

1. Evaluation Context, Scope, and Approach

Access to electricity can enable economic growth, reduce poverty levels, and enhance human welfare. The World Bank Group has long acknowledged this and highlighted it with its decision to support the global Sustainable Energy for All (SE4All) initiative, launched in 2011.¹ Supporting this initiative is integral to achieving the Bank Group's twin goals of increasing shared prosperity and ending extreme poverty by 2030. The goal of SE4All is to achieve universal access to energy, including electricity, within the next 15 years. It also aims to improve energy efficiency and increase the use of renewable energy by 2030. The initiative is co-chaired by the UN secretary-general and the president of the World Bank.

This evaluation examines the Bank Group's support to its country clients for scaling up access to electricity during the 15-year period from fiscal year (FY)2000 through FY2014, aiming to inform its strategy to support access-deficit countries in a move toward universal access in the next 15 years. This assessment covers IBRD and IDA lending and nonlending assistance, IFC investments and advisory services, and MIGA guarantees.

Dimensions of the Access Challenge

About 1.1 billion people – one-sixth of the world's population and mostly poor – do not have access to electricity. Among those who have access, a comparable number receive electricity services that are below the standards of quantity and reliability expected of an efficiently performing sector. These shortcomings in electricity sector performance can seriously undermine a country's economic growth and prevent the realization of improvements in human welfare (figure 1.1; appendix B).

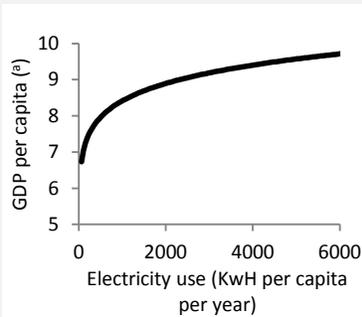
Inadequate electricity access can severely limit human development and quality of life. Directly or through its economic multiplier effects, electricity access can enable transformative progress in all dimensions of human development (education, health care, access to water, essential communications and information), and in access to financial services and opportunities for income generation. For example, education may improve since lighting improves school environments and enables studying at home. Positive health effects may result from better food storage and less indoor air pollution. Outside the home, electricity can facilitate sterilization, water purification and supply, sanitation, and refrigeration of essential medicines. Access to electricity

may also increase the willingness of the educated workforce (teachers and doctors, for example) to live in rural areas. Better access to information and less time spent on nonpaid work can bring positive gender impacts. More access to entertainment and information via television, radio, and mobile phones can also improve opportunities and quality of life (box 1.1).

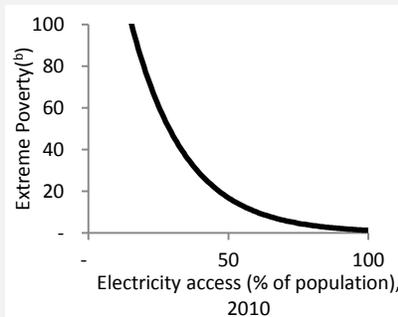
Inadequate electricity access can also have adverse effects on the productivity of manufacturing and commerce (IEG 2014e). Business costs increase because of the need to take preventive measures against power outages, such as self-provision of electricity. Costs are also incurred from outage-related damage, spoilage, and cleanup, startup after an outage, and lost or deferred sales and transactions (Foster and Steinbuks 2009).

Figure 1.1. Socioeconomic Indicators and Electricity

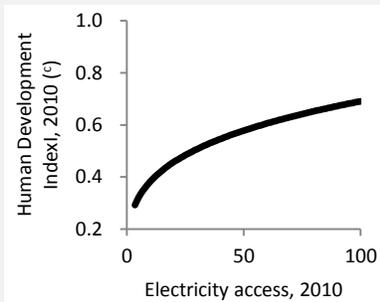
A. Income and Electricity Consumption



B. Poverty and Electricity Access



C. Human Development and Electricity Access



(a) GDP per capita, purchasing power parity (PPP; constant 2011 international).
 (b) Poverty headcount ratio at \$1.25 a day (PPP) (percent of population).
 (c) Human Development Index, 2010.
 Source: World Development Indicators; data related to 2010; United Nations 2012.

The three charts in figure 1.1 show correlations rather than causal relations among income, human development, and electricity access (positive correlations) and between poverty and electricity access (negative correlations). But substantial research has examined the causal links between electricity access and economic growth. Literature reviews (Bayar and Özel 2014; Ozturk 2010