW ESMAP-SUPPORTED ENERGY EFFICIENCY ACTIVITIES, FY2015

Supporting Energy Efficiency in Brazilian Cities. Major cities in Brazil are heavily affected by recent droughts that have resulted in increasing electricity prices and water shortages. For instance, the price of electricity rose by more than 50 percent in 2015 in both Rio de Janeiro and Belo Horizonte. Sao Paulo's water reservoirs are 85 percent below normal levels, and the city has resorted to water rationing. ESMAP is helping Brazil respond to these challenges by ramping up its support to these cities through programs in lighting and in building resource efficiency. The Buildings Resource Efficiency Program was launched in 2015 with the goal of conducting pre-feasibility and financing studies for renewable energy/energy efficiency investments in schools. Following in the footsteps of the public lighting program (see above), this program is being implemented in Rio de Janeiro and Belo Horizonte and will be expanded nationwide when the two cities are significantly advanced. Given the economic challenges in Brazil, the program is also investigating different innovative ways for financing the investments including concessions for rooftop solar PV generations, which pay for the energy efficiency investments in the schools.

Learning from Best International Practice in Smart Transport and Energy Efficiency: Applications to the Wuhan Integrated Transport Development Project and Beyond. Rapid urbanization has transformed China into an increasingly urban and economically diversified economy from a rural, agricultural one. Currently, 622 million people are concentrated in China's large eastern coast cities while the central and western regions of China have lagged behind. This activity aims to determine and understand the institutional and technological conditions under which investments in smart city and intelligent transport systems (ITS) lead to savings in energy. Its methodology includes (i) review of literature on smart cities and ITS and linkages to transport benefits and energy savings; (ii) field work to build case studies in cities such as Singapore, Seoul, and London; (iii) interviews with manufacturers of smart city and ITS technologies; (iv) development of a meta-model emphasizing the cause and effect of conditions that lead to transport benefits and energy savings (with a quantitative part based on the TRACE tool); and (v) a final report. The activity is closely linked to the preparation of the Wuhan Integrated Transport Development Project, a separate World Bank project that comprises an integrated, comprehensive ICT platform to improve the planning, operation, and management of Wuhan's transport system and therefore seeks to enhance energy efficiency in urban transport.

Innovative Energy Efficiency Financing in China. Nearly a decade ago, the World Bank helped to establish the first three energy service companies in China. Since then, the Government of China has made

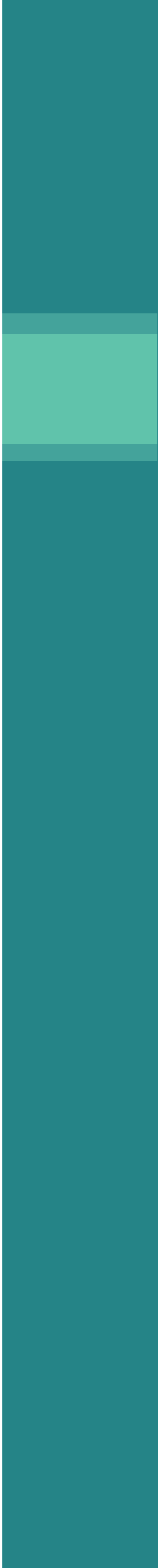


BOX 4.2 *Continued*

energy efficiency one of the top priorities for the nation. Embarking on one of the most aggressive energy efficiency campaigns in the world, the government set a mandatory target to cut energy intensity by 20 percent by 2010, with a renewed target of 16 percent reduction by 2015. This commitment by the government and continued support from the World Bank has increased the Chinese banking sector's capacity and confidence in energy efficiency lending with over 5,000 energy service companies now operating in China. Yet, supporting energy efficiency investments by small and medium enterprises or increasing access to financing for those customers who really need it has been a major challenge. In many cases, the most creditworthy potential clients are not necessarily those who need support to access financing for energy efficiency, while the customers most in need of financing are typically not considered creditworthy. The proposed solution includes the development of innovative financing mechanisms, possibly a dedicated Energy Efficiency or Green Fund, for public funds to incentivize investors and unlock commercial financing, with an ultimate goal to green China's energy sector.

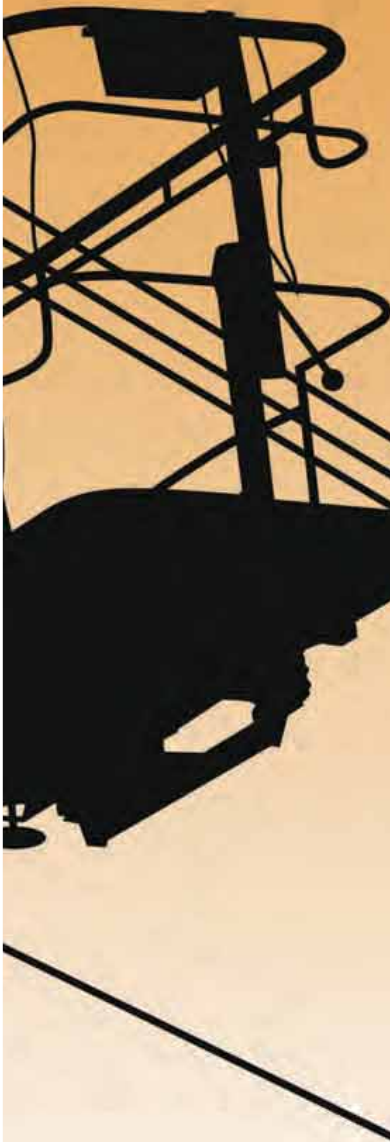
ENACAL Master Plan for Operational Efficiency in Managua, Nicaragua. Nicaragua remains one of the poorest counties in Latin America. In urban areas, nearly one-third of the population lives below the poverty line, especially in the Greater Managua Region. The Nicaraguan Water and Sewerage Enterprise (ENACAL) has been struggling to extend reliable water supply and sanitation services to the entire population. This activity, managed by the WBG's Water Global Practice, aims to enhance ENACAL's financial and environmental sustainability to bring better water supply and sanitation services to the urban poor in the greater Managua region. In particular, this grant focused on two areas identified by ENACAL as crucial to the utility's sustainability: (i) non-revenue water reduction and (ii) energy efficiency maximization. This project is benefitting over 160,000 people with improved water services and over 62,000 with improved sanitation.

Urban Development in the Kyrgyz Republic. The Kyrgyz Republic remains one of the two poorest countries in the Eastern Europe and Central Asia (ECA) region with the highest urban population growth in the region. Its sprawling urban developments have put serious strain on municipal services in the face of increasing local budget constraints. Improving the energy efficiency of municipal infrastructure is of particular importance given Kyrgyz's high energy intensity, ranking 11th worldwide, and the need to free resources for other development priorities. Building on TRACE studies completed in Balykchy, Sulukta, Toktogul, and Karasuu, which identified energy saving priorities for each city, this activity aims to improve access to and quality of municipal services (e.g., water and sanitation, street lighting, transport, and solid waste management) by mobilizing financial resources, supervising of these investments, and contributing to the development of comprehensive Energy Savings Action Plans that address all sectors for these cities.



CHAPTER 5

DEVELOPING
EFFECTIVE
ENERGY SECTOR
POLICIES AND
INSTITUTIONS





BUILDING GLOBAL MOMENTUM TOWARDS ENERGY SUBSIDY REFORM

At a knowledge exchange conference held in Copenhagen on October 22, 2014, the World Bank and ESMAP announced the launch of the **Energy Subsidy Reform Technical Assistance and Delivery Facility**, designed to help countries reform their energy subsidies and put in place social protection measures to help the poor during the transition. The event, organized by ESMAP and co-hosted by Denmark's Ministry of Foreign Affairs, brought together senior representatives from 25 countries to look at what approaches have or have not worked, as countries attempt to remove harmful energy subsidies.

The \$20 million facility is now supporting a wide range of global and country-level activities, including assessments of the social, economic, environmental, and political impacts of subsidy reform; support for consensus building through policy dialogue, consultations, and communications strategies; design of reform approaches, transition plans, subsidy delivery mechanisms, and social protection measures; and support to governments throughout the process of implementation. The work of the facility is made possible in part by funding from the European Commission.

The facility supports knowledge and experience sharing among countries that have undertaken reforms or are planning to. On April 16, 2015, a panel of ministers from Angola, Egypt, Honduras, and Ukraine, who have implemented energy subsidy reforms, came together to describe their countries' experiences. Common themes emerged: successful subsidy reform requires communication



KEY ENERGY ASSESSMENTS AND STRATEGIES ACHIEVEMENTS, FY2015

- Launch of the **Energy Subsidy Reform Technical Assistance and Delivery Facility** in October 2014, with activity underway in 15 countries and a ministerial-level event in Washington, DC, at the IMF/WBG Spring Meetings
- Completion of a screening curve analysis feature, an addition to **META**
- Publication of a synthesis report on private sector participation in electricity transmission and distribution focusing on the experiences of Brazil, Peru, the Philippines, and Turkey
- Expansion of the **Thirsty Energy** initiative in South Africa and China and a new Energizing Agriculture initiative in Mexico and Costa Rica
- Launch of the report, ***Power of the Mine: A Transformative Opportunity for Sub-Saharan Africa***

with stakeholders and an understanding of their concerns; brings tangible improvements domestically; strengthens social policy; and, while change will likely happen when it can no longer be avoided, can be prepared for in advance. The event took place during the International Monetary Fund (IMF)/WBG Spring Meetings, and was organized by ESMAP and co-hosted by WBG, the United States, and Friends of Fossil Fuel Subsidy Reform.

The facility also launched an online platform, which aims to provide a forum for peer-to-peer


learning and knowledge sharing among a growing community of experts and government counterparts. The **Energy Subsidy Reform Online Community** (ESROC) now has over 150 members who can post blogs and join in online as well as connect to webinars organized monthly. As part of an ongoing series of peer-to-peer knowledge sharing events, a webinar on “Energy Subsidies Reform: Winning the Public Opinion Battle” was held in April 2015. Speakers covered the nature of strategy as the organizing tool for political and communications plans. Leading experts in various fields relating to energy subsidy reform have also been recruited to form a panel of experts that provides technical support to country task teams and to participate in online discussions and webinars.

The facility is now operational in 15 countries, including Belarus, Egypt, Haiti, China, and Ukraine. Among the results of this work in FY2015 were the following:

- A study was conducted in **Belarus** on the impact of heating price reforms and how they could best be implemented. Following the presentation of the report to the government in July 2014, the Government of Belarus has taken steps to improve communications on the reform program, beginning with a new billing system.
- ESMAP supported the **Government of Haiti** in designing petroleum subsidy reforms and analyzing the impacts of these reforms. In collaboration with IMF and UNDP, the World Bank held several workshops aimed at sharing international experience and training 30 government staff members on assessing and managing subsidy reforms.
- Technical assistance to **Kyrgyz Republic** involved a cross-cutting approach to ensure public acceptance and affordability. ESMAP conducted quantitative and qualitative assessments and screening of existing social assistance programs. The Kyrgyz Government enacted their first tariff increases in December 2014.
- In **Ukraine**, the World Bank put together a multi-sectoral team of experts in energy, poverty, social protection, transport, and communications, which provided technical assistance to various government ministries. ESMAP assistance helped the Government of Ukraine schedule a reform plan from April 2015 to the end of 2017, significantly increasing gas and heating tariffs for households while protecting the poor from price shocks through targeted social assistance.
- Workshops in **El Salvador** and **Jordan** focused on technical and implementation issues. Presentations and group exercises covered the range of subsidy reform challenges, from tackling political economy hurdles to designing social compensation mechanisms and developing communication strategies.

HELPING TO FIND THE OPTIMAL TECHNOLOGY MIX

In 2012, ESMAP developed the **Model for Electricity Technology Assessment** (META) tool to inform energy policy and decision making by facilitating a comparative assessment of the economic costs of more than 50 electricity generation and delivery technologies. META can be used to provide economic analyses of power sector



investment projects, undertake deeper assessments of the effect that uncertain inputs, such as capital costs, can have on the energy generation cost as well as estimate the cost of environmental externalities. The tool has been increasingly mainstreamed into World Bank operations.

In FY2015, ESMAP completed an addition to META: a screening curve analysis feature that finds the least cost mix of different electricity technologies. It provides a simplified method of static power planning without determining the details of an expansion plan such as particular unit sizes and the timing of the plants entering the system. The outputs of this tool can be used as an input to or alongside more advanced power system planning models. The new screening analysis function was used to inform the preparation of lending projects in Turkey.

COUNTRY-LEVEL EXPERIENCE OF PRIVATE SECTOR PARTICIPATION IN POWER GRIDS

Because electric power systems are among the most capital-intensive parts of a modern economy, their successful development requires a massive deployment of resources from both public and private sectors. In recent decades, many countries have embarked on structural reform programs involving private sector participation (PSP) across the entire value chain of the power sector, including transmission and distribution. The growth of PSP in transmission, in particular, is a relatively new phenomenon, as some governments have started to free up this “strategic” subsector for private participation.

In FY2015, ESMAP published a synthesis report, *Private Sector Participation in Electricity Transmission and Distribution: Experiences from Brazil, Peru, the Philippines and Turkey*. The report distills the main findings and policy messages from in-depth country case studies recently completed by ESMAP. According to the report, PSP in transmission tends to focus on mobilizing capital for new, large grid expansion investments, while PSP in distribution has focused on networks already in place with the aim of improving operational and financial performance.

Based on the experience of Brazil, a build-own-operate-transfer type of contract can be effective in mobilizing substantial private investments for grid expansion. The Philippines experience shows that attracting private investment to the existing assets of a country’s core transmission business is a major undertaking that requires a strong focus on the design and enforcement of the legal and regulatory framework. In distribution, the experience of Latin American countries and Turkey shows that private operation of distribution companies can bring in solutions and levels of efficiency significantly higher than those achieved by state-owned enterprises.

ENERGY, WATER, AND AGRICULTURE

Launched in January 2014 with ESMAP support, the **Thirsty Energy** initiative helps countries to integrate water constraints into energy planning and to better understand their specific water and energy interlinkages. Thirsty Energy has been presented at a number of international events,

including the SE4All Forum, United Nations Water Conference, African Utility Week, and World Water Week, to raise awareness of the water-energy challenges and promote dialogue among government, international organizations, and the private sector.

In South Africa, where water is already scarce with stressed basins and strict water allocation, competition for water across all sectors is expected to increase. Thirsty Energy is working with the Energy Research Center of the University of Cape Town to fully incorporate water constraints into their energy planning tools by (i) matching energy producing regions with water resource areas and developing marginal water supply cost schedules by region, (ii) developing a “water smart” energy system optimization model, and (iii) running different scenarios to assess how energy sector development strategies change if water is a constraint.

In China, Thirsty Energy is supporting the National Energy Agency in its efforts to integrate water resources in the country’s five-year energy plan and assessment of the long-term sustainability of the plan. In February 2015, the team finalized contractual agreements with the Tsinghua and China Institute of Water Resources and Hydropower Research. In June 2015, a preliminary assessment was shared with the National Energy Agency. The final results and report are expected to be finalized in FY2016.

In Latin American countries, farmers face growing global food demand and increasing pressure on water resources and the power sector to improve agricultural productivity for national

consumption and export. With ESMAP support, a joint Energy-Agriculture team is undertaking the development of an Energizing Agriculture Assessment Tool that will calculate energy costs, efficiency, production, and greenhouse gas emissions in value chains in Mexico and Costa Rica.

In Mexico, the tool will customize and calculate energy contributions to greenhouse gas emissions in the country’s supply chains for meat and help the Ministry of Agriculture develop a plan for a Nationally Appropriate Mitigation Action to reduce carbon emissions in the livestock industry. In Costa Rica, the tool will examine coffee and milk value-chains to optimize energy and water usage in both. Work in each country will be compared to other countries, with the longer-term goal of introducing the tool across the region.



BOX 5.1

THE POWER OF THE MINE

Two-thirds of people in sub-Saharan Africa live entirely without electricity. For those with a power connection, supply cuts are frequent. Without new investment and with current rates of population growth, there will be more Africans without power by 2030 than there are now.

A report funded by ESMAP and the South African Fund for Energy, Transport and Extractives, *Power of the Mine: A Transformative Opportunity for Sub-Saharan Africa*, released in February 2015, calls on Africa's mining industry to work more closely with electricity utilities to meet growing energy demand. Rather than supplying their own energy on site, mines can become major and reliable customers for electricity utilities or independent power producers (IPPs), which can then grow and develop better infrastructure to bring low-cost power to communities.

The report found that mining's demand for power in Sub-Saharan Africa would likely triple between 2000 and 2020, reaching over 23,000 MW. This could be higher than non-mining demand for power in some countries. Yet many mining companies, often because of shortcomings in national power systems in the region, opt to supply their own electricity with diesel generators rather than buy power from the grid.

According to the report, another 10 GW of electricity would be added to meet mining power demand by 2020 from 2012 levels—and a part of this is projected to come from "self-supply" arrangements costing mining companies up to \$3.3 billion.

But new models of power supply for mines are emerging across Sub-Saharan Africa—including mines self-supplying and selling to the grid or serving as anchor consumers for IPPs. The report estimated that \$6 billion in potential public-private partnership opportunities exists for new power generation from clean energy sources (including natural gas and hydropower) in Guinea, Mauritania, Tanzania, and Mozambique—countries with strong expected growth in power demand from the mining sector.

The report states that though there are risks associated with power-mining integration—for example from falling commodity prices or a shortage of transmission links—regulatory and financial solutions can help mitigate these risks. A key element is for countries across Sub-Saharan Africa to continue with their power sector reforms and create an attractive operating environment for IPPs, including renewable energy developers.

BOX 5.2

HIGHLIGHTS OF NEW ESMAP-SUPPORTED ENERGY ASSESSMENTS AND STRATEGIES ACTIVITIES, FY2015

Bangladesh | Analysis of Economy-wide Impact of Energy Sector Reforms. Bangladesh's power sector faces a number of challenges such as rising, unmet energy demand, a significant financial gap between the cost of power delivered to consumers and the price they pay (leading to a continued need for state support to the Power Development Board), and limited success in attracting private

BOX 5.2 *Continued*

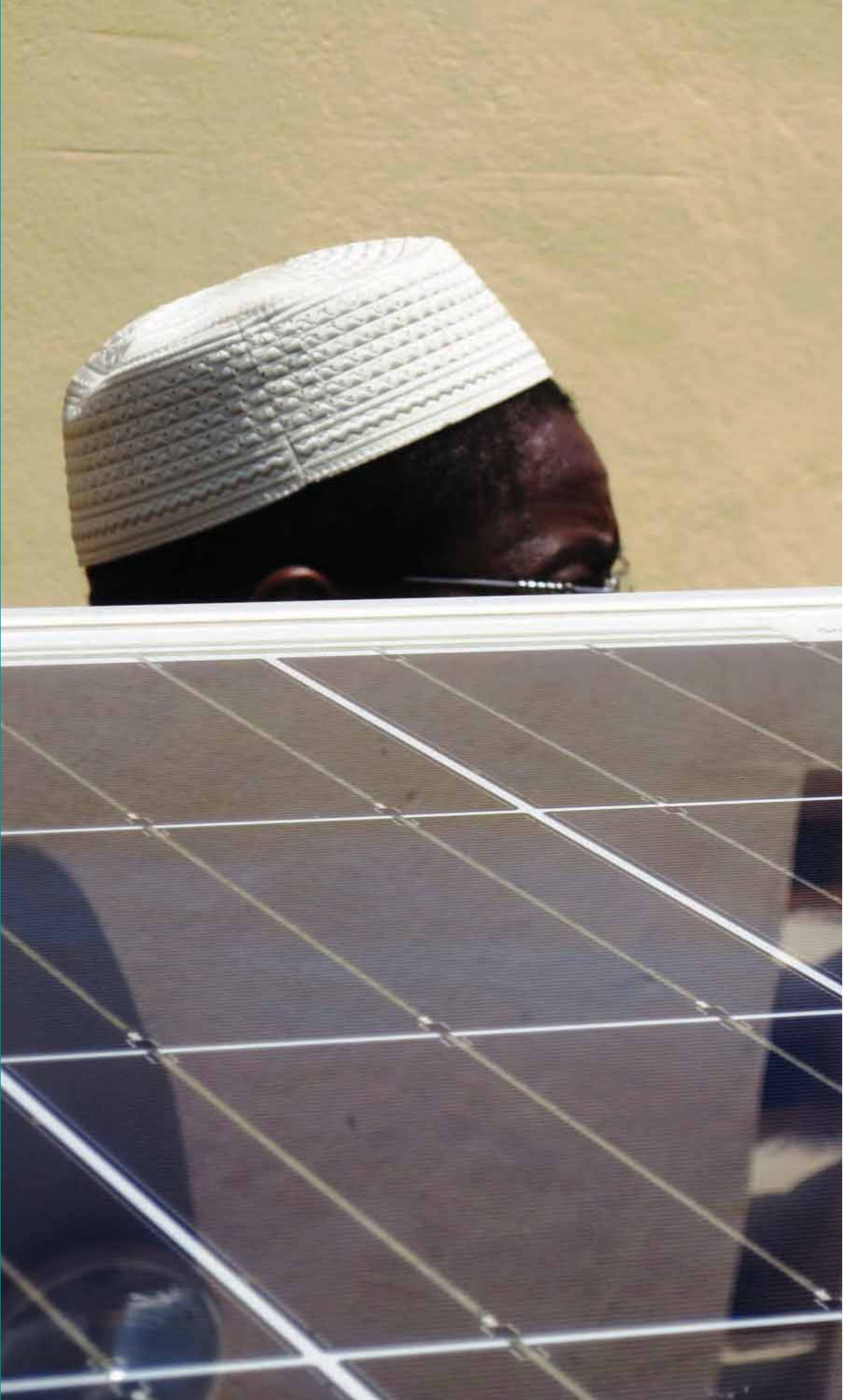
investment for new base-load IPPs. This activity supports the development and use of a Computable General Equilibrium model to assess the impact of different scenarios resulting in changes to power tariffs. Scenarios identified for analysis include gas price increases to international levels and removal of subsidies on power consumption. The activity also includes training for staff at the Bangladesh Energy Regulatory Commission to understand the model and collaboration with a professor at Dhaka University who can help them use the model to run simulations of particular interest.

Burkina Faso | Energy Mix Diversification. This activity supports the Government of Burkina Faso in crafting a medium-term energy mix strategy that takes into account its policies, market design, and system operations and integrates renewables in the most cost-effective way. The activity will include recruitment of a consultancy firm to analyze and recommend an optimal renewable energy mix; a stock-taking seminar; technical and economic comparison of different options on generation and supply mix, including renewable sources; and a medium-term strategy with an action plan and financing needs.

Turkey | Social Compact in Electricity Privatization. In southeastern Turkey, electricity supply is often interrupted, sometimes for up to four hours. Many people believe that such an irregular supply does not warrant regular payment, resulting in an estimated 70 percent non-payment rate. This project involves a pilot social development project implemented in Madrin and Sanliurfa, two southeastern provinces. A social compact serves to align service provider incentives for revenue collection with user incentives for quality service. The social compact project sets up stakeholder committees representing urban and rural communities to forge and sustain a dialogue between the consumers and the electricity company on increased electricity payment and improved service quality. The stakeholder committees devise a joint stakeholder committee strategic plan to address payment, service quality, and communication issues. Moving forward, the electricity company will institutionalize the stakeholder committee meetings and start implementing portions of the strategic plan, starting with an energy efficiency educational campaign and improving its grievance redress mechanism.

Regional | Study on the Performance of Distribution Utilities in Sub-Saharan Africa. In most Sub-Saharan African countries, quality of electricity supply and customer service from predominantly state-owned utilities is poor, total losses are high, and collection rates of payments are low. The objective of this activity is to support countries in improving the performance of their electricity distribution and retail utilities. To achieve this objective, the regional activity will identify and analyze the main operational, managerial, and institutional approaches that proved effective in enhancing performance of electricity utilities in Sub-Saharan Africa over the last decade. The study focused on five utilities in Kenya, Uganda, Senegal, Burkina Faso, and Côte d'Ivoire that have improved or shown good performance over the last decade and then carried out a comparative analysis with approaches successfully applied by utilities in other developing countries in Latin America, South Asia, Europe, and Central Asia.

Regional | Uganda-DRC 220kV Interconnector. The Northeastern Democratic Republic of Congo (DRC) is very far and isolated from the country's interconnected transmission grid in the west and southeast. Due to the lack of interconnectivity, power in the area is supplied from expensive imported liquid fuels such as diesel, and the cost of production is well above the average in Sub-Saharan Africa. Regional interconnectivity with neighboring countries, such as Uganda, would allow Northeastern DRC to access other sources of power such as hydro, geothermal, wind, and natural gas and substantially reduce the overall cost of supplying electrical energy in the short and long term. The activity will investigate and assess the overall feasibility of the proposed 220kV Uganda-DRC interconnector.






CHAPTER 6



AFRICA RENEWABLE ENERGY AND ACCESS PROGRAM (AFREA)



The Africa Renewable Energy and Access Program (AFREA) was established in 2008 to serve as a special ESMAP program focusing on clean energy and energy access for Africa. It is now midway through its second five-year phase of operations. AFREA helps client governments to meet Africa's energy challenges by informing and leveraging the resources of the large World Bank Africa energy program.

AFREA's first phase (AFREA I) closed successfully in 2014. AFREA II focuses on leveraging and shaping present and future World Bank operations. AFREA II supports the scale-up of energy access and clean energy through four pillars: (i) supporting investments; (ii) improving policy and building institutions; (iii) leveraging markets; and (iv) developing knowledge and capacity. Underlying these pillars are the two



cross-cutting themes of enhancing impact through gender and productive uses; and supporting post-conflict and fragile states.

AFREA finances three types of interventions: regional initiatives; country-specific activities; and regional strategic studies.

REGIONAL INITIATIVES

The purpose of the five ongoing regional initiatives is to provide focused technical assistance on topical areas that form a shared concern across the continent. These activities provide timely, cost-effective, and focused client support, drawing from the collective team knowledge and experience. Regional activities include Lighting Africa; Accelerating On-grid Electrification (AGAT); the Gender and Energy program; the Africa Electrification Initiative (AEI) and the Africa Clean Cooking Energy Solutions Initiative (ACCES).

Lighting Africa. Lighting Africa, a joint World Bank/IFC program, stimulates commercial markets to deliver clean, affordable, and safe solar lighting products to homes and businesses throughout the region. Since its inception in 2007, the program has facilitated modern energy access for more than 35 million people not connected to the electricity grid, including over 10 million people in FY2015. In the long term, the goal is to eliminate market barriers for the private sector to reach 250 million people by 2030 who depend on fuel-based lighting as of now. Recent activities have focused on Burkina Faso, DRC, Ethiopia, Liberia, Mali, Nigeria, Senegal, South Sudan, Tanzania, and Uganda.



Accelerating On-grid Access Team (AGAT). AGAT is a team of experienced electrification practitioners from around the developing world that provides just-in-time advice and inspiration on technical, institutional, and financial last mile solutions to African governments and utilities. The team supported workshops and quick country assessments related to on-grid access in Congo, Kenya, Tanzania, Uganda, and Zambia and provided clients with advice on project preparation and activities to enhance household connection access. AGAT interventions have improved the quality of investment projects in both Kenya and Uganda. In FY2015, AGAT experts also helped the Kenya government to define a new National Strategy for Electrification.


Gender and Energy. AFREA's Gender and Energy program promotes a more equitable sharing of the benefits from energy access projects and improves the participation of women in the energy sector. In Benin, Comoros, Mali, Senegal, Tanzania, and

Zambia, the program is working with project teams to mainstream gender into rural electrification programs. The program is also providing just-in-time technical assistance during project preparation to help design gender-sensitive components in projects in countries such as Niger, Liberia, and Uganda. With training throughout the entire charcoal value chain, 1,018 women became charcoal producers. The share of total community income to women rose from 3 percent in 2009 to 12 percent in 2013.

COUNTRY-SPECIFIC ACTIVITIES

AFREA II supports a number of country-focused activities to provide client governments with tailored technical assistance. Three representative activities are described below.

Madagascar Support for the Development of Hydropower IPPs. AFREA is providing



technical assistance to share knowledge and best practices to the Government of Madagascar as it develops small hydropower and expands electricity services to the 85 percent of country's population without access to electricity. Madagascar is a fragile state, having a low energy access rate and facing severe power shortfalls. The Government of Madagascar is working to attract private investors to support small hydropower development and develop its estimated hydropower potential of 6,000 MW. AFREA's support builds upon ESMAP's Renewable Energy Mapping Initiative, which is helping to map resources at the country level.

In FY2015, support included establishing regulatory frameworks to facilitate hydropower development and to build the foundation for private sector-financed small hydropower IPPs. Support to the Government to develop Standard Power Purchase Agreements and Standard Implementation Agreements began to expedite bringing small hydropower projects on-line throughout the country.

Gabon Rural Electrification and Water Services Sustainability Mechanism. AFREA is helping the Government of Gabon to develop institutions for sustainable basic electricity service in rural regions. Rural access to electricity in Gabon remains low at 15 percent, despite Gabon's relatively high economic development level. As part of this work, AFREA is working with the Government of Gabon to identify and train skilled providers responsible for the installation, operation, and maintenance of electricity systems and for an oversight mechanism for private

providers. In addition, cost recovery mechanisms are being developed, combining customer payments and smart subsidies.

During FY2015, the project helped catalogue the status of existing electricity installations in rural areas and conducted technical assessments for selected villages.

REGIONAL-SPECIFIC STUDIES

New Models to Scale Up Power Generation Investments in Africa. AFREA is expanding the understanding of the role of IPPs as a critical source of new investment in the African power sector. This review presents an overview of current power generation investments in the region, with an extensive analysis of IPPs, a review of the business models for Chinese investments, and case studies that examine the experiences of countries with IPPs and major generation investments financed from sources in China. The study will help inform policy dialogue and focus technical assistance to client countries to help them to better select, negotiate, and contract IPPs.

Review of Hydropower Development in Africa. AFREA is analyzing experiences from the past decade in hydropower development and drawing lessons on how the World Bank and other partners can help to scale up sustainable hydropower development in Africa. The hydropower potential in Africa is estimated at 283 GW with the ability to generate close to 1,200 TWh per year. Yet so far, less than 10 percent of the potential of the



region has been tapped. The review established a unique database on ongoing and potential hydropower projects, analyzed experiences from projects financed by governments, private financiers, donors, and emerging partners, and provided recommendations that can be used to strengthen the role of the Bank and other donors in future hydropower projects in Africa.

Power Subsidies in Sub Saharan Africa. AFREA is financing a study on power sector subsidies in Africa to help analyze options for tariff reform. The study is especially timely given the recent

drop in worldwide fuel prices, which provides an opportunity to revise, reduce, or even remove energy subsidies. Over the course of FY2015, the project team reviewed over 300 documents from 48 countries and collected information on 50 indicators over the last 5 years. A preliminary analysis informed governments about the cost of supply estimates, tariff benchmarking, and the short-term impact of lower world oil prices on electricity sectors. The final study will include case studies that focus on policy reforms and provide more detailed analyses of subsidies in the energy sector.






CHAPTER 7



GENDER AND SOCIAL INCLUSION IN THE ENERGY SECTOR





The aim of the ESMAP Gender and Social Inclusion program is twofold: (i) to establish a core body of evidence to demonstrate that promoting improved gender equality in energy projects improves development outcomes; and (ii) to develop state-of-the-art approaches for how to improve gender equality in energy projects.

GENDER AND ENERGY INFRASTRUCTURE

In FY2015, ESMAP, together with the WBG's Social Inclusion team, carried out research on Gender and Electricity Infrastructure to explore the gender-specific impacts of generation, transmission, and distribution projects. Some of the key known gender impacts around large infrastructure involve issues of displacement, resettlement, loss of livelihoods, job creation, benefit sharing, land titles, and exposure to hazardous work (mostly impacting men). Initial findings indicate that gender issues are mainly addressed in energy projects that included health and education components; ethnic and gender sensitization for construction workers; or during the construction stage of projects where workers and surrounding communities were involved in the project and women were engaged directly in the project or through indirect jobs such as food production, cleaning, and services.

Based on this, research was conducted in a few selected countries. A qualitative analysis of gender impacts on land and labor markets of transmission and distribution network extension, densification, and rehabilitation was carried out in Senegal. In Morocco, the team carried out focus group discussions with stakeholders around the

concentrated solar power plant in Ouarzazate. A quantitative analysis of gender-differentiated labor outcomes of a power grid development project was carried out in India. And in Nepal, a qualitative analysis of longer term gender impacts of the Kali Gandaki hydropower project took place.

At the global level, the team interviewed power utilities to identify good practices on gender and identified examples in France and Indonesia. A webinar was hosted in September 2014 that focused on barriers for women in the energy workforce and Science, Technology, Energy and Mathematics (STEM) fields.

The findings were presented during a technical workshop organized in June 2015. The workshop brought together lead experts from energy, safeguards, social, and gender as well as external partners. The workshop emphasized the need for research given the dearth of data and examples on this topic. Experts encouraged the team to make the business case while also bringing in operational examples and tools that are relevant for project teams. The report is forthcoming for FY2016.

GLOBAL EFFORTS, REGIONAL RESEARCH

ESMAP, together with the World Bank Institute and the Gender Cross-Cutting Solutions Area, launched the gender and development e-learning course with a specific emphasis on energy access, energy infrastructure, and energy policy. Over 160 people took the course when it was first offered in June 2015, with participants coming from 53 countries and including WBG staff, government officials, technical experts, and representatives from civil society.

Additional online trainings will be offered and the e-course is being converted to a self-paced module and a series of face-to-face trainings.

ESMAP has also helped the ECA and SAR regional units of the World Bank carry out gender and energy research. Teams also coordinate closely with the AFREA and ASTAE gender and energy programs (Chapters 6 and 10, respectively) to exchange knowledge and expertise. For example, ASTAE support to the Upper Cisokan Pumped Storage project in Indonesia included a gender strategy in its action plan to ensure that both women and men participate fully in consultations and negotiations, have access to grievance redress, and share benefits of employment and replacement assets (see Box 10.1).

The AFREA Gender and Energy program has piloted approaches, developed know-how, and worked with energy teams and government clients to integrate gender into existing and new energy access operations. The first phase of the gender and energy program was completed in 2014 with engagement across six countries: Mali, Senegal, Benin, Kenya, Tanzania, and Zambia. The second phase of the program is now underway with \$1.4 million in funding, with a focus on screening across the Africa energy lending portfolio to identify entry points for gender during project preparation.

In FY2015, the AFREA Gender and Energy program focused extensively on operational activities with World Bank energy teams and government clients through existing projects in Mali, Senegal, and Benin, in addition to engagement in eight new countries including Cameroon, Comoros, Liberia, Niger, Tanzania, the Gambia and Uganda. In Comoros, support on gender is being provided to the Comoros

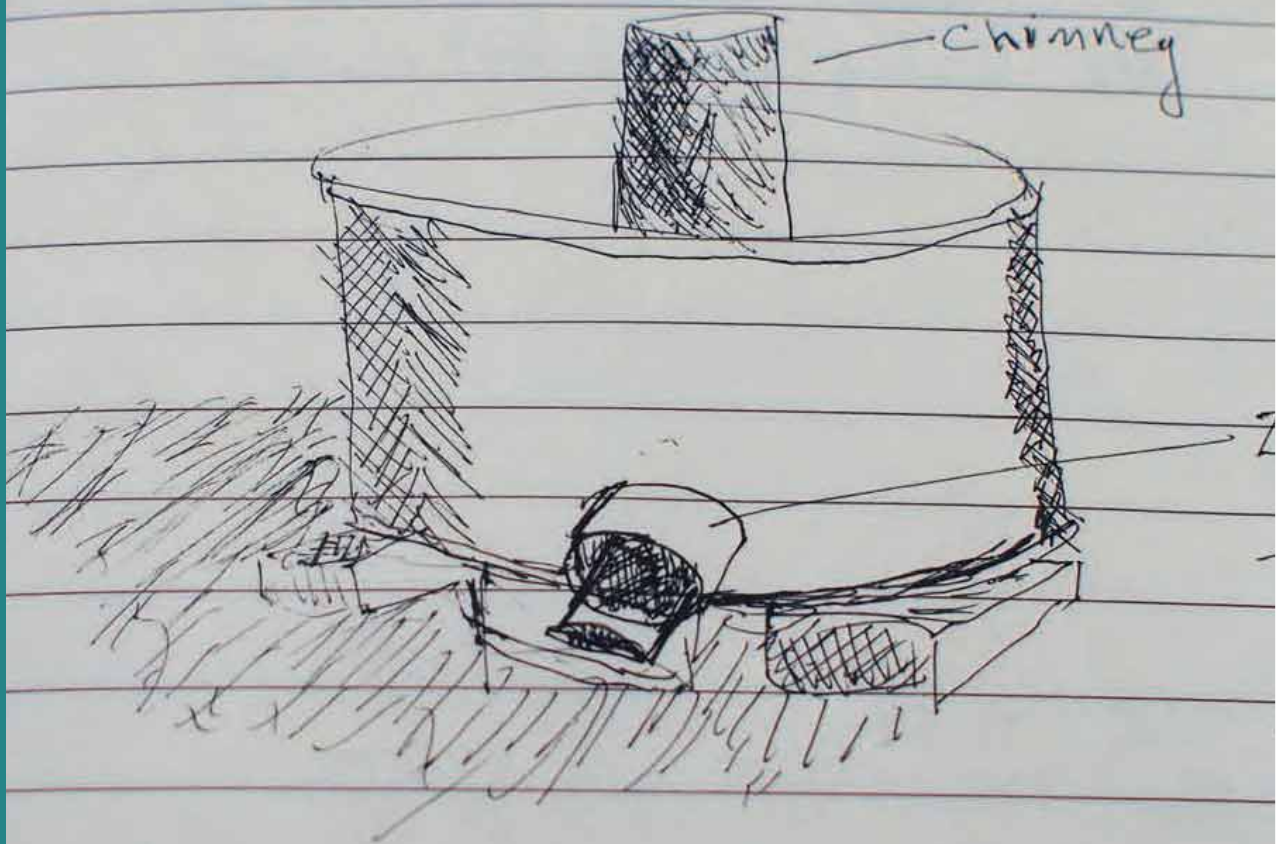
Electricity Sector Recovery Project. Areas of focus include technical assistance in the elaboration of a poverty and social impact analysis and support in the design of an awareness campaign on illegal connections. In Uganda, the team identified gender entry points with specific actions developed to focus on a gender strategy and action plan, captured baseline data, and monitored arrangements to measure patterns of electricity access differentiated by the sex of the household head. A toolkit will be piloted and training and capacity building delivered to assist the client and the project team.

In ECA, as part of overall work on energy subsidy reform (see Chapter 5), a study was commissioned on gender impacts of such reforms, involving over 200 focus groups. This study found that men and women may be affected differently by reforms; that they face different challenges in interacting with energy providers or social assistance institutions; and may have different views and levels of information on policy reforms. Adapting to energy sector reforms may require gender-specific behavioral change and mitigation measures, for instance, gender-targeted awareness raising and communication efforts.

Gender-energy assessments were completed for Nepal, India, and Pakistan in 2015. Teams found that prevalent structural and cultural barriers in the region meant that women are marginalized while also bearing the brunt of the energy burden. A few common themes that emerged pointed to the need for more gender-responsive national policies in the energy sector, the need for more gender-inclusive project planning that engages with women from the start, and the need for better monitoring and evaluation that collects gender-disaggregated data during the project planning phase.

Briguettes made from Straw, box, kapur,
Dharoi, Kalamass, millet

Banana peels, jamun, Sugar cane, Pitha,
Persimmon, photocopy, mushroom, Pine wa,
Watermelon, rice husk, newspaper, peanut sh,
lapsi leaves, (hug plum), Emili seeds



Biochar Maker



Katahar
11/11


parts material
to burn

1 part air
for ventilation

CHAPTER 8



RESULTS-BASED APPROACHES TO ENERGY SECTOR DEVELOPMENT



ESMAP initiated a work program on results-based financing (RBF) in 2011, recognizing the growing international interest in this topic and general lack of experience in the energy sector outside of output-based aid. The objective was to determine if and how results-based approaches could be used in the energy sector to improve outcomes and raise efficiency in the use of public funds.

During FY2015, the report *Results-Based Aid in the Energy Sector – An Analytical Guide* was published and disseminated. The work involved a substantial deep dive into the Multi-Tier Framework for Measuring Energy Access (Chapter 3) to explore how results-based aid could be linked to the achievement of different outcomes on the energy results chain, and how results agreements could be designed to the mutual agreement of both funder and beneficiary. As with much of this work program, the analysis has potential application across other sectors, including through instruments such as Program for Results, the World Bank’s newest lending modality that is intended for programs rather than projects.

Under the East Asia and Pacific (EAP) Clean Stove Initiative (CSI), ESMAP supported the development of an RBF framework to promote clean stoves with the aim of increasing private sector investment and supporting market sustainability. The framework includes a definition of clean stoves, results-based incentives, and a monitoring and verification system.

In Indonesia, ESMAP is supporting a pilot initiative to test the use of RBF as an enabling mechanism to broaden access to modern biomass cooking solutions. The program is providing

performance-based financial incentives to a pre-selected group of “Market Aggregators” who will be tasked with marketing, distribution, and sales of a range of quality-approved stoves.

In the Lao People’s Democratic Republic (Lao PDR), ESMAP is funding a pilot program to explore whether the country’s high rate of disability-adjusted life years could be reduced through an RBF clean cookstove scheme. This approach involves verifying the health benefits for women and children that result from the use of clean cookstoves in the household and then compensating the stove provider.

In March 2015, ESMAP organized an experience sharing event involving representatives from many of the key RBF initiatives internationally and within the World Bank, to take stock and discuss future needs. The collective opinion of those present was that the overarching knowledge needs had been largely met through the work of ESMAP and others but that there was still a major experience gap that could only be filled through piloting and experimentation. This might require a shift towards greater “learning-by-doing,” and a greater willingness to open up dedicated funding channels to a broader range of results-based options.

An RBF pilot, funded by DFID and implemented by GIZ under the Energising Development program, offers incentive payments to businesses in Sub-Saharan African and South Asia that deliver specified outputs within the low carbon, off-grid energy sector. ESMAP provided support to the technical steering committee of the RBF pilot, drawing on reports and previous work carried out



under the ESMAP program. The portfolio of products and services available for support includes equipment and appliances, such as cookstoves and solar lanterns, and off-grid infrastructure installations such as mini grids.

Towards the end of FY2015, ESMAP took steps to close the primary knowledge generation


activity—two years later than originally envisaged due to the expansion in the work program to cover results-based aid. Support for country projects, and ESMAP team engagement, both internally and externally, remains in place, but there is now an opportunity to reflect on what shape and size ESMAP’s work in this area should be for the next Business Plan starting in FY2017.



CHAPTER 9

BUILDING
SUSTAINABLE
ENERGY SECTORS
IN SMALL ISLAND
STATES





Small island developing states (SIDS) are widely known for their beautiful environments and vibrant ecosystems, but they also face a unique set of challenges to sustainable development that differ from those of other developing countries. The islands' small size narrows their range of natural resources and their isolation from markets further limits their access, which leads to dependency on imported fossil fuels for power generation. This reliance leaves SIDS vulnerable to oil price volatility, supply interruptions, and high costs of energy, infrastructure, and transportation. The environments that make SIDS so attractive to tourists are also highly susceptible to natural disasters and negative impacts from climate change, sea-level rise, and pollution.

However, SIDS often have considerable renewable energy potential—solar, wind, geothermal, and biomass—that they can tap to ensure a more sustainable energy future. Recognizing the key role that renewable energy can play in SIDS' sustainable future energy, ESMAP, in partnership with UNDP and the Alliance of Small Island States, launched the **SIDS DOCK Support Program** in 2011. The program is funded by the governments of Denmark and Japan.

FY2015: HIGHLIGHTS AND ACHIEVEMENTS

The following six SIDS DOCK projects in the Africa, Caribbean, and Pacific regions had achievements in FY2015:

Tuvalu | Energy Sector Development Project. The World Bank is supporting the Energy Sector Development Project, which aims 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 system. The project has three components: (i) renewable energy investments, (ii) energy efficiency investments, and (iii) technical assistance and project management support. The SIDS DOCK Support Program co-finances the first component, which includes support for supply and installation of renewable energy technology for Tuvalu Electricity Corporation, a state-owned company that manages and operates the grid-connected and off-grid systems, including solar PV, wind-power generation, batteries, battery inverters, and an integrated power-control system.

ASTAE supported the design of all three components of the project, as well as a gender analysis, monitoring and evaluation, and action plan. A joint mission by the Pacific Gender Focal Point and World Bank's energy team was conducted in August 2014 to help the government implement its national gender policy.

An IDA grant of \$7 million and a SIDS DOCK Support Program MDTF grant of \$2.1 million were approved by the World Bank in FY2015.

Dominica | Geothermal Project. The Government of the Commonwealth of Dominica, with assistance from the AFD and the European Union, confirmed the presence of resources in the Wotten Waven/Laudat geothermal field, which indicates viability for a geothermal power plant that could supply domestic demand and provide electricity to neighboring islands. A gap analysis financed by the SIDS DOCK Support Program identified key areas that needed to be addressed to meet international standards for such a plant. In FY2015, the project supported follow up on the outcomes of the gap analysis, including: (i) peer review and guidance on drilling, (ii) revision and upgrade of the feasibility studies consistent with good industry practice (in collaboration with the Government of New Zealand), and (iii) financial and transaction guidance and

support (in collaboration with the Clinton Climate Initiative). This assistance contributed to the successful drilling of a production well, supported ongoing negotiations with a qualified developer, and evaluated the feasibility of a domestic power plant. In response to the government's request for help to lead financing of the next stage of development, the World Bank is collaborating with CTF and other partners on next steps.

Saint Lucia | Geothermal Project. The project will assist the Government of Saint Lucia in undertaking preparatory activities for geothermal exploration and development. The World Bank, with funding from the SIDS DOCK Support Program and GEF, is collaborating with the Government of New Zealand and the Clinton Climate Initiative to identify areas for drilling in the Qualibou region, prepare an exploration program for resource confirmation, partner with a qualified developer, and undertake the necessary policy reform so that the country can realize its geothermal power generation potential. In FY2015, the Government of Saint Lucia carried out surface studies and related activities, including aerial LIDAR mapping surveys, hired a technical coordinator, initiated negotiations with a potential partner, and began stakeholder consultations. Going forward, the project will assist with preparing a pre-feasibility study and an environmental and social impact assessment so that the government of Saint Lucia can make informed investment decisions.

São Tomé and Príncipe | Power Sector Efficiency Improvement. In FY2015, the World Bank completed studies to improve energy sector efficiency and rehabilitate the transmission and distribution network in São Tomé and Príncipe. The first report provided recommendations to upgrade the system and reduce commercial losses, including the replacement of all mechanical meters, new processes for meter reading and billing, and the

replacement of a number of transmission lines. A second report on the El Contador hydropower plant showed the technical and economic viability of a plan upgrade that would improve the electricity supply in the country. As follow up to this activity, the World Bank is preparing an infrastructure project to finance and implement the recommendations of both studies.


Mauritius | Preparation of a Grid Code, Feed-in-Tariffs and Model Energy Supply Purchase Agreements for Renewable Energy Systems. The Government of Mauritius has developed a long-term strategy to expand electricity generation capacity through the use of renewable energy. Mauritius's Central Electricity Board, supported by the SIDS DOCK Support Program and GEF, completed a project aimed at scaling up renewable sources of energy to the maximum extent possible, taking into consideration the grid absorption capacity. The project included developing grid codes for small- and medium-scale wind, solar, micro-hydropower and biomass; designing a feed-in tariff policy for wind, solar, micro-hydropower, and biomass; and drafting model power purchase agreements for renewable energy generation.

Seychelles | Technical Assistance to Support Integration of Renewable Energy into the Power Grid. The Government of Seychelles, where fossil fuels account for 90 percent of the country's energy supply, completed a project to decrease its vulnerability to fuel price fluctuations by diversifying its energy mix. In FY2015, ESMAP supported the development of a grid code that set out the technical requirements for connection of renewables to the power system, design of a feed-in tariff policy, and a proposed model for power supply purchase agreements. The project has prepared Seychelles for a planned scale-up of renewable energy that will enable the government to fulfill national renewable energy targets for 2020 and 2030.





CHAPTER 10



ASIA SUSTAINABLE AND ALTERNATIVE ENERGY PROGRAM (ASTAE)

According to the data from the SE4All Global Tracking Framework Report 2015, an estimated 449 million people in the Asia-Pacific region do not have 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 lead to premature deaths—especially among women—from respiratory diseases associated with indoor smoke inhalation as well as increased local pollution. As the population of the region continues to grow, accommodating the rising energy demand will require a turn towards modern cooking fuels and more sustainable sources of power.

A global partnership created in 1992, ASTAE has been helping the EAP and SAR regions transition to sustainable, inclusive, and low carbon green growth paths. ASTAE’s work programs rest on three pillars: renewable energy, energy efficiency, and access to energy, with climate change as an overarching key objective.

KEY ASTAE ACHIEVEMENTS, FY2015

- Support to a number of **clean cookstove initiatives in Bangladesh, Indonesia, Lao People’s Democratic Republic, and India**, which included design of clean cookstove-testing methods and development of a gender component
- Publication of a series of guidance notes under the **EAP Gender and Energy Facility** that can be used to integrate social and gender dimensions into work on clean stoves in EAP and beyond
- Support for the **Development of Private Sector Models for Off-Grid Electrification**

in South Asia, including activities on solar PV in Bangladesh, knowledge exchange of off-grid connections in Nepal, and project development to attract private investment for solar PV in the Maldives

- Completion of a study, **Addressing Public and Private Sector Opportunities for Scaling up Decentralized Renewable Energy Access**, that explored the option of micro-hydropower system development in remote areas of Nepal
- Preparatory support for **Indonesia’s geothermal power development**, including feasibility studies of the Ulubelu geothermal field, a tariff methodology report, and a report on unlocking Indonesia’s geothermal potential
- International training workshop held on **Sediment Management in Water Resources and Hydropower Projects** in Beijing and Yichang, China, attended by Afghanistan, Bangladesh, Bhutan, Cambodia, India, Indonesia, Laos, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, and Vietnam
- Pilot of “decision making under uncertainty” approaches to climate and other risks such as the **Climate Change Decision Tree in Nepal’s Upper Arun Hydropower Project**
- Support to Pakistan in **Addressing Public and Private Sector Opportunities for Scaling up Decentralized Renewable Energy Access**
- Launch of the **Program to Establish Pilots for Access through Renewable Energy in Bihar** to support India’s off-grid and mini-grid renewable energy
- Support to strengthen institutional framework for **on- and off-grid electrification in Myanmar**
- Preparation and early implementation support for the **Tuvalu Energy Sector Development Project**, including a gender and energy scoping study, a gender action plan, and a gender monitoring and evaluation framework, using a human rights-based approach

ASTAE programs help design, implement, monitor, and evaluate World Bank investment projects and provide technical assistance in 23 EAP and 8 SAR countries. ASTAE’s flexible funding helps accelerate and intensify early-stage energy sector innovations and provides just-in-time assistance to deliver results. This timely assistance—whether to conduct a study, hire a consultant, or test a promising “first of its kind” concept—can inform the direction of a World Bank investment project or help alter its

course in the case of rapidly evolving conditions during the implementation phase. To better support World Bank investment projects and enable private sector investment, ASTAE also shares best practices to improve institutional, policy, financial, legal, and regulatory frameworks across the region.

Table 10.1 summarizes the ASTAE results framework and status. Table 10.2 provides a pipeline of activities and strategic priorities in place for FY2016.

TABLE 10.1

| ASTAE Business Plan Result Framework, FY2012–15 ¹ | | | | | | |
|--------------------------------------------------------------------------|--------------|---------------|--------------------------|-----------------------|--------------------------|--------------|
| DIRECT INDICATORS | UNIT | VALUE PLEDGED | VALUE ACHIEVED FY2012-14 | VALUE ACHIEVED FY2015 | VALUE ACHIEVED FY2012-15 | PROGRESS (%) |
| 1. Total World Bank Lending Catalyzed by ASTAE Activities | | | | | | |
| Project and Program Lending | US\$ million | 3,200 | 4,218 | 1,013 | 5,232 | 163% |
| 2. New Capacity and Increased Generation of Renewable Electricity | | | | | | |
| Renewable Energy, Capacity | MW | 1,500 | 1,309 | 64 | 1,372 | 91% |
| Renewable energy, Generation | GWh/yr | 3,000 | 2,630 | 239 | 2,868 | 96% |
| 3. Electricity Savings Resulting from Efficiency Improvements | | | | | | |
| Energy Savings, Capacity | MWe | 1,000 | 351 | 0.001 | 351 | 35% |
| Energy Savings, Generation | GWh/yr | 2,000 | 2,820 | 8.77 | 2,829 | 141% |
| 4. Households with Access to Modern Energy Services | | | | | | |
| Access to Electricity (new) | households | 2,000,000 | 558,000 | | 558,000 | 28% |
| Access to Electricity (improved) | households | 1,000,000 | 150,000 | 163,000 | 313,000 | 31% |
| Improved Stoves for Heating (cooking & space) | households | 5,000,000 | 1,195,000 | | 1,195,000 | 24% |
| 5. Avoided Greenhouse Gas Emissions | | | | | | |
| Direct CO ₂ Avoided Over 20 Years | million tons | 200 | 375 | 4 | 379 | 190% |
| 6. Countries Benefiting from ASTAE support | | | | | | |
| Number of Countries | countries | 15 | 12 | 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 10.2

FY2016 Activities and Strategic Priorities

| PROPOSED ACTIVITY | ASTAE FUNDING (in US\$ millions) |
|---------------------------------------------------------------------------------------|-------------------------------------|
| Indonesia: Additional budget to support the implementation of CSI pilot project | 120 |
| Integrated Catchment Management (ICM) for the Matenggeng Pumped Storage Power Project | 200 |
| Lao PDR: Continuation of CSI activity | 110 |
| Additional funding request for developing joint IFC-IDA solar program specifications | 80 |
| Myanmar: NEP impact evaluation study | 250 |
| India: Support to 24x7 Power For All Program | 180 |
| Bhutan: Supporting Environmentally and Socially Sustainable Hydropower Development | 200 |
| Pakistan: Renewable Energy Resource Mapping and Geospatial Planning | 352 |

FY2015: HIGHLIGHTS AND ACHIEVEMENTS

In FY2015, ASTAE launched seven new programs in six countries and two regional activities. With the approval of five ASTAE-supported Bank projects totaling \$1 billion, the value of ASTAE-supported projects approved by the World Bank's Board of Executive Directors since the beginning of the current FY2014-16 Business Plan totals \$5.2 billion.

Of the three ASTAE pillars in FY2015, 50 percent of total disbursement was distributed to renewable energy activities, 39 percent to energy access activities, and the remaining 11 percent disbursed to energy efficiency activities. The unallocated funding balance under ASTAE as of June 2015 was \$1.27 million.

Regional Highlights and Achievements
East Asia and Pacific (EAP) Clean Stove Initiative (CSI). EAP CSI was launched in early 2012 with

the aim of scaling up access to clean cooking and heating solutions in the region, particularly for rural households likely to continue relying on solid fuels to meet most of their cooking and heating needs beyond 2030. This multi-country, multi-phase initiative comprises four country-specific programs in China, Indonesia, Lao PDR, and Mongolia.

Under the CSI program in Indonesia, a pilot project designed and introduced an innovative stove-testing method that incorporates local cooking practices based on anthropological field studies and comprehensive household cooking surveys. The new stove-testing method is contributing to the ongoing International Organization for Standardization discussion on global standards for defining and testing clean cookstoves. Since women and children, who are responsible for collecting firewood and cooking, can be disproportionately affected by household air pollution, the project team is also developing a social testing protocol under a technical assistance activity,


Integration of Social Dimension in Energy Access Projects, to determine how gender and social dimensions can be strategically addressed. This ASTAE-funded activity provides methodological and operational input to task teams on how to assess, incorporate, and supervise the effective integration of social dimensions such as gender, indigenous peoples, and cultural aspects. The program's recommendations on stove promotion are expected to continue through the EAP Gender and Energy Facility.

EAP Gender and Energy Facility. The joint program, supported by ASTAE and ESMAP, targets the integration of gender and social inclusion into ongoing and future energy operations in the EAP region. The overall objective is to improve the development effectiveness of energy projects in EAP, by making them more socially and gender inclusive. The program takes a three-pronged approach: (i) consultations with energy task team members that will result in the development of detailed work plans; (ii) direct technical support to current and pipeline operations; and (iii) capacity enhancement, advocacy work, and knowledge sharing related to addressing gender and social issues in the energy portfolio. The Facility produced a series of practical documents that can be used to integrate social and gender dimensions into work on clean stoves in EAP and beyond, including guidance notes on *Understanding User Needs in Developing Clean Stove Technologies* and *Integrating a Gender Perspective in the Promotion and Assessment of Impacts of Clean Stoves*.

Clean Cooking in South Asia: Options and Strategies. ASTAE funded a study to identify cost-effective and practical measures to mitigate short-lived climate pollutant emissions in South Asia. One component of the study focuses on options and strategies for clean cooking in India. In

FY2015, the study initiated work on defining a roadmap for the clean cooking sector where private sector implementation capacity and business models for replication are expected to be identified. Terms of reference have also been developed for the use of remote sensors for large open data systems to help design more effective clean cooking strategies. The use of remote sensors is expected to lead to the development of credible monitoring and evaluation systems that will support results-based financing instruments.

Understanding Impacts of Climate Change on Hydropower. To address the challenge of identifying climate change-robust investments in South Asia's hydropower sector, a conceptual framework called the "Decision Tree" has recently been developed to guide project planners through the application of "decision making under uncertainty" (DMU) approaches to climate and other risks. DMU approaches identify vulnerabilities by exploring a wide range of changes in climate and other non-climate factors, judge the level of concern, and manage them pragmatically. The Decision Tree was applied in the Upper Arun Hydropower Project (UAHP) with an analysis of how uncertainty in future climate and other project performance variables, such as the price of hydropower supply, can affect the optimal design capacity of the project. The application of the Decision Tree to the UAHP development demonstrated that the original design of 335 MW was robust to climate change and other risks. However, it was not able to exploit much wet season flow. The design capacity of 1,000 MW emerged as an attractive alternative, providing the best combination of robustness and opportunity, including during dry season production, but is also more sensitive to increases in capital costs and low electricity prices. Preparation of UAHP's detailed



design will be supported under the Bank-financed Nepal Power Sector Reform and Sustainable Hydropower Development Project. A related DMU framework that focuses on ways to identify and select robust and balanced portfolios of hydropower options was proposed and applied to the Koshi River Basin. The basin-scale assessment showed how a DMU approach can be applied to larger geographic scales, leading to elements of a study that was conducted at the national level to support energy sector planning in Nepal. Unlocking Nepal's hydropower can also be key to the SAR region reducing its emissions growth rate by importing energy from Nepal. The report was shared with the Government of Nepal to assist it in better planning exercises for choosing projects that are robust no matter what the future may bring.

Development of Private Sector Models for Off-Grid Electrification in South Asia. This project supports activities in private sector-based electrification in South Asia, with countries of focus including Bangladesh, Nepal, and the Maldives. The activity in Bangladesh explored the technical, financial, and economic aspects of supplying reliable, around-the-clock PV power through small private entrepreneurs, using a central PV station that served households within a one-kilometer radius. In Nepal, which has significant hydropower potential but suffers from generation shortages and up to 12-hour power cuts, the activity supported options for private investment in the energy sector. Following the earthquake in Nepal in April 2015, private entrepreneurs and civil society groups coalesced around the objective of restoring normality in areas that were hard hit. One such location was Barpak, the epicenter of the earthquake. The community's energy connection was rebuilt using off-grid distributed generation and is a model for use of micro-hydropower that

is operated by non-governmental groups. The activity in Barpak supported knowledge exchange from the reconstruction exercises currently underway. A brown bag lunch event on the experiences in Barpak was held, and lessons on reconstruction in that location disseminated. Lastly, the activity supported project development of Accelerating Sustainable Private Investments in Renewable Energy program (ASPIRE) in the Maldives. This initiative used a combination of grant and IDA funds to develop a security package to attract private investments in the area of solar PV in the Maldives.

Country-specific Highlights and Achievements

Reducing Emissions and Household Air Pollution with Clean Cookstoves. Traditional cookstoves exacerbate global health and environmental problems, contributing to the premature deaths of over 4 million people every year, according to the World Health Organization. Safe, affordable, and accessible clean cooking solutions can drastically reduce fuel consumption and exposure to harmful smoke from cookstoves, while providing economic opportunities in communities around the world.

In Lao PDR, exposure to biomass smoke from cooking over open fires or crude wood-burning cookstoves is the number one risk factor out of 60 that cause ill health in the country. The Lao PDR Cookstoves and Health Initiative, supported by ASTAE, has brought the Ministry of Energy and Mines and the Ministry of Health together in a unique collaboration to improve the health and economic well-being of the rural poor. As a result of ASTAE support, the Lao government established the first national cookstove standards in June 2015. In June 2015, the World Bank Board approved an IDA

credit and grant totaling \$26.4 million for a Health Governance and Nutrition Development Project in Lao PDR. This project includes social and behavior change communication activities at the village level to reduce household air pollution through the use of near-smokeless cookstoves. This is the first World Bank lending project in which the energy, health, and sanitation sectors worked together to promote clean cookstoves. To complement these activities, the private sector has expressed interest in financing large-scale clean cookstove dissemination activities through innovative health impact results-based financing, which uses averted disability-adjusted life years as a financing unit with other multiple co-benefits such as CO₂ and black carbon reductions.

In Bangladesh, ASTAE financed the design of a gender-responsive household fuel component for the Rural Electrification and Renewable Energy Development Project. Activities included support for a technical standards committee that emphasizes gender aspects, research and development of traditional stoves and higher efficiency stoves, and supervision of the distribution of cookstoves.

Scaling Up Electricity Access through Mini and Micro Hydropower Applications in Nepal. About 45 percent of Nepal's population has access to on-grid electricity while 30 percent of the population that lives in remote areas has no access to electricity at all. Load shedding can last up to 12 hours per day. Renewable energy technologies can play a key role for increasing energy access, which is crucial for poverty reduction by improving rural livelihoods and boosting rural economy. In FY2015, ASTAE funded a study titled Addressing Public and Private Sector Opportunities for Scaling up Decentralized Renewable Energy Access to explore the option of micro- and mini-hydropower

development. Of the 25 percent of Nepal's population that has access to off-grid sources of power, the majority is served by hydropower systems that use river water flows to produce energy on a micro scale, with an average size of 35 kW (as of 2013). Micro-hydropower (MHP) is the most cost-efficient off-grid rural electrification method wherever it is technically feasible and where adequate hydropower potential exists. The study finds that, to make MHP development in rural areas financially viable and to facilitate private sector participation, there is a need to explore increasing the scale of MHP plants and introduce suitable metered tariff mechanisms. The study also recommends connecting an MHP system to the national grid once the distribution line is extended to MHP-electrified villages. This endeavor will require close collaboration with the government's energy agencies so that MHPs are smoothly integrated into the grid and programs and objectives are harmonized. The study points out that the most important next steps are to prepare a national rural electrification master plan, develop realistic rural electrification strategies compliant with the master plan, and introduce "smart subsidies" to realize the rural electrification strategies. Due to the earthquakes that struck Nepal in April 2015, planned workshops for dissemination of the study results were postponed. In FY2016, the report will be launched at a workshop in Kathmandu followed by an online chat to exchange opinions with the general public. Exchanges with other donors active in the country would include post-earthquake rehabilitation and focus on scaling up micro- and mini-hydropower plants in a way that is in line with the policy recommendations of the study.

Unlocking Geothermal Energy Potential in Indonesia. With the largest potential for geothermal



energy in the world, Indonesia plans to more than quadruple its geothermal capacity from the existing rate of 1,335 MW to 6,000 MW by 2020, which would make the country the world's largest producer of geothermal power. ASTAE helped fund the government's plans to increase power generation from renewable geothermal resources and reduce local and global environmental impacts. The grant supported the preparation of feasibility studies for the Ulubelu geothermal field, regulatory reform through a tariff methodology report, as well as a report on unlocking Indonesia's geothermal potential. A new loan that will support upstream exploration and development of steam fields and expand access to geothermal resources is being prepared. The loan will be supported by a convertible grant from CTF and GEF. The ASTAE activity contributed to two World Bank investment projects in Indonesia: the Geothermal Clean Energy Investment Project, a \$300 million loan that is supporting the development of two geothermal power plants, and the Geothermal Energy Upstream Development Project, which is currently under development.

Building Resilience in Sustainable Sediment Management. Recognizing the current insufficient understanding of the link between climate change and sediments, the World Bank helped develop a *Technical Guidance Note on Sediment Management*, as well as a rapid assessment method using the RESCON2 software. The note, together with the software, helps identify technically feasible and economically optimal sedimentation management approaches in hydropower projects that will enhance the sustainability of water resource infrastructure. Dissemination of the software along with publication of the guidance note is planned for December 2015. In addition, from August 18–22, 2014, ASTAE supported a major

international workshop on sediment management in Beijing and Yichang, China, for managers and engineers from 13 countries in South and Southeast Asia—Afghanistan, Bangladesh, Bhutan, Cambodia, India, Indonesia, Laos, Myanmar, Nepal, Pakistan, Sri Lanka, Thailand, and Vietnam—to learn about sediment management from the world's leading sediment management experts.

Scaling Up Renewable Energy in Pakistan.

ASTAE is supporting an activity in Pakistan that seeks to understand the challenges and opportunities for scaling up renewable energy in the country and to then develop a strategy for World Bank engagement in this sub-sector. This activity is part of a broader program on low carbon energy sector development that includes ESMAP-funded technical assistance to assess and map Pakistan's renewable energy resources, including biomass, solar, and wind. Under this ASTAE-funded activity, the World Bank has identified three areas for potential engagement: (i) large-scale, grid-connected power generation from mainly solar and wind; (ii) smaller, distributed generation within cities and in rural areas, including rooftop solar; and (iii) off-grid energy access. During FY2015, the activity was initiated with a comprehensive stakeholder engagement, followed by discussions with the State Bank of Pakistan on domestic financing for renewable energy that culminated in a joint workshop held in June 2015. In FY2016, a number of studies will be carried out to provide an evidence-based approach for determining the next steps, including a nationwide survey of electricity access and a study of the physical potential for distributed generation in Karachi, Lahore, and rural parts of Punjab Province. All the data obtained will be placed into the public domain alongside the final

reports. The World Bank team will then discuss with the various stakeholders any opportunities identified and how to take these forward.

PREPARE for Energy Access in Bihar. India has the largest energy access deficit of any single country, compounded by unreliable supply and low consumption. Rural consumers constitute the bulk of India's un-electrified population. According to the Indian Census 2011, 80.7 million households in India live without electricity and of these, about 75 million households are in rural areas. The World Bank launched a project called Program to Establish Pilots for Access through Renewable Energy (PREPARE) in the state of Bihar, the state with the lowest electricity access rate—25 percent—in India, to demonstrate the use of mini-grids based on renewable energy technologies and to increase access to electricity. The project covers (i) financial and technical support for setting up solar or solar-hybrid mini-grids in a few villages in Bihar and (ii) technical assistance support to Bihar's power distribution companies, which will implement the project. Located in villages that are completely un-electrified or have poor access to electricity, the activity will test off-grid business models that can be scaled up and replicated by addressing market challenges such as the size of consumer markets, access to finance, and transaction costs of obtaining government financial assistance. Market assessment studies were completed in select districts in Uttar Pradesh and Bihar, and two districts in Bihar were chosen for project implementation. Project preparation activities, such as market and technical pre-feasibility studies, have been completed, and the preparation of bidding documents is underway.

Expanding On- and Off-grid Electrification in Myanmar. At 160 KWh per year—20 times less

than the world average—Myanmar's energy consumption is among the lowest in the world. As of 2014, about 70 percent of the population lacked grid electricity access. The main challenge facing the power sector is scaling up access to electricity in a reliable, efficient, affordable, and sustainable manner.

In line with the goals of the global SE4All initiative, the Myanmar Government is committed to achieving universal access to electricity by 2030. With assistance from ESMAP's SE4All Technical Assistance Program (see Chapter 3), the government developed a National Electrification Plan in 2014 to accomplish rapid expansion through a two-pronged, sector-wide approach: an ambitious extension of the national grid plus off-grid electrification of communities that would otherwise have to wait for years for grid access.

To support the implementation of the plan, since September 2014, ASTAE has provided essential support to strengthen the institutional framework for on- and off-grid electrification in Myanmar and to prepare a \$400 million IDA investment operation. With the goal of benefiting 6 million people with new electricity connections by 2021, the project has three main components: (i) grid extension to connect communities to the national power grid; (ii) off-grid electrification that targets communities unlikely to receive grid access in the next 10 years or more; and (iii) technical assistance and project management to support national government agencies in implementing the National Electrification Plan. ASTAE support included advising the government on necessary institutional implementation arrangements, devising effective service delivery models, and supporting project preparation and the implementation capacity of implementing agencies.



Preparation and Early Implementation Support for the Tuvalu Energy Sector Development Project.

ASTAE financed a gender and energy scoping study using a human rights-based approach, which found that gender inequality in relation to energy access and decision making exists, particularly outside the capital. Through the Tuvalu Energy Sector Development Project, the project team assisted Tuvalu in the implementation of its new National Gender Policy. As a result, a gender action plan was prepared, including a monitoring and evaluation framework with key actions for project implementation. The gender action plan includes a strategic objective to utilize the Tuvalu Energy Policy and other national policy provisions and commitments to recognize energy as a human right for men and women as well as a specific action for a behavioral change training program in the community. This specific action includes training in: (i) advocacy and lobbying, (ii) life skills, and (iii) basic energy appliance management. Per the Government of Tuvalu's request, the Tuvalu Energy Sector Development Project included technical assistance to support the government in mainstreaming gender dimensions in the IDA financing agreement as well as the project appraisal document.

SELECTED ASTAE KNOWLEDGE PRODUCTS AND PUBLICATIONS

In its effort to share the knowledge and experience gained from its activities, ASTAE regularly

produces knowledge outputs such as reports, technical guides, methodologies, and workshop proceedings. In FY2015, ASTAE released some 10 publications. As part of the EAP CSI Series, ASTAE co-financed the *Clean Stove Initiative Forum Proceedings*, which was published in November 2014 following the EAP CSI Forum held in Beijing, China, from April 26–29, 2014. The proceedings summarized national programs, progress made, best practices, and next steps in four countries—China, Indonesia, Lao PDR, and Mongolia—where CSI is piloting country-specific programs.

ASTAE financed a synthesis report, two guidance notes, and tools as part of a series of work on the social and gender aspects related to the development and promotion of clean stoves. Published in April 2015, *Understanding User Needs in Developing Clean Stove Technologies* describes an experimental procedure used in Indonesia to assess the performance of selected stoves under real-life conditions. The second note, *Integrating a Gender Perspective in the Promotion and Assessment of Impacts of Clean Stoves: From the Lab to the Field and Back*, published in June 2015, details the results of how well five clean stoves performed in the test. They found that while clean stoves use fuel more efficiently, some do not have the speed and power that women require to perform household activities effectively. To ensure adoption and sustained use of clean cookstoves, more work is needed to integrate users' preferences into their designs.



BOX 10.1

CONSTRUCTING SUSTAINABLE HYDROPOWER WHILE PROTECTING HABITATS AND LIVELIHOODS IN INDONESIA

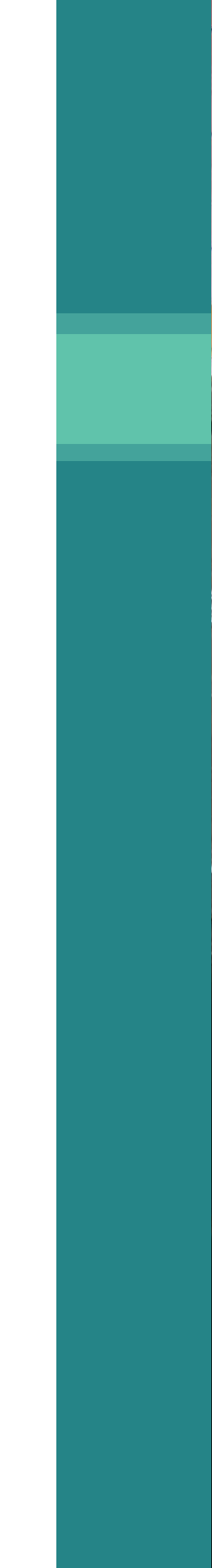
Over the last three decades, Indonesia's power demand has grown at a rapid pace, with electricity consumption projected to increase on average 8 percent per year between 2011 and 2035. But insufficient supply constrains demand, and the power sector now faces the challenge of supplying electricity in the most efficient way while sustaining economic growth and maintaining conservation interests to protect endangered species and their habitats.

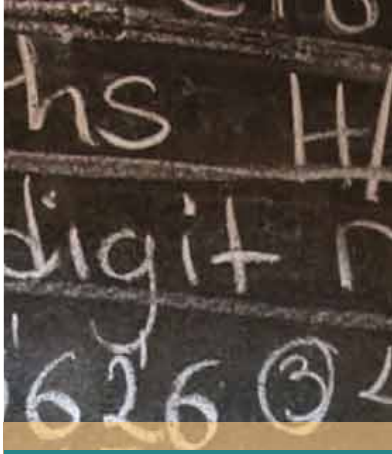
In collaboration with the Indonesia Infrastructure Support Trust Fund, ASTAE is supporting an Integrated Catchment Management (ICM) approach for a World Bank-financed 1,040 MW pumped storage hydro-power project on the Cisokan and Cirumamis Rivers in West Java, Indonesia. The ICM approach provides a framework to address the social and environmental impacts from the project, threats to biodiversity, and improvement for local livelihoods. Through ICM, the ASTAE activity aims to strengthen the planning, operations, and management capacity of Perusahaan Listrik Negara (PLN), the state-owned power company.

The forests surrounding the project area, already threatened by agriculture use and poaching, are also home to several species of critically endangered animals. One-third of the local population in the area lives in poverty, which drives people to turn to illegal logging, slash-and-burn agriculture, and poaching for their income. Over 700 households would require resettlement, which could compound the impact on habitats of endangered animals. A reforestation program is therefore included in the project to preserve and extend habitats as well as to provide opportunities for alternative livelihoods for local people.

ASTAE's funding is designed with a focus on providing women, who can be disproportionately vulnerable to impacts from the project, with equal access to training and services. The gender strategy in the project's land acquisition and resettlement plan ensures that both men and women participate in consultations and negotiations, have access to grievance redress mechanisms, and share the benefits of employment and resettlement assistance.

In March 2015, as a first tangible result of the intervention, PLN and Perhutani, the state-owned forest management agency, signed a Memorandum of Understanding to collaborate on land management.





CHAPTER 11



FINANCIAL REVIEW



The FY2015 figures in this section 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 second year that financial figures for all three MDTFs are being reported side-by-side in a joint annual report. Prior to FY2014, SIDS DOCK figures were included with ESMAP's reporting, and ASTAE figures were reported in a separate ASTAE annual report.

CONTRIBUTIONS

In FY2015, ESMAP received a total of \$36 million from eight donors, including the World Bank. ASTAE and SIDS DOCK did not receive any contributions in FY2015.

Table 11.1 shows the breakdown of receipts from individual donors for the three MDTFs for FY2015, as well as cumulative receipts since FY2010.

TABLE 11.1

Overview of Donor Contributions to ESMAP, ASTAE, and SIDS DOCK MDTFs, FY2010-15 (\$, thousands)

| Country | FY2015 Paid In Contribution | | | Cumulative Paid In FY2010-15 | | | Total Receipts FY2010-15 | % Cumulative |
|----------------|-----------------------------|------------|------------|------------------------------|------------------|------------------|-----------------------------|--------------|
| | ESMAP | ASTAE | SIDS DOCK | ESMAP | ASTAE | SIDS DOCK | | |
| Australia | | | | 7,574.74 | | | 7,574.74 | 4.2% |
| Austria | 855.90 | | | 5,597.16 | | | 5,597.16 | 3.1% |
| Denmark | 8,364.24 | | | 31,961.77 | | 7,093.12 | 39,054.88 | 21.5% |
| Finland | | | | 1,527.54 | | | 1,527.54 | 0.8% |
| France | 1,123.10 | | | 1,967.14 | | | 1,967.14 | 1.1% |
| Germany | 1,104.90 | | | 7,871.20 | | | 7,871.20 | 4.3% |
| Iceland | 550.00 | | | 1,806.13 | | | 1,806.13 | 1.0% |
| Japan | | | | | | 9,000.00 | 9,000.00 | 4.9% |
| Lithuania | | | | 97.79 | | | 97.79 | 0.1% |
| Netherlands | 7,000.00 | | | 25,200.00 | 12,000.00 | | 37,200.00 | 20.4% |
| Norway | | | | 11,887.44 | | | 11,887.44 | 6.5% |
| Sweden | | | | 4,565.34 | 5,913.75 | | 10,479.09 | 5.8% |
| United Kingdom | 16,736.94 | | | 39,445.04 | 6,324.75 | | 45,769.79 | 25.1% |
| World Bank | 218.22 | | | 2,226.84 | | | 2,226.84 | 1.2% |
| Total | 35,953.30 | .00 | .00 | 141,728.12 | 24,238.50 | 16,093.12 | 182,059.74 | 100% |

DISBURSEMENTS

ESMAP disbursed \$26.8 million in FY2015—an increase of 23 percent from the year before.

Table 11.2 shows disbursements for all three MDTFs for FY2014-15 and FY2013 disbursements

for ESMAP. (For FY2013, ESMAP disbursements include SIDS DOCK).

Projects costs are separated into (i) disbursements by region and for global programs and (ii) disbursements for program management, administration, and other centralized functions.

TABLE 11.2

ESMAP Disbursements, FY2013 (including SIDS DOCK); ESMAP, ASTAE, and SIDS DOCK Disbursements, FY2014-15 (\$, thousands)

| | FY2013 | | FY2014 | | | | FY2015 | | | |
|-----------------------------------------------|--------------------|-------------|--------------------|-------------------|-----------------|-------------|--------------------|-------------------|-------------------|-------------|
| | | | ESMAP | ASTAE | SIDS | | ESMAP | ASTAE | SIDS | |
| Project Cost | \$14,636.94 | 87% | \$19,852.74 | \$5,030.18 | \$765.75 | 93% | \$25,082.21 | \$4,858.66 | \$1,040.88 | 94% |
| Africa | 5,199.04 | | 7,681.48 | | 179.77 | | 8,972.78 | | 539.23 | |
| East Asia | 706.64 | | 2,132.92 | 3,847.86 | 74.88 | | 2,680.42 | 3,801.59 | 36.39 | |
| Europe & Central Asia | 1,201.05 | | 1,419.49 | | | | 2,224.79 | | | |
| Latin America & Caribbean | 913.23 | | 2,153.29 | | 379.91 | | 2,110.19 | | 465.26 | |
| Middle East & North Africa | 839.36 | | 448.13 | | | | 413.85 | | | |
| South Asia | 346.01 | | 878.73 | 965.59 | | | 2,834.55 | 1,014.09 | | |
| Global Program | 5,431.61 | | 5,138.70 | 216.73 | 131.19 | | 5,845.62 | 42.98 | | |
| Program Management & Sustaining | \$2,273.13 | 13% | \$1,910.43 | \$77.55 | \$82.31 | 7% | \$1,708.448 | \$58.181 | \$165.298 | 6% |
| Program Management | 997.16 | | 784.69 | 68.19 | 82.31 | | 736.290 | 58.181 | 89.575 | |
| Governance (CG, TAG) | 83.53 | | 98.58 | 9.36 | | | 85.374 | | | |
| Resource Management/Trust Fund Administration | 230.38 | | 217.42 | | | | 151.514 | | | |
| Portfolio Management (M&E) | 316.20 | | 213.46 | | | | 189.505 | | | |
| Knowledge Forums | 102.50 | | 116.65 | | | | 97.953 | | 75.723 | |
| Communication and Outreach | 467.06 | | 543.36 | 479.62 | | | 479.62 | | | |
| TOTAL | \$16,910.07 | 100% | \$21,763.17 | \$5,107.73 | \$848.06 | 100% | \$26,790.65 | \$4,916.84 | \$1,206.18 | 100% |
| Funded by Donors | 16,302.79 | | 21,182.40 | 5,107.73 | 848.06 | | 26,572.43 | 4,916.84 | 1,206.18 | |
| Funded from World Bank Budget | 350.35 | | 344.62 | | | | 218.22 | | | |
| Funded from Fee Income | 256.93 | | 236.15 | | | | | | | |



TABLE 11.3

ESMAP, ASTAE, and SIDS DOCK Disbursements, by Program Area, FY2015 (\$, thousands)

| | ESMAP | | | | | | | | | | | TOTAL DISBURSEMENT | | | |
|---------------------------------|---------------------|----------------|----------------|-------------------------------------|------------------------------------|-----------------------|-----------------------------------|--------------------------------|------------------|--------------------------------------------------|-----------------------|--------------------|------------------|------------------|-------------------|
| | Annual Block Grants | Transport | Water | Sustainable Energy for All (SE4ALL) | Global Geothermal Development Plan | Results Based Funding | Renewable Energy Resource Mapping | Energy Subsidy Reform Facility | AFREA | City Energy Efficiency Transformation Initiative | Other Global Programs | ESMAP | ASTAE | SIDS | TOTAL |
| Africa | 747.970 | | | 1,457.158 | | | 2,205.049 | 4,562.605 | | | | 8,972.783 | | 539.234 | 9,512.017 |
| East Asia | 792.910 | 152.503 | | 526.636 | 54.339 | 261.955 | 468.042 | 200.790 | 223.246 | | 2,680.421 | 3,801.585 | 36.386 | 6,518.393 | |
| Europe & Central Asia | 844.186 | 107.783 | 49.567 | | | | 978.470 | | 244.786 | | 2,224.792 | | | 2,224.792 | |
| Latin America & Caribbean | 626.280 | 173.111 | 112.939 | 606.928 | 362.477 | | 71.839 | | 156.616 | | 2,110.190 | | 465.261 | 2,575.451 | |
| Middle East & North Africa | 207.654 | | .859 | | | | 205.338 | | | | 413.851 | | | 413.851 | |
| South Asia | 776.748 | 214.925 | | 67.955 | | | 1,774.924 | | | | 2,834.553 | 1,014.094 | | 3,848.646 | |
| Global Programs | | .233 | | 249.206 | 639.763 | 98.827 | 374.735 | 570.542 | 935.187 | 2,977.123 | 5,845.616 | 42.980 | | 5,888.596 | |
| Program Management & Sustaining | | | | | | | | | | 1,708.448 | 1,708.448 | 58.181 | 165.298 | 1,931.926 | |
| TOTAL | 3,995.749 | 648.555 | 163.364 | 2,907.883 | 1,056.579 | 360.782 | 4,822.750 | 2,026.980 | 4,562.605 | 1,559.836 | 4,685.571 | 26,790.653 | 4,916.840 | 1,206.180 | 32,913.673 |

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

Regional activities are those managed by World Bank regional units. ESMAP global programs include analytical and advisory activities managed by the ESMAP core unit and those led by World Bank Global Practices such as Energy, Water, Urban, and Transport. A portion of the expenditures under global programs is associated with work performed by ESMAP core technical staff for clients through World Bank regional units.

BREAKDOWN BY REGION AND PROGRAM AREA

Table 11.3 shows FY2015 spending by region for all three MDTFs as well as by program area for ESMAP. The Renewable Energy Resource Mapping initiative—a major global initiative launched by ESMAP to support renewable energy resource assessment and mapping for biomass, small hydro, solar and wind—made up the largest portion of ESMAP’s portfolio, closely followed by AFREA.

Figure 11.1 provides the breakdown in FY2015 of ESMAP disbursements by program areas. Figure 11.2 shows ASTAE spending by ASTAE’s pillars.

FIGURE 11.1

ESMAP Disbursements, by Program Area, FY2015

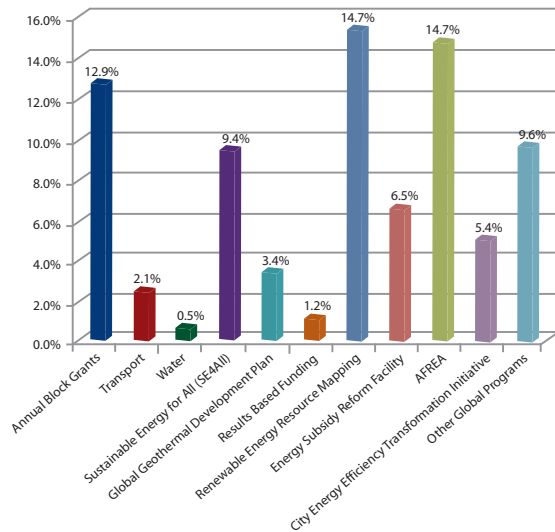
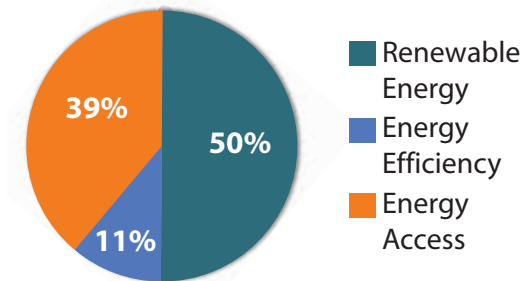


FIGURE 11.2

ASTAE Spending, by Pillars, FY2015





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

22—24 April 2015, Washington, DC

The Consultative Group (CG) meeting for the World Bank-managed Energy Trust-Funded Programs was held in Washington, DC, on April 22-24, 2015. The Technical Advisory Group (TAG) report session was chaired by Mr. Rohit Khanna, Program Manager, ESMAP, in the Energy and Extractives Global Practice of the World Bank, while ESMAP Program Briefings were led by their team leaders, respectively.

Below are the discussion highlights for the sessions. For more details regarding each session, please refer to the CG workspace www.esmap.org/cg to access all reports, briefing materials, and presentations.

Session 1 | Annual Portfolio Review

Given the time constraints, this session was combined into the session on the TAG report to the CG.

Session 2 | TAG Report to the CG

The discussion on the TAG report was focused on the following:

- i. *Results framework and knowledge sharing.* The CG agreed that dissemination of results and knowledge had improved and requested to continue to work on this aspect. The current results framework is practical and provides clear linkages among inputs, outputs, and outcomes. The CG emphasized the importance of sharing impact stories

and discussed examples of results to communicate—e.g., stories for the public and specific figures for ministries. ESMAP Program Manager noted that impacts of ESMAP’s contributions on the ground are now communicated in a series of impact stories that were launched in 2013. Furthermore, the TAG was reminded of the CG’s recommendation to reach out to client countries and incorporate such assessment in the next TAG report. The TAG also suggested the CG share their respective activities so as to facilitate knowledge sharing and synergies in the sector. Denmark tabled an overview of their key energy activities and suggested that the other CG members share such summaries.


- ii. *Risk management.* The logframe under the current Business Plan does not have risk management at the program level. It was agreed to include it in the logframe for the new Business Plan.
- iii. *Low implementation rates and new activities.* The CG sought clarification regarding new activities to be proposed despite the relatively low implementation rates of the existing activities. ESMAP management confirmed that these activities are fully anchored in the current Business Plan and reflect an evolution in sector context and emerging client demand. An example is the Variable Renewable Energy Grid Integration Program, which is evolving from the Power System Planning Support Program proposed in the current Business Plan. Similarly, the clean cooking initiative reflects an attempt to fill a clear gap in the SE4ALL Technical Assistance Program, whose portfolio is significantly weighted towards electricity access.

- iv. *Soft earmarking.* ESMAP Program Manager noted that soft earmarking has allowed the program to grow significantly, while ensuring consistency with the strategic directions of the Business Plan. Soft earmarking allows ESMAP to receive and disburse funds through a single MDTF, thus keeping transaction costs low and ensuring collective CG ownership of the program. It respects the various priority areas of respective donors. No soft earmarking is accepted for activities outside the scope of Business Plan.
- v. *Country-level coordination.* In response to the TAG's recommendation for exploring ESMAP's role in country level coordination, ESMAP Program Manager confirmed that this would be challenging for the following reasons: (i) the ESMAP does not have the capacity to take on this role; and (ii) such coordination is the responsibility of World Bank regional energy teams, with ESMAP participating in the World Bank team. It was also noted that country energy teams were advised to invite donor embassies to ESMAP-supported knowledge events and missions.
- vi. *Nexus activities.* The CG agreed with TAG's recommendation that the nexus work be given more attention and advanced by supporting additional activities. In response, ESMAP shared that the nexus work is now picking up pace, with a number of activities initiated: (i) global policy level (e.g., GTF 2015 has a chapter on nexus issues); (ii) operational level (e.g., analytical and modeling tools being developed and implemented at the regional/country level, agriculture with both water and agriculture sectors); and (iii) knowledge base (e.g., case studies through the science of delivery approach).
- vii. *World Bank Group (WBG) reforms.* Several CG members expressed keen interest in the opportunities and constraints that ESMAP had encountered due to the WBG reforms. The TAG observed that the new WBG organization had been beneficial to the implementation of the ESMAP and ASTAE Business Plans and cited the clean cooking initiative as one example of possibilities and synergies across the WBG.
- viii. *ESMAP contribution.* The contribution of ESMAP's work to the Sustainable Development Goals, reflecting the SE4All objectives, as well as ESMAP's work to follow up on the World Bank's Strategic Directions for the Energy Sector Paper were noted.

Session 3 | Efficient and Clean Cooking and Heating Initiative

The session on efficient, clean cooking and heating began with remarks from the CEO of the Global Alliance for Clean Cookstoves (the Alliance), senior representatives from the World Bank (Environment, Health, Climate Change, Gender units) and IFC, affirming the commitment to work together through internal and external partnerships to support scaling up access to cleaner, more efficient cooking and heating. The team highlighted the importance of this agenda in terms of meeting the SE4All objectives and the upcoming Sustainable Development Goals; a number of new developments—both in understanding of the negative impacts of traditional cooking and heating and in technologies.

The CG commented that they are pleased to learn of WBG's renewed focus in this area, welcomed better coordination between WBG and Global Alliance and emphasized the importance of working



with other international organizations and development partners. The CG also noted that they would expect to see the World Bank contributing resources to the scale up internally, given the strong commitment, but also recognized the need for upfront policy and preparation work, which is where grant support through ESMAP would be particularly useful.

On the proposal itself, there was feedback in three areas: (i) the CG suggested that the focus of the Partnership should be on a coherent, coordinated program, rather than flow of funds from ESMAP to the Alliance—those that want to support the Alliance would prefer to do so directly; those that want to see WBG get more involved would provide funds to ESMAP; (ii) the CG would like to understand how resources provided would be used for in-country activities; and (iii) the CG would like to see more concrete/detailed write ups of how, and for what, funds would be used, including the comparative advantage and value-added of the ESMAP initiative.

As next steps, ESMAP will prepare a more detailed proposal focusing on ESMAP/World Bank-supported activities in the next 18 months. The World Bank will work with the Alliance to make sure that the proposal is a good complement to Alliance activities in those countries. A longer-term program will be presented in the next Business Plan.

Session 4 | Asia Sustainable and Alternative Energy Program (ASTAE)


The meeting started with a presentation on the current status of ASTAE, which emphasized the value of ASTAE and its contribution to the East

Asia and Pacific (EAP) and South Asia (SAR) regions' strategic objectives in the energy sector. The following six ASTAE activities were then presented by task team leaders to highlight concrete achievements: (i) Vietnam and India: Using Satellite Imagery to Monitor Rural Electrification Progress; (ii) Strategy to Scale Up Renewable Energy in Pakistan; (iii) Vietnam Sustainable Urban Energy and Emissions Planning (SUEEP), Phase 3; (iv) Myanmar Strengthening Institutions for On-and Off-grid Electrification; (v) Indonesia: Support to Integrated Catchment Management (ICM) for Upper Cisokan Pumped Storage Project; and (vi) EAP Clean Stove Initiative.

The discussions centered around the following:

- i. Energy access indicator.* Management noted that the energy access results are not likely to be met by the end of the Business Plan, primarily due to delayed or dropped programs in a few large countries (such as Indonesia and India).
- ii. Collaboration with IFC.* In response to a question on how ASTAE activities collaborate with IFC, the ASTAE team pointed out that there is strong corporate emphasis on working as a one-WBG and shared the example of the Myanmar Energy Program (supported by ASTAE), where the WBG has a joint implementation program team with staff from International Bank for Reconstruction and Development (IBRD) and IFC. They also highlighted projects in the Philippines and the Solomon Islands (also supported by ASTAE) where IBRD and IFC were working closely together.

- iii. *East Asia and the Pacific Clean Stove Initiative.* Regarding a question on next steps for the initiative, the ASTAE team noted that in the case of large countries such as China and Indonesia, the World Bank was looking for impacts at the national level. In the case of China, the World Bank is currently looking at the second phase of the national program that will distribute some 40 million clean stoves. In the case of Indonesia, the distribution of some 10 million clean stoves is targeted under the national program. It was also pointed out that market-based institutions should play the key role in sustainable clean stove distribution programs and that the World Bank would conduct a study to engage private investors. On the question of the possible dominance of non-domestic manufacturers in the market, the ASTAE team noted the advantages that local producers had in the market, as imports are expensive.
- iv. *Consolidation of ESMAP and ASTAE.* The CG acknowledged the synergies that resulted from the recent consolidation of ASTAE with ESMAP. ESMAP focuses on upstream analytical work while ASTAE targets mid- to downstream work. In this context, the question was asked on whether it still made sense to keep a regionally specific set of competencies that are not necessarily brought in full play in other regions, given that ESMAP has a global reach. However, the CG admitted that the value of keeping a regional focus could be also seen. ESMAP Program Manager highlighted that there was another regional window: AFREA, and that overall, there was a very good case to have supplemental resources. CG members also noted such a regional program should also prioritize regional work—for example, for the development of regional transmission projects.
- v. *Results Framework.* The CG expressed concern that given the long term nature of the projects, the possibility of delays, and the current structure of ASTAE's results monitoring framework, ASTAE's results may not be captured appropriately and asked whether there might be other better ways for tracking ASTAE's results. ESMAP Program Manager shared the findings of the Independent Evaluation Group's latest evaluation report, where this was flagged as a problem, and advised to look for a pragmatic solution for this Business Plan, which might be to devise a supplemental interim set of indicators, reflecting more accurately the current and future pipeline of projects.
- vi. *Dissemination of project stories.* The CG reiterated the need to disseminate more project stories. ESMAP Program Manager noted that up until recently, ASTAE did not have a dedicated communication team, but ASTAE now benefits from a well-organized ESMAP infrastructure to communicate information. For example, ASTAE activities are included in the regular electronic bulletin received by donor countries. Impact Stories could cover ASTAE results, and a website dedicated to ASTAE is being established.
- vii. *Future of the ASTAE Multi-Donor Trust Fund (MDTF).* Four possible options for the ASTAE MDTF whose end disbursement date is June 30, 2016 were discussed: (i) close the MDTF as scheduled with Business Plan targets not fully met; (ii) create a new single MDTF structure, which would include an ASTAE program for East and South Asia and to which ASTAE's assets and liabilities would be transferred;



(iii) extend the end disbursement date by one year to allow orderly progression and closing of ongoing activities; and (iv) keep ASTAE as a separate MDTF under the overall ESMAP program management and administration. The CG agreed that there are benefits of a common management structure in terms of efficiency, economies of scale, and quality control and that the World Bank had been able to maintain a common but differentiated approach for the two trust funds. The corporate policy of the World Bank, developed in consultation with donors, is to rationalize the trust fund architecture and avoid proliferation of trust funds. Pending further discussion on the future of a separate ASTAE MDTF in the context of the next Business Plan, the CG agreed to extend the current MDTF by a year.

Session 5 | Clean Energy

During the session, the six tracks of the Clean Energy Program were introduced: (i) Renewable Energy Resource Mapping; (ii) Global Geothermal Development Plan; (iii) Clean Energy Operational Support and Low Carbon Planning Tools; (iv) Climate Resilience; (v) Renewable Energy Training/Project Resource Center; and (vi) Global Variable Renewable Energy (VRE) Integration Program.

The main emphasis of the discussion was on the recently launched Global VRE Integration Program. This program will support technical assistance to country clients to increase the share of VRE in electricity supply, while improving the reliability and affordability of the electricity supply. ESMAP seeks to raise \$8 million for this program in the new Business Plan, with initial activities starting this coming fiscal year and for which supplemental contributions from donors are being sought.

ESMAP also aims to leverage this program by identifying further investment funding sources (such as the Green Climate Fund). In addition to funding, potential collaboration with GSEP and UVIG are being investigated. The CG strongly supported the program and several donors confirmed that it would be a key priority area, while also underlining that ESMAP's efforts should not crowd out commercial players. Furthermore, CG members enquired about the extent to which smart grid solution and demand-side management would be part of the program, if social issues were considered, and on the collaboration with client counterparts.

The Renewable Energy Resource Mapping Initiative was also presented and its focus on low and lower-middle-income country clients for the next Business Plan period was explained, with greater outreach to other countries in the form of advice and technical materials (but no project funding). The strong outreach of the program was highlighted, including a partnership with IRENA on their Global Atlas and involvement of NREL, GIZ, and KfW Development Bank, and several task team leaders presented the CG with country-level experience from the countries in which they work. The CG was very supportive of the program and found it a vital activity for ESMAP.

Finally, ESMAP's work on the Geothermal Development plan was exemplified through a presentation on technical assistance to Indonesia.

Session 6 | Results-Based Financing (RBF)

During the session, the CG was provided with a brief summary of recent progress, including the following highlights: (i) as previously reported, demand is slowly growing both within the World

Bank and outside for testing out and applying RBF in the energy sector; ESMAP is now funding two cookstove projects in Indonesia and Laos, both of which are piloting innovative approaches; (ii) ESMAP has continued to provide ad-hoc support and knowledge sharing with EnDev colleagues in support of their RBF program; (iii) in January 2015, ESMAP launched its second of two analytical guides, on results-based aid, as the successor to the successful RBF report published in 2013; (iv) ESMAP held a multi-stakeholder meeting on RBF in the energy sector in March 2015 to share updates on ongoing activities and programs from outside and within the World Bank. This helped reinforce the conclusion that further piloting and experimentation is needed and that there is a potential ESMAP role to support this; and (v) going forward, the intention is to fully allocate the remaining budget (perhaps to an additional country project) and begin the thinking on what shape and form ESMAP's support for RBF should take in the next business plan.


The CG desired to see more piloting to help build on the analytical work and suggested that ASTAE/AFREA funding could be used to take forward and apply the lessons learned so far to better leverage the upstream work that ESMAP has carried out. In general, the CG supported continued high ambition to keep the topic alive and encouraged ESMAP to scale up activities. The ESMAP team welcomed these comments, but noted that any major scale-up on the ESMAP side would require additional resources. There was also a question mark over the extent to which GPOBA could broaden their scope to take on some of this piloting role, potentially enabling ESMAP to support rather than lead such activities.

Session 7 | Gender and Social Inclusion in the Energy Sector

During this session, the team provided a brief overview of the Gender and Social Inclusion program that was launched in ESMAP's FY2014–16 Business Plan. The program aims to build and disseminate evidence to demonstrate that gender equality improves development outcomes. One of the main focuses of the program is to develop knowledge on gender across energy topics—energy access, electricity infrastructure, clean energy, and energy policy.

In its first year, the program has focused on building partnerships across the World Bank to deliver the work, and several colleagues from other units joined the session to present on the joint work. Together with the Social Inclusion team, ESMAP is conducting research on gender and electricity infrastructure to examine gender-differentiated impacts in areas such as land and labor. The forthcoming report (FY2016) consists of quantitative and qualitative country analyses, literature and portfolio reviews, and a review of the private sector/utilities. Another key activity highlighted is ESMAP's work with the World Bank Institute on developing an online training on gender and energy. The first e-training is scheduled for May/June 2015 and additional online and face-to-face trainings will be carried out in FY2016. The training covers gender issues across energy topics and is a facilitated interactive module with presentations, discussion forums, videos, and case studies.

The team also noted how there has been increased demand for gender support: the South Asia region carried out gender and energy assessments in India, Nepal, and Pakistan through its regional



Annual Block Grant; a rural electrification project in Bolivia developed a gender-informed baseline survey with ESMAP support; the AFREA Gender and Energy program is now in its second phase and continuing to engage at the country level; the East Asia and Pacific region has developed a similar program on gender and energy with input from the ESMAP team; and the ECA region has developed a report on gender and energy subsidies.

In addition to seeing an increase of gender and energy activities within the World Bank, the team noted the uptake on collaboration with other partners such as ENERGIA, Global Alliance, IUCN, USAID, ADA, and UNIDO. Lastly, the team highlighted the positive support received on gender through World Bank senior management and how ESMAP will continue to provide feedback into the development of the upcoming gender strategy. The discussion with the CG focused around how the ongoing reports, knowledge work, and partnerships are critical to build the evidence base. However, the team was encouraged to delve deeper and apply the knowledge generated into supporting operational work and integrating gender across ESMAP-managed activities.

Session 8 | Africa Renewable Energy and Access program (AFREA), Phase II

Practice Manager, Energy, West and Central Africa, presented the AFREA Phase II program.

The presentation was prepared bearing in mind the suggestions made at last year's CG meeting, in particular, the need for reporting on AFREA, the need to use AFREA to leverage IDA, and the need to support programs of larger size that were

less fragmented in order to increase efficiency and cost effectiveness.

The AFREA I final report, which summarized the activities, outputs, and outcomes produced under AFREA Phase I, was presented to the CG prior to shifting to the rest of the discussion focusing on activities and challenges being encountered in AFREA Phase II. The Phase II portfolio can be divided into: (i) country-specific activities; (ii) special regional initiatives; and (iii) regional analytics, strategies, and lessons. So far, \$23 million out of the five-year target of \$50 million has been programmed across 25 different activities.

Some activities were featured in more detail such as: (i) Nigeria: Analytical base for on- & off-grid access scale-up; (ii) Madagascar: Crowding in private finance for clean energy mix; (iii) Regional: Accelerating on-grid access through knowledge sharing; (iv) Regional: Lighting Africa; (v) Regional: Building an up-to-date knowledge base on subsidies; (vi) Regional: Scaling solar—grid-scale solar at scale through standard approaches; and (vii) Cross-cutting themes gender and fragility.

The key message was that AFREA brings tailored innovation and provides operationally linked analytics to the World Bank's Africa energy sector dialogue and lending programs through (i) leveraging IDA; (ii) applying know-how; and (iii) efficient implementation.

During the discussion, the issue raised was concerning donor coordination. It was agreed that there is scope to improve coordination and collaboration.

Regarding the issue of AFREA and knowledge sharing, it was mentioned that the South-South exchange between practitioners has worked extremely well as the trust level among those working in “the trenches” of access is high. AGAT and AEI both use this approach. Working in many fragile states remains a challenge: for example, the South Sudan activity is on hold.

The initial low implementation rate under AFREA Phase II was explained to be mostly related to the lead time of starting a new program. Current disbursements stand at \$3.3 million, or 25 percent, and disbursements plus commitments (implementation rate) equals \$5.7 million, or 42 percent.

Session 9 | Energy Access

Urban Poor Energy Access Program sub-session complemented the program briefing with insights by World Bank operational task team leaders on the program support to operations in Haiti, Jamaica, and Kenya. The active ESMAP support to the operational programs was seen as a major development, which vindicated the upstream thinking that went into ESMAP’s decision to develop this into a focus area in 2011. The CG acknowledged that this is a priority area that would gain increasing importance in the future, and efforts should be made to fill any funding gaps.


For the Sustainable Energy for All Technical Assistance Program, CG members expressed a desire for detailed information on the process of the investment prospectus: what it is, how it is developed, and how it will be implemented. Specific briefing was made on the Myanmar investment prospectus, which was already completed and is

currently entering the implementation phase. The example of developing the prospectus around the hydropower sector in Guinea was also presented. The CG was informed that the other investment prospectuses would be completed over the next fiscal year.

The CG was also informed that the *Clean Energy Mini-grids Facility* was launched in April 2015. The Africa part of the Facility focusing on knowledge management is a component of a larger program that is also being implemented by DFID and AfDB, while the non-Africa component focuses on knowledge management as well as market development activities. The Facility also has a close partnership with the High Impact Opportunity group under SE4ALL.

Session 10 | Energy Assessments and Strategies (including Energy Subsidies Reform TA Facility)

The ESMAP team presented the key highlights of ongoing activities and future plans under the FY2014–16 Business Plan. Discussions focused on the following major initiatives under the Energy Assessments and Strategies area: Energy-Water-Food Nexus, the Energy Subsidy Reform and Delivery Facility, and META. With regard to the nexus work, main questions centered around the low uptake, the challenges being faced, and the comparative advantage of the World Bank. The ESMAP team and the task team leader for the Thirsty Energy Initiative noted that within the limited budget available, a number of new activities have commenced recently. There are a number of other agencies involved in global advocacy and research, and the World Bank’s comparative advantage is in country dialogue, though this is where the real



challenges are: political sensitivity, lack of coordination among agencies, etc.

Task teams presented their experience in utilizing the Subsidy Reform TA Facility in countries such as Egypt, Haiti, and Ukraine. The team also updated the CG on the progress of the knowledge strategy, in particular the launch of the ESROC platform and the side-event on energy subsidies reform at the Spring Meetings, which CG members appreciated. On TAG questions about plans for utilizing the remaining funding for the Facility, it was noted that this Facility was expected to continue beyond the Business Plan period, given the political sensitivity of these reforms and the significant efforts it is taking to make these reforms a comprehensive effort. Several CG members enquired about the selection of countries and whether smaller low-income countries were also eligible for support from the facility. It was noted that while initial funding was targeted at middle-income countries, where there could be significant climate mitigation co-benefits, the facility was open to and supporting low-income countries such as Haiti and the Kyrgyz Republic. CG members commended this flexibility and noted the hope that their future support for the Subsidy Reform Facility could also prioritize low-income countries. CG members commended the World Bank task teams on progress in energy subsidy reforms, despite the risks and challenges.

With regard to META, the team updated the CG on work that has been completed to integrate the screening curve analysis feature in the tool and to customize the tool for Morocco.

In conclusion, CG members requested: (i) continued collaboration with various agencies such as

IEA and IISD/GSI on subsidy reform; (ii) sharing of experiences and results from country initiatives in subsidy reform; and (iii) increased effort on expanding the energy-water-food nexus work to also include the agriculture/food linkage.

Session 11 | SIDS DOCK Support Program

In the session on SIDS DOCK Support Program, the following points/issues were discussed:

It was noted that the global activities under the first phase program were all completed, as were some of the country-level projects—Seychelles, Mauritius, and Sao Tome and Principe—which aimed at regulatory reform and instruments to promote renewable energy.

The Japanese representative noted that the resources from the first tranche (\$9 million) of the second phase would need to be substantially committed before they would consider releasing the second tranche. The CG was briefed about the progress made on the geothermal projects in Dominica and Saint Lucia and the solar PV program in the Eastern Caribbean. In Tuvalu, SIDS DOCK resources went towards promoting clean energy as part of an overall power sector development plan.

The CG noted the low disbursement rate in some of the new projects and the team outlined the upcoming activities that would address this issue.

The CG enquired about the rationale for the knowledge event on SIDS in Vienna and it was clarified that this is held in lieu of the erstwhile program management group gatherings with the objective of facilitating knowledge exchange among the different regions and SIDS and





providing a platform for relevant partners to share their programs.

Session 12 | Energy Efficient Cities

The Energy Efficient Cities team presented an overview of the program including the city energy diagnostics supported by the TRACE tool and the City Energy Efficiency Transformation Initiative (CEETI) with its main components: (i) capacity building; (ii) technical assistance; and (iii) knowledge creation and exchange, noting the key insights gained thus far and highlighting areas of untapped potential and anticipated demand. The discussion benefitted from inputs from World Bank regional colleagues working on urban energy efficiency activities supported by ESMAP (in Ukraine, China, Brazil, and Ethiopia, as well as on the ICT-energy efficiency nexus and on the Negawatt competition). The session also featured a short presentation on the IFC's EDGE tool, which supports resource-efficient buildings. (The IFC

EDGE Green Building Program is supported by a CEETI grant).

CG members expressed interest and support for the overall program. CG members highlighted the following issues for consideration by the CEETI team: (i) linkages with global sustainable urban initiatives, such as ICLEI, C40, WRI, Covenant of Mayors, and SE4ALL, which could provide opportunities to leverage ESMAP's work; (ii) collaboration on tools within the WBG to approach cities with a more holistic package; (iii) ways to address innovative approaches to foster urban energy efficiency; and (iv) the two different urban energy efficiency paradigms between mature cities (facing a retrofit challenge) on the one hand and those cities in rapidly developing countries that currently see strong growth in urbanization (needing to focus on design as well as regulations and enforcement of building codes) on the other hand.

ANNEX II | ESMAP RESULTS, FY2015: OUTCOMES, OUTPUTS, AND WORLD BANK OPERATIONS INFORMED

During FY2015, ESMAP activities have contributed to the identification and design of approved World Bank Group energy lending of **\$1.59 billion**.

The following table gives a quantitative summary of ESMAP's results for FY2015. 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, FY2015 | | | |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | OBJECTIVE | INDICATOR | ACHIEVEMENTS |
| Outcomes | Development Financing Informed | Existing operations informed | World Bank Operations Informed: 10 existing and new (including AFREA) Existing operations informed: |
| | 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 | <ul style="list-style-type: none"> • Comoros Electricity Sector Recovery Project (Comoros / \$5 million) • Espírito Santo Integrated Sustainable Water Management Project (Brazil / \$225 million) • Household Natural Gas Connection Project (Egypt / \$500 million) • PNG Energy Sector Development (Papua New Guinea / \$8.3 million)* • Upper Cisokan Pumped Storage Hydro-Electrical Power (1040 MW) Project (Indonesia / \$640 million)* |
| | | Mobilization of non-Bank resources informed | |
| | | Preparation of new operation informed | New operations informed: <ul style="list-style-type: none"> • Armenia Geothermal Exploratory Drilling Project (Armenia / CSCF \$8.5 million) • Efficient & Sustainable City Bus Services (India / \$9.2 million) • Energy Sector Development Policy Operation (Kyrgyz Republic / \$24 million) • Lao PDR Health Governance and Nutrition Development Project (Lao / \$26.4 million)* • Uganda Energy for Rural Transformation APL-3 (Uganda / \$143 million) |
| | | | Mobilization of Non-Bank Resources Informed: 6 existing and new (including AFREA) Existing operations informed: <ul style="list-style-type: none"> • Armenia Geothermal Exploratory Drilling Project (Armenia / Government \$2.13 million) • Espírito Santo Integrated Sustainable Water Management Project (Brazil / Government \$98.10 million) • Household Natural Gas Connection Project (Egypt / EU \$78.9 million, AFD \$96 million, Government \$473 million, private sector \$326 million) • Upper Cisokan Pumped Storage Hydro-Electrical Power (1040 MW) Project (Indonesia / Government \$160 million) |
| | | | New operations informed: <ul style="list-style-type: none"> • Efficient & Sustainable City Bus Services (India / Government \$103.8 million) • Uganda Energy for Rural Transformation APL-3 (Uganda / Government \$33.2 million) |

TABLE A2.1 *Continued*

Summary of ESMAP Results, FY2015

| | OBJECTIVE | INDICATOR | ACHIEVEMENTS |
|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|---------------------------------------------------------------------------|
| | Policy & Strategy Informed and Client Capacity Increased 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 | Government policy/ strategy informed | 9 outcomes |
| | | Public debate stimulated/initiated | 5 outcomes |
| | | Contributed to stakeholder involvement | 3 outcomes |
| | | Development community/partner policy/strategy informed | 3 outcomes |
| | | Bank country strategy informed/influenced | 1 outcome |
| | | Bank sector strategy informed/influenced | 4 outcomes |
| | | Design capacity strengthened | 4 outcomes |
| | | Implementation capacity strengthened | 5 outcomes |
| | | M&E capacity increased | 2 outcomes |
| | | Client is recognized with good practice or similar awards | 1 outcome |
| | Knowledge Increased/ Deepened and Innovative Approaches & Solutions Generated | Facilitated exchange of best practice with clients | 6 outcomes |
| | | Facilitated exchange of best practice with partners | 1 outcome |
| | 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 | Disseminated best practices | 9 outcomes |
| | | New innovative approach fostered | 0 outcomes |
| | | New innovative approach developed | 2 outcomes |
| | | Other action/behavior adopted or observed | 1 outcome |
| Outputs | Economic and Sector Work (ESW) & Technical Assistance (TA) | # of Research (ESW, TA) and Knowledge Products Published | Total # of Outputs: 154 ESW & TA Outputs: 60 Knowledge Products: 94 |
| | Research & Knowledge Products | # Academic Mentions | 267 |
| | Academic Mentions/References of ESMAP Products/Knowledge | # Impact Stories Developed and Disseminated | 0 |
| | Impact Stories Peer-Reviewed Research | # of Peer-Reviewed Research Published | 0 |

*ASTAE co-financed with ESMAP.

The following tables summarize the outputs under each of the ESMAP program areas in FY2015, in line with the M&E system introduced in 2010.

TABLE A2.2

| ESMAP Program Outputs, FY2015 | | |
|------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| AFRICA RENEWABLE ENERGY ACCESS PROGRAM (AFREA) | | |
| 1 | Analytical & Advisory Activities | Economic and Sector Work: Sector or Thematic Reports Technical Assistance: Implementation / Advisory Reports, Event Proceedings Documents |
| | AFR | ACCES Quality Assurance & Technical Support Implementation Guide |
| | AFR | Clean and Improved Cooking in Sub-Saharan Africa: A Landscape Report |
| | AFR | Political Economy of Power Sector Subsidies: A Review with Reference to Sub-Saharan Africa |
| | AFR | Sharing Lessons – AFREA Gender and Energy Workshop Proceedings |
| | Kenya | National Electrification Strategy for Kenya (prepared with AGAT support) |
| | Niger | Preparatory Studies for the Extension of the Distribution Network in Niamey and Six Other Urban Centers |
| | Nigeria | A “Blueprint” for National Access Policy Development |
| | Nigeria | Investment Prospectus for Access for 7 States |
| | Nigeria | Nigeria Electricity Access Program: Technical Assistance Preparation of a Least Cost Geospatial Implementation Plan for Grid and Off-Grid Rollout (2015–2030) |
| | Uganda | Market Assessment of Modern Off-grid Lighting Products in Uganda |
| 2 | Knowledge Products | Toolkits, Operational Guides, Models, Handbooks, Databases, Internal And External Trainings, Forums, and Workshops |
| | Assessment | Capacity Assessment of Uganda’s Rural Electrification Agency (March 2015) |
| | Assessment | Elaboration of a financing scheme proposal for the connection charges and the existing Electrification Fund in Kenya (February 2015) |
| | Assessment | Electricity Connection Market Assessment Report in Uganda (April 2015) |
| | Assessment | Initial assessment of the country’s current electricity access situation in Zambia (April 2015) |
| | Assessment | Initial Assessment of the country’s current electricity access situation in Congo-Brazzaville (February 2015) |
| | Assessment | Institutionalizing Continual Cost-reduction Strategies in Rural Electrification in Kenya (June 2015) |
| | BBL | Analysis of Hydropower Development Trends in Sub-Saharan Africa (Washington DC, April 2015) |
| | BBL | Energy and Extractives Global Practice: Gender Town Hall (Washington, DC, March 2015) |
| | Case Studies | IPP Case studies of Kenya, Nigeria, South Africa, Tanzania and Uganda |
| | Case Studies | Preparatory studies for Uganda Clean Cooking Supply Chain Expansion Project |
| | Conference Proceedings | AFREA Gender and Energy workshop (Dakar, Senegal April 7–9, 2014) |
| | Database | IPP database and Financing Flows to Sub-Saharan Africa |
| | Live Wire Report | Improving Gender Equality and Rural Livelihoods in Senegal through Sustainable and Participatory Energy Management: Senegal’s PROGEDE II Project (Live Wire, June 2015) |
| | Report | From the Bottom Up: How Small Power Producers and Mini-Grids Can Deliver Electrification and Renewable Energy in Africa (French) |
| | Strategy Note | South Sudan Energy Sector Strategy Note |
| | Study Tour | Zambian energy officials visit to Namibia to learn about low-cost electrification technologies |
| | Tool | Nigeria Geospatial Least-Cost Access Expansion Planning Tool (7 states) |
| | Training | Capacity building for the rural electrification service providers in Uganda (September 2014–May 2015) |

TABLE A2.2 *Continued*

| ESMAP Program Outputs, FY2015 | | |
|-------------------------------|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Workshop | Best practices and experiences of national electrification initiatives in Congo-Brazzaville (February 2015) |
| | Workshop | Best practices and experiences of national electrification initiatives in Niger (April 2015) |
| | Workshop | Best practices and experiences of national electrification initiatives in Tanzania (January 2015) |
| | Workshop | Co-facilitated ECREE in-house capacity building workshop on gender mainstreaming and shared AFREA Gender and Energy experiences (November 2014) |
| | Workshop | Electricity Access Workshop and Consultations to Exchange Best Practices in Uganda (February 2015) |
| | Workshop | Gender, Energy, and M&E – West Africa Webinar |
| | Workshop | High Level Consultation Workshop on Kenya's National Electrification Strategy (September 2014) |
| | Workshop | Meeting the Challenges of Growth and Transformation: A National Electrification Strategy for Ethiopia (June 2015) |
| | Workshop | Off-grid Lighting Market Assessment and Analysis Workshop (Uganda, October 2014) |
| CLEAN ENERGY | | |
| 1 | Analytical & Advisory Activities | Economic and Sector Work: Sector or Thematic Reports Technical Assistance: Implementation / Advisory Reports, Event Proceedings Documents |
| | China | Comparing Production-based with Consumption-based Carbon Accounting at City-level Application to Beijing and Shanghai |
| | China | Strategies and Indicators for Pilot Low-Carbon Cities in China |
| 2 | Knowledge Products | Toolkits, Operational Guides, Models, Handbooks, Databases, Internal and External Trainings, Forums, and Workshops |
| | Conference | American Geophysical Union (AGU) Fall Meetings |
| | Conference | Joint Global Change Research Institute Program on Integrated Assessment Model Development, Diagnostics and Inter-Model Comparisons (PIAMDDI) Meeting at Stanford University |
| | Training | Solar GIS and Wind (Islamabad, Pakistan, October 15–17, 2014) |
| | Training | Solar GIS and Wind (Lahore and Karachi, Pakistan, October 20–21, 2014) |
| | Workshop | Technical Discussion on GIS tools & the value of the renewable energy mapping outputs through geospatial analysis and planning (October 15, 2014) |
| | Workshop | Uruguay Low Carbon Development Study Dissemination (February 10–11, 2015) |
| ENERGY ACCESS | | |
| 1 | Analytical & Advisory Activities | Economic and Sector Work: Sector or Thematic Reports Technical Assistance: Implementation / Advisory Reports, Event Proceedings Documents |
| | Guatemala | Guatemala Country Action Plan |
| | LCR | Brief on Health and Clean Cooking and Heating in Collaboration with the Stockholm Environment Institute |
| | LCR | Cooking with Gas: Why Women In Developing Countries Want LPG and How They Can Get It |
| | Nicaragua | Preparación del Plan de Acción y Plan de Inversión para Fomentar el Uso de Soluciones Limpias para Cocinar en Nicaragua (May 2015) |
| | Papua New Guinea | Report: Papua New Guinea: National Electricity Roll-Out Plan (NEROP) |
| 2 | Knowledge Products | Toolkits, Operational Guides, Models, Handbooks, Databases, Internal and External Trainings, Forums, and Workshops |
| | Conference | Launch of "Sustainable Energy for All (SE4ALL) in the Americas" (Santiago, Chile, October 15–17, 2014) |
| | Report | Outlook for Clean Cooking in Central America by 2030 |
| | Workshop | Technical workshops: State-Level Stakeholder meetings (February 2015) in Hyderabad, Mumbai, Mohali, and Patna |
| | Workshop | Preparation of a Clean Cooking Solutions Roadmap and Investment Prospectus for Guatemala, Honduras, and Nicaragua (January 2015) |

TABLE A2.2 *Continued*

ESMAP Program Outputs, FY2015

ENERGY ASSESSMENTS AND STRATEGIES

| 1 | Analytical & Advisory Activities | Economic and Sector Work: Sector or Thematic Reports Technical Assistance: Implementation / Advisory Reports, Event Proceedings Documents |
|---|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Afghanistan | Report: Energy Security Trade-Offs under High Uncertainty: Resolving Afghanistan's Power Sector Development Dilemma |
| | AFR | Report: Viability of West Africa LNG Imports Final Report |
| | EAP | Report: Strategic Options for Enhanced Financial Performance of EVN |
| | ECA | Inception Report: Sector Study on Biomass-based Heating in the Western Balkans |
| | ECA | Report: Assessment of the Role of Glaciers in Stream Flow from the Pamir and Tien Shan Mountains |
| | Kazakhstan | Integration of Renewables in Power Market and Power System, Kazakhstan Area 1: Integrating Renewables in the Power Market |
| | Kazakhstan | Integration of Renewables in Power Market and Power System, Kazakhstan Area 2: Integrating Renewables in the Power System |
| | Kyrgyz Republic | Presentation: Technical Assistance In Support Of Energy Tariff Reforms in the Kyrgyz Republic (May 2015) |
| | LCR | Introduction of LNG in Central America Final Report |
| | MNA | Cost Competitiveness of Generation Technologies |
| | Moldova | Moldova Electric Power Market Options Sector Study |
| | Moldova | Moldova Power Sector Stakeholder Workshop (Chisinau, Moldova, May 14, 2015) |
| | Philippines | Philippines Energy Commission Regulatory Technical Assistance: Implementation Report |
| | Philippines | Philippines Energy Commission Regulatory Technical Assistance: RSEC RSEC-WR & TGP Final Report |
| | Yemen | Overview of Global Development of Solar PV Applications; Solar PV Water Pumping in Yemen |
| | Yemen | Power Regulatory Council in Yemen: A Suggested Roadmap |
| | Yemen | Yemen Power Sector Reform and Development: Back to the Basics |
| | Yemen | Yemen Power Sector Reform Strategy: Towards Improved Performance and Financial Sustainability |
| 2 | Knowledge Products | Toolkits, Operational Guides, Models, Handbooks, Databases, Internal and External Trainings, Forums, and Workshops |
| | Case Study | Republic of Turkey Social Compact in Electricity Privatization in Southeastern Turkey |
| | Communication Strategy | Communication Strategy 1: Preparing Ukrainian People for the Required Increase in Utility Tariffs in autumn 2014 |
| | Communication Strategy | Communication Strategy 2: Preparing the Population of Ukraine for Higher Utility Bills (Fall 2014) |
| | Conference | XXVIII Annual Convention of the National Association of Water Utilities (Merida, Mexico, November 9–12, 2014) |
| | Conference | World Water Week 2014 (Stockholm, Sweden, August 31–September 05, 2014) |
| | Conference | Authors' Workshop for the Regional Study "Latin America's Energy Pricing Policies" (Washington, DC, October 1, 2014) |
| | Documentary release | "Katiyabaaz" or "Powerless" in India and Bangladesh state capitals (Lucknow, Patna, Kolkata, and Jaipur) and 12 districts in Uttar Pradesh, Bihar, and Rajasthan (January 2015) |
| | Forum | 2015 Energy and Extractives Forum (Washington, DC, Apr 27–May 8, 2015) |
| | Forum | 2015 GP Social, Urban, Rural & Resilience Forum (April 20–24, 2015) |
| | Report | Public Opinion Poll on Issues Related to Ukraine's Energy Sector |
| | Workshop | Benefit Sharing and Hydropower Workshop (Jakarta, Indonesia September 25, 2014) |

TABLE A2.2 *Continued*

ESMAP Program Outputs, FY2015

| | |
|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Workshop | Second Stakeholder on Energy Security Trade-Offs under High Uncertainty: Resolving Afghanistan's Power Sector Development Dilemma Report (Dubai, UAE, May 2015) |
| Workshop | ECA Citizen Engagement clinic |
| Workshop | Public and Private Sector Stakeholder Workshops (Ankara and Istanbul, Turkey, February 2015) |
| Workshop | DIME Impact Evaluation Workshop: Energy & Environment (Lisbon, Portugal, October 13–17, 2014) |
| Workshop | Second Workshop on methodology and international Practice (Beijing, China, April 13, 2015) |
| Workshop | Urumqi District Heating pricing Technical Assistance (China, April 2015) |
| Workshop Proceedings | National Consultation & Information Sharing Workshop Report (Belize, June 25, 2015) |

ENERGY EFFICIENCY

| | | |
|----------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Analytical & Advisory Activities | Economic and Sector Work: Sector or Thematic Reports Technical Assistance: Implementation / Advisory Reports, Event Proceedings Documents |
| | AFR | Development of Energy Efficiency in Sub-Saharan African Cities: A Municipal Perspective from Accra, Addis Ababa and Nairobi |
| | Belarus | Republic of Belarus Heating Tariff Reform and Social Impact Mitigation Recommendations for a Sustainable District Heating Sector in Belarus |
| | ECA | Energy Efficiency Institutional Review Stakeholder Workshop (May 21, 2014) in Ankara |
| | Kyrgyz Republic | Report: Urban Heating Options in the Kyrgyz Republic |
| | Panama | Panama Energy Crisis: Initiatives Assessment and Emergency Action Plan |
| | Panama | Strengthening of the Institutional Framework for the Energy Sector in Panama |
| | Tajikistan | Report: Urban Heating Options in Tajikistan |
| | Turkey | Republic of Turkey Institutional Review of Energy Efficiency in Turkey |
| | Ukraine | Energy Efficiency Assessment Report Kiev, Ukraine (March 26, 2015) |
| | Ukraine | Energy Efficiency Assessment Report: Kamyenetz-Podilsky, Ukraine (March 26, 2015) |
| | Ukraine | Energy Efficiency Assessment Report: Ternopil, Ukraine (March 26, 2015) |
| | Uzbekistan | Report: Assessment of Heating and Hot Water Supply and Demand Options for Andijan, Chirchik and Sergili district of Tashkent |
| 2 | Knowledge Products | Toolkits, Operational Guides, Models, Handbooks, Databases, Internal and External Trainings, Forums, and Workshops |
| | Conference | 2015 Danube Water Conference, co-financed by GIZ Open Regional Fund (May 6–8, 2015) Vienna, Austria |
| | Guidance Note | Capacity Building Program in Bus Fuel Efficiency |
| | Inception Report | Development of a LED Street Lighting Retrofit Project for Surabaya, Indonesia |
| | Report | State of the Sector Report |
| | Report | Strategies and Roadmap of Coordination Between the Energy Savings, Renewable Energy, and Carbon Trading Schemes in China |
| | Study Tour | China: Wuhan Integrated Transport Development Project – learning from best international practice in smart transport and EE (February 2015) |
| | Study Tour | China: Wuhan Integrated Transport Development Project : Learning from Best International Practice in Smart Transport and EE (April 2015) |
| | Tool Implementation | TRACE (Kamyenetz-Podilsky, Ukraine, March 26, 2015) |
| | Tool Implementation | TRACE (Kiev, Ukraine, March 26, 2015) |
| | Tool Implementation | TRACE (Ternopil, Ukraine, March 26, 2015) |
| | Workshop | Knowledge-Exchange Workshop (Surabaya, Indonesia, June 9–12, 2015) |

TABLE A2.2 *Continued*

ESMAP Program Outputs, FY2015

| | |
|----------------------|-------------------------------------------------------------------------------------------------------------|
| Workshop | Regulatory benchmarking Workshop (Pristina, Kosovo, February 2015) |
| Workshop | Keeping Warm: Urban Heating Options For the Kyrgyz Republic Workshop (Bishkek, Kyrgyz Republic, April 2015) |
| Workshop | Workshops on TRACE (Kiev, Ternopil, Kamyenetz-Podilsky, Ukraine, February 21–24, 2015) |
| Workshop Proceedings | Proceedings of the China-ASEAN Energy Efficiency Knowledge Exchange Workshop |

GENDER AND SOCIAL INCLUSION

| | | |
|---|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1 | Analytical & Advisory Activities | Economic And Sector Work: Sector or Thematic Reports Technical Assistance: Implementation / Advisory Reports, Event Proceedings Documents |
| | Assessment | Enhancing the Social Sustainability of Energy Development by Gender Mainstreaming in India, Pakistan and Nepal |
| 2 | Knowledge Products | Toolkits, Operational Guides, Models, Handbooks, Databases, Internal and External Trainings, Forums, and Workshops |
| | | Engaging Private Sector on Gender and Energy (Online Facilitated Discussion – August 2014) |
| | BBL | Gender and Energy Access – Lessons from Global Alliance, USAID and Solar Sister |
| | Conference | Deloitte Run of Show: Women, Energy, and Economic Empowerment Panel Discussion (Washington, DC, March 19, 2015) |
| | Course | Gender and Energy e-learning online training (May–June 2015) |
| | Report | Nexus Chapter on Gender and Energy Data for Global Tracking Framework Report |
| | Workshop | Gender and Electricity Infrastructure Technical Workshop (Washington DC, June 2015) |
| | Workshop | Gender and Energy Deep Dive Workshop at the Asia Clean Energy Forum (June 2015) |
| | Workshop | Gender and Renewable Energy Workshop by USAID and IUCN (Arlington, VA, September 2014) |
| | Workshop | Side Event on Gender and Energy – Vienna Energy Forum (June 2015) |

RESULTS-BASED FINANCING

| | | |
|---|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2 | Knowledge Products | Toolkits, Operational Guides, Models, Handbooks, Databases, Internal and External Trainings, Forums, and Workshops |
| | BBL | Updates of Lao Clean Cookstove Initiative Innovative Health Impacts Result Based Financing Feasibility Study (Washington, DC, September 16, 2014) |
| | Report | Lao Stove Intervention Feasibility Study |
| | Report | Laos PDR 50,000 Clean Stove Demonstration Project Economics and Implementation Issues |
| | Report | Piloting Improved Woodstove Project in Northern Lao PDR and Contributing to the Development of Cookstove Standards Framework |
| | Report | Social Acceptability & Willingness to Pay |
| | Survey | ACE-1 Project Stove Usage Follow-up Xonboury District |
| | Workshop | Inter-ministerial CSI Taskforce Workshop on Health Benefits of Clean Cookstoves and the Design of an Innovative Result-Based Financing to Promote Clean Cookstoves in Lao PDR (Vientiane, June 24, 2015) |

TABLE A2.3

SIDS DOCK Outputs, FY2015

| 1 | Analytical & Advisory Activities | Economic And Sector Work: Sector or Thematic Reports Technical Assistance: Implementation / Advisory Reports, Event Proceedings Documents |
|---|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | Mauritius | Determination of the Grid Absorption Capacity of Mauritius and Preparation of a Grid Code, Feed-in Tariffs and Model Energy Supply Purchase Agreements for Renewable Energy Systems between 50kW to 2MW Summary Report |
| | Mauritius | Grid Code for Medium Scale Distributed Generation Greater than 200kW, but not exceeding 2MW |
| | Mauritius | Grid Code for Medium Scale Distributed Generation Greater than 50kW, but less than 200kW |
| | Mauritius | Grid Code for Small Scale Distributed Generation |
| | Mauritius | Model: Feed-in Tariffs model |
| | Mauritius | Model: Power System model |
| | Mauritius | Report: Determination of the Grid Absorption Capacity of Mauritius and Preparation of a Grid Code, Feed-in Tariffs and Model Energy Supply Purchase Agreements for Renewable Energy Systems up to 2MW (Vol. 1) |
| | Mauritius | Report: Determination of the Grid Absorption Capacity of Mauritius and Preparation of a Grid Code, Feed-in Tariffs and Model Energy Supply Purchase Agreements for Renewable Energy Systems between 50kW to 2MW (Vol. 2) |
| | Mauritius | Report: Determination of the Grid Absorption Capacity of Mauritius and Preparation of a Grid Code, Feed-in Tariffs and Model Energy Supply Purchase Agreements for Renewable Energy Systems up to 2MW (Vol. 3) |
| | Vanuatu | Council of Ministers DECISION 142/2014: Endorsing Scaling up renewable energy in low income countries program (SREP) investment plan |
| | Vanuatu | Interim Report on Power Pricing Strategy and Self Financing Mechanism Design |
| | Vanuatu | Scaling Up Renewable Energy in Low Income Countries (SREP) Investment Plan for Vanuatu |
| 2 | Knowledge Products | Toolkits, Operational Guides, Models, Handbooks, Databases, Internal and External Trainings, Forums, and Workshops |
| | Model | Feed-in Tariffs model |
| | Model | Power System model |
| | Workshop | Design the Self Financing Mechanism and Power Pricing Strategy (Virtual, August 2014) |
| | Workshop | Determination of the Grid Absorption Capacity of Mauritius and Preparation of a Grid Code, Feed-in Tariffs and Model Energy Supply Purchase Agreements for Renewable Energy Systems between 50kW to 2MW (Mauritius, September 2014) |
| | Workshop | Regional Study "Latin America's Energy Pricing Policies (Washington, DC, October 1, 2014) |
| | Workshop | Second Design the Self Financing Mechanism and Power Pricing Strategy Workshop (Grenada, October 2014) |
| | Workshop | Workshop for the Draft Scaling Up Renewable Energy in Low Income Countries (SREP) Investment Plan (Vanuatu, August 2014) |
| | Workshop | Workshop for the Options Paper with Stakeholders (Vanuatu, July 2014) |

ANNEX III | ASTAE RESULTS, FY2015: 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-financed projects that are approved by the Board. ASTAE-supported IDA/

IBRD/GEF projects approved by the Board totaled \$1.013 billion in FY2015. The cumulative FY2012-15 total is \$5.232 billion, exceeding the target for the current Business Plan. Physical target indicators are obtained from the Project Appraisal Documents of IDA/IBRD/GEF projects that ASTAE supported.

Table A3.2 links the ASTAE activities and the IDA/IBRD/GEF projects that contributed to the above ASTAE indicators during FY2015.

TABLE A3.1

| ASTAE Business Plan Result Framework, FY2012-15 ¹ | | | | | | |
|--------------------------------------------------------------------------|--------------|---------------|--------------------------|-----------------------|--------------------------|--------------|
| DIRECT INDICATORS | UNIT | VALUE PLEDGED | VALUE ACHIEVED FY2012-14 | VALUE ACHIEVED FY2015 | VALUE ACHIEVED FY2012-15 | PROGRESS (%) |
| 1. Total World Bank Lending Catalyzed by ASTAE Activities | | | | | | |
| Project and Program Lending | US\$ million | 3,200 | 4,218 | 1,013 | 5,232 | 163% |
| 2. New capacity and Increased Generation of Renewable Electricity | | | | | | |
| Renewable Energy, Capacity | MW | 1,500 | 1,309 | 64 | 1,372 | 91% |
| Renewable energy, Generation | GWh/yr | 3,000 | 2,630 | 239 | 2,868 | 96% |
| 3. Electricity Savings Resulting from Efficiency Improvements | | | | | | |
| Energy Savings, Capacity | MWe | 1,000 | 351 | 0.001 | 351 | 35% |
| Energy Savings, Generation | GWh/yr | 2,000 | 2,820 | 8.77 | 2,829 | 141% |
| 4. Households with Access to Modern Energy Services | | | | | | |
| Access to Electricity (new) | households | 2,000,000 | 558,000 | | 558,000 | 28% |
| Access to Electricity (improved) | households | 1,000,000 | 150,000 | 163,000 | 313,000 | 31% |
| Improved Stoves for Heating (cooking & space) | households | 5,000,000 | 1,195,000 | | 1,195,000 | 24% |
| 5. Avoided Greenhouse Gas Emissions | | | | | | |
| Direct CO ₂ Avoided Over 20 Years | million tons | 200 | 375 | 4 | 379 | 190% |
| 6. Countries Benefiting from ASTAE support | | | | | | |
| Number of Countries | countries | 15 | 12 | 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 FY2015

| ASTAE ACTIVITY (FISCAL YEAR WHEN ACTIVE) | WORLD BANK PROJECT (IDA/IBRD/GEF) (FISCAL YEAR APPROVED) | INDICATORS | | | | | SOURCE OF INDICATOR |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|------------------------------------|-------------------------------------|--------------------------|---------------------------------------------------------------------------------------|----------------------------|------------------------------------------------------------------|
| | | INVESTMENT LEVERAGE (US\$ MILLION) | RENEWABLE ENERGY PILLAR | ENERGY EFFICIENCY PILLAR | ACCESS PILLAR | CO ₂ MITIGATION | |
| LAO PDR | | | | | | | |
| Clean Stove Initiative Phase 2 (FY13-) Technical assistance for (i) capacity building for the improved traditional clay based cookstove; (ii) establishing a cookstove testing laboratory; (iii) development of the First National Cookstove Standards; and (iv) Lao Health Impacts Assessment and Innovative Health Impact Result Based Financing | Lao PDR Health Governance and Nutrition Development Project (P151425) (FY15) | 26.40 | | | | | World Bank Project Appraisal Document |
| NEPAL | | | | | | | |
| 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 | Kabeli-A Hydro Electric Project (P122406) (FY15) | 108.60 | 37.6 MW 205.2 GWh/ yr by 2020 | | 163,000 customers equivalent by 2019 (increased firm electricity supply per customer) | 2.288 Mtons over 20 years | World Bank Project Appraisal Document -Annex 1: Result Framework |
| Photovoltaic Technology Workshop in Kathmandu (FY14) A workshop to (i) introduce international lessons and experiences and (ii) provide an opportunity to Nepal Electricity Authority staff members to develop their capacity in order to facilitate the preparation of the World Bank-funded grid connected mega solar project | Nepal: Grid Solar and Energy Efficiency (P146344) (FY15) | 138.00 | 25 MWp 31.7 GWh/yr in 2019/20 | | | 0.53 Mtons over 20 years | World Bank Project Appraisal Document -Annex 1: 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 (US\$ MILLION) | RENEWABLE ENERGY PILLAR | ENERGY EFFICIENCY PILLAR | ACCESS PILLAR | CO ₂ MITIGATION | |
| TUVALU | | | | | | | |
| Preparation and early implementation support for the Tuvalu Energy Sector Development Project (FY14-) Support to the Tuvalu Electricity Corporation (TEC) prepare and implement the Tuvalu Energy Sector Development Project in the areas of: (i) technical studies to provide advisory service to assist the TEC in preparing the investments on renewable energy and energy efficiency; (ii) procurement support to TEC for both project preparation and implementation; and (iii) support the TEC to ensure social issues are addressed, especially on gender, including the use of human rights based approach | Energy Sector Development Project (P144573) (FY15) | 9.1 | 1.13 MW 1.8 MWh/yr | 985 MWh/yr in 2020, 0.122 MW at 92% capacity factor | | 0.02 Mtons over 20 years | World Bank Project Appraisal Document- Annex 1: Result Framework, Internal Project File |
| VIETNAM | | | | | | | |
| Renewable Energy Integration and System Efficiency and Reliability Enhancement (FY14) Support to the National Power Transmission Company in defining and refining its smart grid strategy by preparing a detailed Smart Grid investment plan that captures the opportunities of new technologies and relevant international experience on developing smart grids to improve the efficiency, resilience, and increase the transmission grid's ability to absorb intermittent renewable energy resources such as wind and solar. The investment plan will include the development of performance indicators to evaluate the success of the investment in smart grids for the continued development of the program. | Transmission Efficiency Project (TEP) (P131558) (FY15) | 731.25 | | 7,788 MWh/yr load loss saving, 0.966 MW at 92% capacity factor | | 0.89 Mtons over 20 years | World Bank Project Appraisal Document |

ANNEX IV | COMPLETED, NEW, AND ONGOING ACTIVITIES, FY2015

TABLE A4.1

ESMAP Completed, New, and Ongoing Activities, FY2015

| COMPLETED ACTIVITIES | | |
|------------------------------|--------------------------------------------------------------------------------------------------------|----------------------------------|
| Country/Region | Activity | Task Manager |
| CLEAN ENERGY | | |
| China | China Electricity Regulation to Integrate Climate Change Considerations | Ximing Peng |
| China | Defining and Measuring Low Carbon Cities in China | Xiaodong Wang |
| Global | Turn Down the Heat, Phase 3 | Kanta K. Rigaud |
| Indonesia | Financing Options with Public-Private Partnership for a Medium Hydropower Project in Outer Islands | Anh Nguyet Pham |
| Indonesia | Geothermal Clean Energy Investment Project | Anh Nguyet Pham |
| Mexico | Renewable Energy Forum | Karen Bazex |
| MNA | North Africa Regional Concentrated Solar Power Scale-Up Initiative | Fanny Kathinka Missfeldt-Ringius |
| Uruguay | Low Carbon Study | Holger A. Kray |
| ENERGY ACCESS | | |
| Global | Defining and Measuring Access to Energy | Mikul Bhatia |
| Global | Economics of Household Energy | Venkata Ramana Putti |
| Global | Sustainable Energy for All Global Tracking Framework 2015 | Gabriela Elizondo Azuela |
| Global | Piloting Multi-Tier Energy Access Metric | Mikul Bhatia |
| India | State-Level Dissemination of India Power Sector Review | Mohua Mukherjee |
| Myanmar | Development of Myanmar National Electrification Program | Dejan R. Ostojic |
| Papua New Guinea | Support the Development of an Electrification Roll-out Plan | Roberto Gabriel Aiello |
| SAR | Gender Mainstreaming in Energy Sector in South Asia | Chaohua Zhang |
| South Asia | Strategic Communication for Improving Governance and Efficiency in the Power Sector | Ashish Khanna |
| ENERGY EFFICIENCY | | |
| AFR | Energy Efficiency Development in African Cities | Karan Capoor |
| China | China-ASEAN Energy Efficiency South-South Knowledge Exchange | Xiaodong Wang |
| China | Issues and Options in Monitoring, Verification, and Reporting in Energy Efficiency | Xiaodong Wang |
| Egypt | Data Analytics for Urban Transport to Mitigate Climate Change: Cairo | Isabelle Huynh |
| Ethiopia | Ethiopia CFL and Incandescent Lamp Recycling Operation Framework | Raihan Elahi |
| Global | Capacity Building for Leaders in Energy Efficient Urban Transport Planning | Thierry Desclos |
| Indonesia | Reforming the Minibuses in Surabaya | Reindert Westra |
| Iraq | Iraq Energy Efficiency Action Plan | Ferhat Esen |
| Kyrgyz Republic & Tajikistan | Heating and Energy Efficiency Assessment for the Building Sector of the Kyrgyz Republic and Tajikistan | Ani Balabanyan |
| Nicaragua | ENACAL Master Plan for Operational Efficiency in Managua, Nicaragua | Lilian Pena Pereira Weiss |

TABLE A4.1 *Continued*

| ESMAP Completed, New, and Ongoing Activities, FY2015 | | |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|
| 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 Stephen Lambrides |
| Philippines | Metro Manila Bus Network Optimization Plan | Ajay Kumar |
| Sri Lanka | Colombo Low Carbon Urban Transport Technical Assistance | Zhiyu Chen |
| Turkey | Energy Efficiency Institutional Review | Jasneet Singh |
| Uzbekistan | Least Cost Assessment for the Heating Sector of Uzbekistan | Pekka Kalevi Salminen |
| West Bank & Gaza | Energy Management for Water Utility Program | Iyad Rammal |
| ENERGY ASSESSMENTS AND STRATEGIES | | |
| Afghanistan | Energy Security Trade-Offs Under High Uncertainty | Richard Jeremy Spencer |
| AFR | Harnessing African Gas for African Power | David John Santley |
| AFR | Integration of Mining Sector Demand for Power Sector Development in Africa | Sudeshna Ghosh Banerjee |
| AFR | Liquefied Natural Gas Import Options for West Africa | Syed Waqar Haider |
| Belarus | Heating Tariff Reform and Social Impact Mitigation | Fan Zhang |
| ECA | Assessment of the Role of Glaciers in Stream Flow from the Pamir and Tien Shan Mountains | Winston Yu |
| ECA | Western Balkans Biomass Heating Study | Jari Vayrynen |
| Egypt | Policy Note on Social Accountability in the Egypt Energy Sector | Waleed Saleh I. Alsuraih |
| Egypt | Egypt Energy Pricing and Subsidy Technical Assistance | Sudeshna Ghosh Banerjee |
| Honduras | Strategic Engagement in the Power Sector | Koffi Ekouevi |
| India | Institutional Strengthening of Power Utilities in North-East Region | Rohit Mittal |
| Iraq | Capacity Development for Electricity Sector Reform | Simon Stolp |
| Jamaica | Jamaica Emergency Integrated Resource Plan | Todd M. Johnson |
| Kenya | Kenya's Power Sector: Future Role of the Public and Private Sectors | Kyran O'Sullivan |
| LCR | Energy Sector Diagnostics in Latin America and Caribbean Region | Mark Lambrides |
| LCR | Introduction of Liquefied Natural Gas in Central America and the Caribbean | Francisco J. Sucre |
| Moldova | Moldova Power Sector Note | Sandu Ghidirim |
| Philippines | Electric Cooperative Regulatory Efficiency | Alan F. Townsend |
| Yemen | Yemen Energy Sector Strategy | Jianping Zhao |
| NEW ACTIVITIES | | |
| Country/Region | Activity | Task Manager |
| AFRICA RENEWABLE ENERGY ACCESS PROGRAM (AFREA) | | |
| AFR | Review of Hydropower Development in Africa | Frederic Louis Catherine Tovey |
| AFR | African Rural Electrification Concession | Richard H. Hosier |
| Gabon | Rural Electrification and Water Services Sustainability Mechanism | Stephan Garnier |
| Madagascar | Madagascar: Support for the Development of Small Hydropower Independent Power Producer | Vonjy Rakotondramanana Isabel Neto |
| Mali | Support to Energy Services Access | Manuel Berlingiero |
| Somalia | Somalia Power Sector Development Master Plan | Anders Cajus Pedersen |

TABLE A4.1 *Continued*

| ESMAP Completed, New, and Ongoing Activities, FY2015 | | |
|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|------------------------------|
| CLEAN ENERGY | | |
| Brazil | Interface between Carbon and Energy Pricing Policy | Christophe de Gouvello |
| Chile | Technical Assistance for Sustainable Geothermal Development in Chile | Migara Jayawardena |
| Ethiopia | Renewable Energy Resource Mapping and Geospatial Planning: Ethiopia | Issa Diaw |
| Malawi | Renewable Energy Resource Mapping and Geospatial Planning: Malawi | Maria Isabel A. S. Neto |
| Nepal | Renewable Energy Resource Mapping: Nepal | Tomoyuki Yamashita |
| Philippines | Philippines Power Sector Strategy: Variable Renewable Energy Distribution Grid Code | Alan F. Townsend |
| ENERGY ACCESS | | |
| Global | Sustainable Energy for All Global Tracking Framework 2015 | Gabriela Elizondo Azuela |
| Global | Global Rollout of Readiness for Investment in Sustainable Energy (RISE) | Gevorg Sargsyan |
| Global | Global Facility for Promotion of Green Mini Grids | Venkata Ramana Putti |
| India | State-Level Dissemination of India Power Sector Review | Mohua Mukherjee |
| South Asia | Strategic Communication for Improving Governance and Efficiency in the Power Sector | Ashish Khanna |
| ENERGY EFFICIENCY | | |
| Bangladesh | Open Accessibility Planning for Integrated and Inclusive Transport in Dhaka | Ke Fang |
| Belarus | Scaling Up Energy Efficiency in the Building Sector | Feng Liu |
| China | Wuhan Integrated Transport Development Project: Learning from Best International Practice in Smart Transport and Energy Efficiency | Arturo Ardila Gomez |
| China | Developing an Innovative Energy Efficiency Financing Mechanism in China | Xiaodong Wang |
| East Asia and Pacific | Inclusive Green Growth for East Asia and Pacific Region Cities | Judy L. Baker |
| Europe and Central Asia | Knowledge Sharing and Energy Efficiency Outreach | Kathrin Hofer |
| Global | EDGE Green Building Market Transformation Program | Prashant Kapoor |
| Global | Data Analytics for Intelligent Energy Systems | Karin Anna Maria Lerner |
| Global | Capacity Building | Martina Bosi |
| Kyrgyz Republic | Efficiency Improvements of the District Heating System in the Kyrgyz Republic | Kathrin Hofer |
| Kyrgyz Republic | Urban Development Project | Kremena M. Ionkova |
| LCR | Brazil Energy Efficient Cities Program | Christophe de Gouvello |
| Mexico | Mexico Municipal Energy Efficiency Project | Janina Andrea Franco Salazar |
| Mexico | Supporting a Low Carbon Economy | Karen Bazex |
| Nicaragua | ENACAL Master Plan for Operational Efficiency in Managua, Nicaragua | Lilian Pena Pereira Weiss |
| Ukraine | Sustainable Urban Transport for the City of Kyiv | Jung Eun Oh |
| Uzbekistan | Scaling Up Energy Efficiency in Buildings in Uzbekistan | Feng Liu |
| ENERGY ASSESSMENTS AND STRATEGIES | | |
| AFR | Cost Review of Transmission Development in Africa | Atsumasa Sakai |
| AFR | Regional Study on the Performance of distribution Utilities in Sub-Saharan Africa | Pedro Antmann |

TABLE A4.1 *Continued*

| ESMAP Completed, New, and Ongoing Activities, FY2015 | | |
|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| AFR | Uganda-DRC 220kV Interconnector | Mbuso Gwafila |
| Armenia | Financial Recovery of the Power Sector | Artur Kochnakyan |
| Bangladesh | Analysis of Economy-wide Impact of Energy Sector Reforms in Bangladesh | Sheoli Pargal |
| Belize | Energy Resilience for Climate Adapt | Migara Jayawardena |
| Burkina Faso | Energy Mix Diversification in Burkina Faso | Jan Friedrich Kappen |
| Central America | Energy Subsidy Reform in Central America | Marco Antonio Hernandez Ore |
| China | Fossil Fuel Subsidy Study | Yanqin Song |
| China | Urumqi District Heating Pricing Technical Assistance | Gailius J. Draugelis |
| ECA | Directions for the Energy Sector in the Western Balkans | Claudia Ines Vasquez Suarez |
| Egypt | Phase II of Subsidy Reforms Technical Assistance from the Energy Subsidy Reform and Delivery Technical Assistance Facility | Sudeshna Ghosh Banerjee |
| Georgia | Georgia Power Sector Strategy | Joseph Melitauri |
| Global | World Bank Staff Training on Variable Renewable Energy Integration as Part of the Power System Planning Program | Rhonda Lenai Jordan |
| Global | Thirsty Energy: The Case of China | Diego Juan Rodriguez |
| Iraq | Iraq Best Practice: Public Investment in Power Infrastructure | Simon J. Stolp |
| Latin America | Energizing Agriculture: Enhancing Efficiency in Agriculture in Latin America and Caribbean Region | Katie Kennedy Freeman |
| Moldova | District Heating and Electricity Tariff and Affordability Analysis | Shinya Nishimura |
| Nigeria | Unlocking Nigeria's Potential for Gas | Masami Kojima |
| Seychelles | Improving Electricity Planning | Maria Isabel A. S. Neto |
| Tunisia | Strategic Development of Energy Sector in Tunisia, Phase II | Fanny Kathinka Missfeldt-Ringius |
| Tunisia | Tunisia-Italy Electricity Transmission Interconnection Project | Sameh I. Mobarek |
| Turkey | Social Compact in Electricity Privatization in Southeastern Turkey | Zeynep Durnev Darendeliler |
| Ukraine | Moving Forward Energy Tariffs Reforms | Yadviga Viktorivna Semikolenova |
| Vietnam | Equitization and Divestiture Strategy for the Vietnam Electricity's Generation Companies | Joel J. Maweni |
| ONGOING ACTIVITIES | | |
| Country/Region | Activity | Task Manager |
| AFRICA RENEWABLE ENERGY ACCESS PROGRAM (AFREA) | | |
| AFR | Gender and Energy Program | Awa Seck |
| AFR | Africa Clean Cooking Energy Solutions (ACCES) | Jan Friedrich Kappen |
| AFR | Africa Electrification Initiative II | Jenny Maria Hasselsten |
| AFR | Africa Region Solar Strategy | Daniel J. Murphy |
| AFR | Increased Electricity Access Support: On-Grid Access Team | David Vilar Ferrenbach |
| AFR | New Models to Scale Up Power Generation Investments in Africa | Elvira Morella Pedro Antmann |
| AFR | Power and Agriculture in Africa | Sudeshna Ghosh Banerjee Kabir Malik |

TABLE A4.1 *Continued*

| ESMAP Completed, New, and Ongoing Activities, FY2015 | | |
|-------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------|
| AFR | Role of Subsidies: Financing Electricity Supply and Providing Affordable Access in Sub-Saharan Africa | Christopher Philip Trimble |
| AFR | Lighting Africa Expansion | Daniel J. Murphy |
| Mali | AFREA II: Support to Energy Services Access | Manuel Berlengiero |
| Niger | Electricity Access Expansion Program | Clemencia Torres De Mastle |
| South Sudan | Energy Sector Technical Assistance Project | Rahul Kitchlu |
| CLEAN ENERGY | | |
| Djibouti | Geothermal Power Generation Project | Roger Coma Cunill |
| Global | Assessing Climate Risks of Electricity Systems | Xiaoping Wang |
| Global | Clean Energy Staff Training and Knowledge Platform | Almudena Mateos Merino |
| Global | Energy Sector Low Carbon Development Operational Support | Pierre Audinet |
| Global | Geothermal Scale-up Investment Plan | Pierre Audinet |
| Global | Renewable Energy Resource Mapping | Oliver Knight |
| Global | Smart Grids Knowledge Exchange Platform | Peter Johansen |
| Indonesia | Renewable Energy Resource Mapping and Geospatial Planning: Indonesia | Dhruva Sahai |
| LCR | Assessment of Geothermal Potential in Latin America & Caribbean Region | Migara Jayawardena |
| Lebanon | Renewable Energy Resource Mapping: Lebanon | Daniel Camos Daurella |
| Lesotho | Renewable Energy Resource Mapping Initiative: Lesotho (IFC) | Daniel Croft |
| Madagascar | Renewable Energy Resource Mapping and Geospatial Planning: Madagascar | Vonjy Miarintsoa Rakotondramanana |
| Maldives | Renewable Energy Resource Mapping and Geospatial Planning: Maldives | Abdulaziz Faghi |
| Pakistan | Renewable Energy Resource Mapping and Geospatial Planning: Pakistan | Anjum Ahmad |
| Papua New Guinea | Renewable Energy Resource Mapping and Geospatial Planning: Papua New Guinea | Gerard Fae |
| SAR | Low Water Growth and Water Efficiency in South Asia | Chandra Shekhar Sinha |
| Tanzania | Renewable Energy Resource Mapping and Geospatial Planning: Tanzania | Anders Cajus Pedersen |
| Vietnam | Renewable Energy Resource Mapping and Geospatial Planning: Vietnam | Ky Hong Tran |
| Zambia | Renewable Energy Resource Mapping Initiative: Zambia | Abdolreza B. Rezaian |
| ENERGY ACCESS | | |
| AFR | Enhancing Regional Power Trade in Africa | Erik Magnus Fernstrom |
| Burundi | SE4All Technical Assistance for Burundi | Kyran O'Sullivan |
| Central America | Central America Clean Cooking Initiative (CACCI) | Koffi Ekouevi |
| Global | State of Access Report | Koffi Ekouevi |
| Global | Energy Access for the Peri-urban/Urban Poor | Alain Ouedraogo |
| Guinea | SE4All Technical Assistance for Guinea | Moez Cherif |
| LCR | Deploying New Solar Technologies for Isolated Rural Areas: Supporting their Adoption in Latin America & Caribbean Region | Lucia Spinelli |

TABLE A4.1 *Continued*

| ESMAP Completed, New, and Ongoing Activities, FY2015 | | |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------|---------------------------------|
| Liberia | SE4All Technical Assistance for Liberia | Clemencia Torres De Mastle |
| Mozambique | SE4All Technical Assistance for Mozambique | Mustafa Zakir Hussain |
| Nepal | Developing Improved Solutions for Cooking | Sandeep Kohli |
| Nigeria | SE4All Technical Assistance for Nigeria | Erik Fernstrom Rahul Kitchlu |
| Papua New Guinea | Support the Development of an Electrification Roll-out Plan | Roberto Gabriel Aiello |
| Senegal | SE4All Technical Assistance for Senegal | Awa Seck |
| GENDER AND SOCIAL INCLUSION | | |
| Global | Gender and Large Energy Infrastructure | Maria Beatriz Orlando |
| Global | Gender Equality and Development e-Course | Adyline Waafas Ofosu-Amaah |
| ENERGY EFFICIENCY | | |
| China | Developing Low Carbon Strategy for Shenzhen | Xiaodong Wang |
| ECA | Wholesaling Energy Efficiency in Water Utilities in the Danube Region | David Michaud |
| Global | CEETI: Low Carbon Growth for Cities through Energy Efficiency | Ivan Jaques |
| Global | Tool for Rapid Assessment of City Energy (Deployment & Dissemination) | Pedzi Makumbe |
| India | Efficient and Sustainable City Bus Services: Capacity Building Program in Fuel Efficiency | Nupur Gupta |
| LCR | Achieving Energy Efficient Urban Transport in Cities in Latin America | Shomik Raj Mehndiratta |
| LCR | Energy Efficiency in Water and Wastewater Utilities in Latin America & Caribbean Region | Carmen Rosa Yee-Batista |
| LCR | Latin America & Caribbean Region Urban Energy Efficiency | Todd M. Johnson |
| Macedonia former Yugoslav Republic | Macedonia Municipal Energy Efficiency Promotion | Jasneet Singh |
| SAR | Scaling Up Energy Efficiency and Demand-Side Management Business Line in South Asia | Ashok Sarkar |
| Ukraine | Energy Efficiency Transformation in Cities | Tamar Sulukhia |
| West Bank & Gaza | Energy Efficiency Action Plan | Roger Coma Cunill |
| ENERGY ASSESSMENTS AND STRATEGIES | | |
| China | Promotion of Power Sector Reform to Unlock Renewable Energy Development | Xiaodong Wang |
| ECA | Europe & Central Asia Energy Subsidy Core Group | Ani Balabanyan |
| Egypt | Egypt Gas Regulator Capacity Building | Husam Mohamed Beides |
| Global | Economic Tradeoffs of the Water and Energy Nexus | Diego Juan Rodriguez |
| Global | Energy Subsidy Reform and Delivery: Safeguarding the Poor and Vulnerable | Sameer Shukla |
| Global | Model for Electricity Technology Assessment (Deployment Phase) | Bipulendu Narayan Singh |
| Haiti | Distributional Analyses and Reform Options for Petroleum Price Reforms | Raju Singh |

TABLE A4.1 *Continued*

| ESMAP Completed, New, and Ongoing Activities, FY2015 | | |
|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|------------------------|
| Indonesia | Local Benefit Sharing for Hydropower Projects in Indonesia | Anh Nguyet Pham |
| Kazakhstan | Power Market Structure Options for Kazakhstan | Mirlan Aldayarov |
| Kyrgyz Republic | Tariff Setting Methodology | Ani Balabanyan |
| LCR | Best Practices for Sustainable Hydropower Development | Ernesto Sanchez-Triana |
| LCR | Pricing Policies in the Energy Sector | Koffi Ekouevi |
| MNA | Benchmarking Electricity Utilities performance in the MNA Region | Daniel Camos Daurella |
| Turkey | Energy Reform Milestones and Challenges | Kari J. Nyman |
| RESULTS-BASED FINANCING | | |
| Indonesia | Support to the Design of an RBF Mechanism for the Implementation of the Indonesia Clean Stove Initiative | Yabei Zhang |
| Lao People's Democratic Republic | Background Analysis and Design of Health Impact Results-Based Financing Mechanism for Clean Stoves Initiative | Rutu Dave |

TABLE A4.2

| SIDS DOCK Completed, New, and Ongoing Activities, FY2015 | | |
|-----------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------|
| COMPLETED ACTIVITIES | | |
| Country/Region | Activity | Task Manager |
| Seychelles | Determination of the Grid Absorption Capacity of the Public Utilities Corporation Grid Code, Feed-in Tariffs for Renewable Energy | Silvia Martinez Romero |
| Mauritius | Preparation of a Grid Code, Feed-in-Tariffs & Model Energy Supply Purchase Agreements for Renewable Energy Systems Greater than 50kW | Silvia Martinez Romero |
| Sao Tome and Principe | Power Sector Efficiency Improvement | Silvia Martinez Romero |
| NEW ACTIVITIES | | |
| St. Lucia | Geothermal Resource Development in Saint Lucia | Migara Jayawardena |
| Tuvalu | Energy Sector Development Project | Roberto Gabriel Aiello |
| ONGOING ACTIVITIES | | |
| Dominica | Geothermal Development in Dominica | Migara Jayawardena |
| LCR | Eastern Caribbean Energy Regulation Authority | Mark Stephen Lambrides |
| Vanuatu | Vanuatu Energy Sector Development Project | Kamleshwar Prasad Khelawan |

TABLE A4.3

ASTAE Completed, New, and Ongoing Activities, FY2015

| COMPLETED ACTIVITIES | | |
|-----------------------------|--------------------------------------------------------------------------------------------------------|----------------------------------------------|
| Country/Region | Activity | Task Manager |
| ENERGY ACCESS | | |
| EAP | East Asia & Pacific Region Clean Stoves Initiative Forum | Yabei Zhang |
| India | Access to Electricity Solutions in South Asia | Sheoli Pargal |
| Indonesia | Integration of Social Dimension in Energy Access Projects | Helene Monika Carlsson Rex |
| Vietnam | Strategic Options for Enhanced Financial Performance of Vietnam's Electricity Companies | Joel J. Maweni |
| ENERGY EFFICIENCY | | |
| Bangladesh | Showcasing Results in World Bank Supported Intervention in Bangladesh Rural Electrification | Zubair K.M. Sadeque |
| EAP | Greenhouse Gas Emission Mitigation in Road Transport: Toolkit Implementation and Life-Cycle Analysis | Fei Deng, Holly Krambeck |
| EAP | Renewable Energy Training for South Asia Officials | Laurent Durix |
| Indonesia | Large Enterprises Energy Efficiency Project | Dhruva Sahai |
| Indonesia | Building Innovation Capacity in Clean Energy in Indonesia | Dandan Chen, Jean-Louis Racine, Ratna Kesuma |
| Indonesia | Geothermal Power Development Program II | Migara Jayawardena, Peter Johansen |
| Mongolia | Enhance Awareness of Effort at Electrification of Rural Herders through Solar Home Systems in Mongolia | Migara Jayawardena, Peter Johansen |
| Mongolia | Evaluation of Social Impacts of Mongolia Renewable Energy and Rural Electricity Access Project | Peter Johansen |
| Nepal | Photovoltaic Technology Workshop in Kathmandu | Jie Tang |
| Nepal | Scaling up Decentralized Energy Access in Nepal | Priti Kumar |
| Pakistan | Natural Gas Loss Reduction | Bjorn Hamso |
| Philippines | Philippines Electricity Cooperatives Capacity Strengthening | Alan F. Townsend |
| Philippines | Electric Cooperatives Reform and Restructuring, Phase II | Alan F. Townsend |
| Regional | EAP-SAR Renewable Energy and Energy Efficiency South-South Knowledge Exchange | Dejan R. Ostojic |
| RENEWABLE ENERGY | | |
| Vietnam | Cumulative Impact Assessment on Small Hydropower Projects on River Cascades | Franz Gerner |
| Vietnam | Capacity Building Support to Vietnam Pumped Storage Power Program | Franz Gerner |
| NEW ACTIVITIES | | |
| ENERGY ACCESS | | |
| EAP | EAP Gender and Energy Facility | Helene Monika Carlsson Rex |
| India | Clean Cooking in South Asia (India): Options and Strategies | Chandra Shekhar Sinha, Jie Li |
| Myanmar | Strengthening Institutions for On- and Off-grid Electrification in Myanmar | Dejan R. Ostojic, Xiaoping Wang |
| RENEWABLE ENERGY | | |
| EAP | Implementation Support for the Pacific Energy Program | Roberto Gabriel Aiello |
| India | Program for Grid Based Solar Sector | Ashish Khanna; Surbhi Goyal |
| Maldives | Renewable Energy Resource Mapping and Geospatial Planning: Maldives | Abdulaziz Faghi |
| Papua New Guinea | Renewable Energy Resource Mapping and Geospatial Planning: Papua New Guinea | Gerard Fae |

TABLE A4.3 *Continued*

| ASTAE Completed, New, and Ongoing Activities, FY2015 | | |
|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Philippines | Capacity Strengthening of the National Electrification Administration, Department of Energy and the Energy Regulatory Commission in the Philippines | Alan F. Townsend |
| Vietnam | Pumped Storage Hydropower Development Strategy | Franz Gerner |
| ONGOING ACTIVITIES | | |
| ENERGY ACCESS | | |
| EAP | Using Satellite Imagery to Monitor Progress of Rural Electrification | Kwawu Mensan Gaba |
| Indonesia | Clean Stove Initiative, Support to the Emergence of Scalable Biomass Stoves Markets | Yabei Zhang |
| Indonesia | Indonesia Clean Stove Initiative: Piloting Biomass Cookstove Markets (RBF Component) | Yabei Zhang |
| Indonesia | Indonesia Clean Stove Initiative: Piloting Biomass Cookstove Markets (MEMR Component) | Yabei Zhang |
| Lao PDR | Clean Stove Initiative, Phase 2 (Bank-executed part) | Rutu Dave |
| 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 Gabriel Aiello |
| SAR | Development of Private Sector Models for Off-Grid Electrification in South Asia | Sandeep Kohli |
| ENERGY EFFICIENCY | | |
| SAR | Mitigation Options for Short-Lived Climate Pollutants in South Asia | Chandra Shekhar Sinha |
| Vietnam | Sustainable Urban Energy and Emissions Planning (SUEEP), Phase 3: Energizing Green Growth of Da Nang City in Vietnam | Dejan R. Ostojic |
| Vietnam | Renewable Energy Integration and System Efficiency and Reliability Enhancement | Peter Johansen |
| RENEWABLE ENERGY | | |
| EAP | Fundamentals of an Energy Roadmap in Small Island Developing States: Experiences from the Pacific | Roberto Gabriel Aiello |
| EAP | Renewable Energy and Energy Efficiency Knowledge Exchange for Pacific Island Countries | Roberto Gabriel Aiello |
| India | PREPARE for energy access in UP and Bihar | Ashish Khanna, Mani Khurana |
| Indonesia | Renewable Energy Access Improvement | Dhruva Sahai |
| Indonesia | Support for Preparation of Indonesia Hydropower Project | Anh Nguyet Pham |
| Indonesia | Support to Integrated Catchment Program for Upper Cisokan Pumped Storage Project | Peter Johansen |
| Lao PDR | Strategic Advisory for the Lao Power Sector Reform | Franz Gerner |
| Maldives | Clean Energy Development and Regulatory Support | Sandeep Kohli |
| Nepal | Support to Sustainable Hydropower Development in Nepal | Pravin Karki |
| Pakistan | Strategy to Scale-up Renewable Energy: Pakistan | Mohammad Saqib, Oliver Knight |
| Philippines | Philippines Renewable Energy Policy Implementation Support | Alan F. Townsend |
| SAR | Household Energy in South Asia Region | Zubair K.M. Sadeque |
| SAR | Impacts of Climate Change on Water | Pravin Karki |
| SAR | Solar Market Development for Off-grid Access in Pakistan and Afghanistan | Mohua Mukherjee |
| Solomon Islands | Tina River Hydropower Development Project: Benefit Sharing and Technical Quality Assurance | Joel J. Maweni |
| Tonga | Implementation Support for the Tonga TERM-IU | Roberto Gabriel Aiello |
| Tonga | Tonga Energy Roadmap Implementation Project | Roberto Gabriel Aiello |
| Tuvalu | Preparation and Early Implementation Support for the Tuvalu Energy Sector Development Project | Roberto Gabriel Aiello |

ANNEX V | PUBLICATIONS, FY2015

TABLE A5.1

ESMAP Publications, FY2015

| ISBN, PUB. NO., OR Project ID | COUNTRY/ REGION | TITLE | AUTHOR/TTL |
|---------------------------------------------------|-----------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| P146621 | AFR | Clean and Improved Cooking in Sub-Saharan Africa: A Landscape Report | Srilata Kammila, Jan Friedrich Kappen, Dana Rysankova, Besnik Hyseni, Venkata Ramana Putti |
| | AFR | Energizing Africa: Achievements and Lessons from the Africa Renewable Energy and Access Program, Phase I | AFREA |
| WB Directions in Development 978-1-4648-0093-1 | AFR | From the Bottom Up : How Small Power Producers and Mini-Grids Can Deliver Electrification and Renewable Energy in Africa (French) | Bernard Tenenbaum, Chris Greacen, Tilak Siyambalapatiya, James Knuckles |
| WB Directions in Development 978-1-4648-0486-1 | AFR | Le potentiel transformateur de l'industrie minière : une opportunité pour l'électrification de l'Afrique subsaharienne | Sudeshna Ghosh Banerjee, Zayra Romo, Gary McMahon, Perrine Toledano, Peter Robinson, Ines Perez Arroyo |
| P146627 | AFR | Political Economy of Power Sector Subsidies : A Review with Reference to Sub-Saharan Africa | Masami Kojima, Robert Bacon, Chris Trimble |
| WB Directions in Development 978-1-4648-0292-8 | AFR | The Power of the Mine: A Transformative Opportunity for Sub-Saharan Africa | Sudeshna Ghosh Banerjee, Zayra Romo, Gary McMahon, Perrine Toledano, Peter Robinson, Ines Perez Arroyo |
| Live Wire (2014/33) | AFR | Tracking Progress Toward Sustainable Energy for All in Sub-Saharan Africa | Elisa Portale, Joeri de Wit |
| WB Policy Research Working Paper (No. 7385) | Belarus | Distributional Impacts of Energy Cross-Subsidization in Transition Economies: Evidence from Belarus | Corbett Alden Grainger, Fan Zhang, Andrew William Schreiber |
| | EAP | Proceedings of the China-ASEAN Energy Efficiency Knowledge Exchange Workshop | Xiaodong Wang, Dafei Wang, Nejteh Demirian |
| Live Wire (2014/28) | EAP | Tracking Progress Toward Providing Sustainable Energy for All in East Asia and the Pacific | Elisa Portale, Joeri de Wit |
| Live Wire (2014/29) | ECA | Tracking Progress Toward Providing Sustainable Energy for All in Eastern Europe and Central Asia | Elisa Portale, Joeri de Wit |
| P113684 MENA Energy Series (No. 95144-EG) | Egypt | Local Manufacturing Potential for Solar Technology Components in Egypt | Fanny Kathinka Missfeldt-Ringius |
| MENA Energy Series | Egypt | Transparency and Social Accountability in the Egyptian Power Sector | Fowzia Hassan, Evangelos Penglis, George N. Seferiadis, Marjorie K. Araya |

TABLE A5.1 *Continued*

ESMAP Publications, FY2015

| | | | |
|--------------------------------------------|--------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| WB Policy Research Working Paper 7330 | Global | A Quarter Century Effort Yet to Come of Age: A Survey of Power Sector Reforms in Developing Countries | Tooraj Jamasb, Rabindra Nepal, Govinda R. Timilsina |
| P148200 | Global | Beyond Connections: Energy Access Redefined (Executive Summary) | Mikul Bhatia, Nicolina Angelou |
| P127169 ESMAP Technical Report (006/15) | Global | Bringing Variable Renewable Energy Up to Scale | Silvia Martinez Romero, Wendy Hughes |
| P148200 | Global | Capturing the Multi-Dimensionality of Energy Access | Mikul Bhatia, Nicolina Angelou |
| P152448 ESMAP Knowledge Series (021/14) | Global | City Energy Assessments: Mayoral Guidance Note #5 | Feng Liu, Stephen Hammer |
| Live Wire (2014/25) | Global | Doubling the Rate of Improvement of Energy Efficiency | Jonathan Sinton, Ashok Sarkar, Ivan Jaques, Irina Bushueva |
| | Global | ESMAP-ASTAE 2014 Annual Report | Nick Keyes |
| P152448 ESMAP Knowledge Series (018/14) | Global | Financing Municipal Energy Efficiency Projects: Mayoral Guidance Note #2 | Dilip Limaye, William Derbyshire |
| P132394 | Global | Formulating an Urban Transport Policy: Choosing between Options | O.P. Agarwal, Gouthami Padam, Cholpon Ibraimova |
| P152448 ESMAP Knowledge Series (019/14) | Global | Improving Energy Efficiency in Buildings: Mayoral Guidance Note #3 | Feng Liu |
| P152448 ESMAP Knowledge Series (022/14) | Global | Planning Energy Efficient and Livable Cities Mayoral Guidance Note #6 | Serge Salat, Mansha Chen, Feng Liu |
| P127938 WB Study 978-1-4648-0410-6 | Global | Practical Guidance for Defining a Smart Grid Modernization Strategy : The Case of Distribution | Marcelino Madrigal, Robert Uluski |
| P146042 ESMAP Knowledge Series (023/15) | Global | Private Sector Participation in Electricity Transmission and Distribution : Experiences from Brazil, Peru, the Philippines, and Turkey | Victor Loksha |
| P151123 | Global | Progress Toward Sustainable Energy 2015 : Global Tracking Framework Report | Bruce Ross-Larson, Joe Caponio, Christopher Trott, Elaine Wilson, |
| P145624 | Global | Readiness For Investment In Sustainable Energy (RISE): A Tool For Policy Makers | Gevorg Sargsyan |
| P127532 ESMAP Technical Report (005/15) | Global | Results Based Aid in the Energy Sector: An Analytical Guide | Oliver Knight |
| P127219 ESMAP Technical Report (007/15) | Global | The State Of The Global Clean And Improved Cooking Sector | Venkata Ramana Putti, Michael Tsan, Sumi Mehta, Srilata Kammila |

TABLE A5.1 *Continued*

| ESMAP Publications, FY2015 | | | |
|---------------------------------------------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
| P152448 ESMAP Knowledge Series (020/14) | Global | Toward Sustainable and Energy Efficient Urban Transport: Mayoral Guidance Note #4 | Om Prakash Agarwal |
| P132394 | Global | Urban Transport Data Analysis Tool (UT-DAT): User's Manual | O.P. Agarwal, Gouthami Padam, Aroha Bahuguna, Salvador Pena |
| WB Study 978-1-4648-0392-5 | India | Beyond Crisis : The Financial Performance of India's Power Sector | Mani Khurana, Sudeshna Ghosh Banerjee |
| | India | Direct Delivery of Power Subsidy to Agriculture in India | Mohinder Gulati, Sanjay Pahuja |
| WB Directions in Development 978-1-4648-0303-1 | India | Governance of Indian State Power Utilities : An Ongoing Journey | Sheoli Pargal, Kristy Mayer |
| P145887 | India | More Power to India : The Challenge of Distribution: India Power Sector Diagnostic Review (Summary) | Sheoli Pargal, Sudeshna Ghosh Banerjee |
| WB Directions in Development 978-1-4648-0339-0 | India | Private Participation in the Indian Power Sector : Lessons from Two Decades of Experience | Mohua Mukherjee |
| Live Wire (2014/30) | LCR | Tracking Progress Toward Sustainable Energy for All in Latin America and the Caribbean | Elisa Portale, Joeri de Wit |
| Live Wire (2014/31) | MNA | Tracking Progress Toward Sustainable Energy for All in the Middle East and North Africa | Elisa Portale, Joeri de Wit |
| P132320 | Papua New Guinea | Papua New Guinea – National Electrification Roll-Out Plan: Proceedings Of The National Stakeholders' Consultation Workshop | Roberto Gabriel Aiello |
| P143029 | SAR | South Asia Energy Security and Energy Trade Study: The Benefits of Expanding Cross-Border Electricity Cooperation and Trade in South Asia | Michael Toman, Govinda Timilsina |
| Live Wire (2014/32) | SAR | Tracking Progress Toward Sustainable Energy for All in South Asia | Elisa Portale, Joeri de Wit |
| P149119 | Senegal | AFREA Gender and Energy Workshop Proceedings: Dakar, Senegal | Inka Schomer |
| P120629 Live Wire (2015/40) | Senegal | Improving Gender Equality and Rural Livelihoods in Senegal through Sustainable and Participatory Energy Management: Senegal's PROGEDE II Project | Alicia Hammond, Awa Seck, Inka Schomer, Alassane Ngom, Vanessa Lopes Janik |
| P133058 | Tajikistan | Keeping Warm : Urban Heating Options in Tajikistan, Summary Report | Ani Balabanyan, Kathrin Hofer, Johua Finn, Denzel J. Hankinson |
| P129821 MENA Energy Series | Tunisia | Une vision stratégique pour le secteur tunisien de l'énergie: Réflexion sur des thèmes prioritaires (French) | Fanny Kathinka Missfeldt-Ringius |

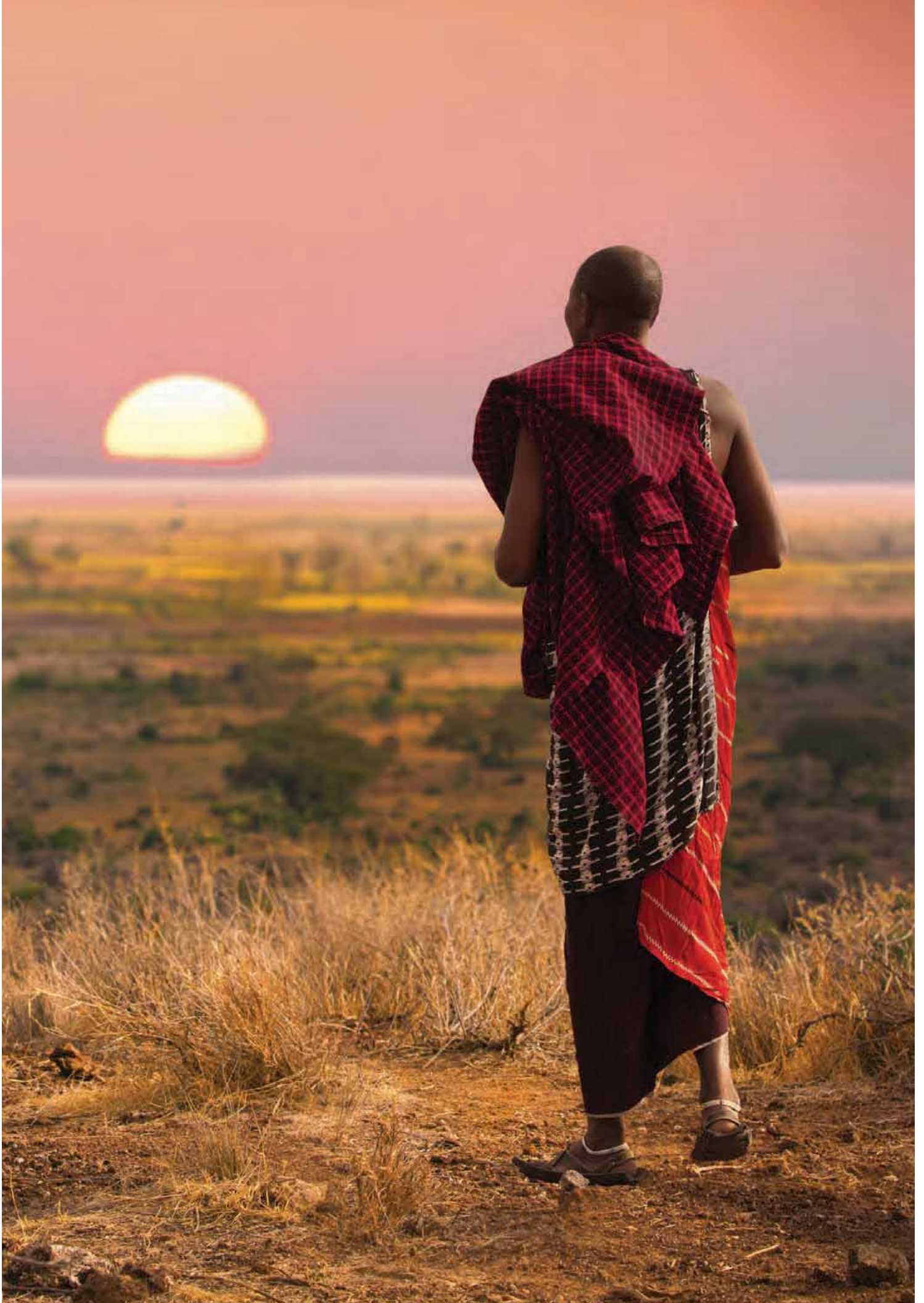
TABLE A5.1 *Continued*

| ESMAP Publications, FY2015 | | | |
|----------------------------|--------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| P146501 | Turkey | Republic of Turkey: Institutional Review of Energy Efficiency (English) | Yesim Akcollu, Onder Algedik, Dilip Limaye, Ayse Yasemin Orucu, Jasneet Singh |
| P146501 | Turkey | Türkiye Cumhuriyeti: Enerji verimliliği kurumsal incelemesi (Turkish) | Yesim Akcollu, Onder Algedik, Dilip Limaye, Ayse Yasemin Orucu, Jasneet Singh |

TABLE A5.2

| List of ASTAE Publication FY2015 | | | |
|-----------------------------------------------------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| ISBN, PUB. NO., OR Project ID | COUNTRY/ REGION | TITLE | AUTHOR/TTL |
| P145887 WB Directions in Development 978-7-4648-0233-1 | India | More Power to India: The Challenge of Electricity Distribution. Directions in Development* | Sheoli Pargal, Sudeshna Ghosh Banerjee |
| WB Study 978-1-4648-0341-3 | India | Power for All: Electricity Access Challenge in India* | Sudeshna Ghosh Banerjee, Douglas Barnes, Bipul Singh, Kristy Mayer, Hussain Samad |
| WB Study 978-1-4648-0412-0 | India | Elite Capture: Residential Tariff Subsidies in India* | Kristy Mayer, Sudeshna Ghosh Banerjee, and Chris Trimble |
| P129830 East Asia & Pacific Clean Stove Initiative Series | East Asia | Beijing, China: Clean Stove Initiative Forum Proceedings* | World Bank |
| P129829 EPA Clean Stove Initiative Knowledge Exchange Series | Indonesia | Social Marketing Plan for Indonesia Clean Stove Initiative Results-Based Financing Pilot program | World Bank |
| | Indonesia | Integrating a Gender Perspective in the Promotion and Assessment of Impacts of Clean Stoves: From the Lab to the Field and Back | Veronica Mendizabal Joffre |
| | Indonesia | Understanding User Needs in Developing Clean Stove Technologies: From the Lab to the Field and Back | Veronica Mendizabal Joffre |
| P144091 | Indonesia | East Asia and Pacific Integration of Social & Gender in Energy Projects in EAP: From the Lab to the Field and Back | Veronica Mendizabal Joffre |
| P144683 | Nepal | Nepal: Scaling Up Electricity Access through Mini And Micro Hydropower Applications | Priti Kumar, Tomoyuki Yamashita, Ajoy Karki, C. Rajshekar; Ashish Shrestha, Abhishek Yadav |
| | Pacific Islands | Pacific Renewable Energy & Energy Efficiency Proceedings Nuku'alofa, Tonga 9-11 September 2014. Policy Making Workshop* | World Bank |
| P129830 Live Wire (2015/46) | EAP | Results-Based Financing to Promote Clean Stoves: Initial Lessons from Pilots in China and Indonesia | Yabei Zhang, Norma Adams |

*ASTAE co-financed with ESMAP.



ACRONYMS

| | |
|--------|------------------------------------------------------------------|
| ACCES | Africa Clean Cooking Energy Solutions Initiative |
| ADB | Asian Development Bank |
| AECID | Agencia Española de Cooperación Internacional para el Desarrollo |
| AEI | African Electrification Initiative |
| AFD | Agence Française de Développement |
| AFREA | Africa Renewable Energy and Access Program |
| AGAT | Accelerating On-grid Access Team |
| ASEAN | Association of Southeast Asian Nations |
| ASTAE | Asia Sustainable and Alternative Energy Program |
| CEETI | City Energy Efficiency Transformation Initiative |
| CG | Consultative Group |
| CSI | Clean Stove Initiative |
| CTF | Clean Technology Fund |
| DFID | Department for International Development (United Kingdom) |
| DMU | Decision making under uncertainty |
| ENACAL | Empresa Nicaragüense de Acueductos y Alcantarillados |
| ESMAP | Energy Sector Management Assistance Program |
| FAO | Food and Agriculture Organization of the United Nations |
| GDP | Gross domestic product |
| GEF | Global Environment Facility |
| GGDP | Global Geothermal Development Plan |
| GIZ | Gesellschaft für Internationale Zusammenarbeit (Germany) |
| GPOBA | Global Partnership on Output-Based Aid |
| GTF | Global Tracking Framework (SE4ALL) |
| IBRD | International Bank for Reconstruction and Development |
| ICM | Integrated catchment management |
| ICT | Information and communication technology |
| IDA | International Development Association |
| IDB | Inter-American Development Bank |
| IEA | International Energy Agency |
| IFC | International Finance Corporation |
| IMF | International Monetary Fund |
| IPP | Independent power producers |
| IRENA | International Renewable Energy Agency |
| ITS | Intelligent transport systems |
| JICA | Japan International Cooperation Agency |
| KfW | German government-owned development bank |



| | | | |
|--------|----------------------------------------------------------------|-------|-------------------------------------------------------|
| LED | Light-emitting diodes | TRACE | Tool for Rapid Assessment of City Energy (ESMAP tool) |
| LIDAR | Light Detection and Ranging | UAHP | Upper Arun Hydropower Project |
| MDTF | Multi-donor trust fund | UN | United Nations |
| MEMR | Ministry of Energy and Mineral Resources (Indonesia) | UNDP | United Nations Development Programme |
| META | Model for Electricity Technology Assessment (ESMAP tool) | UNECE | United Nations Economic Commission for Europe |
| MHP | Micro-hydropower | USAID | United States Agency for International Development |
| MMC | Multi-modal centers | VRE | Variable renewable energy |
| MTF | Multi-tier Framework (SE4All) | WBG | World Bank Group |
| PLN | Perusahaan Listrik Negara (Indonesia's state electric company) | | |
| PPIAF | Public-Private Infrastructure Advisory Facility | | |
| PSP | Private sector participation | | |
| RBF | Results-based financing | | |
| RISE | Readiness for Investment in Sustainable Energy | | |
| RREA | Rural and Renewable Energy Agency (Liberia) | | |
| SE4ALL | Sustainable Energy for All | | |
| SIDA | Swedish International Development Cooperation Agency | | |
| SIDS | Small island developing states | | |
| TAG | Technical Advisory Group | | |

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

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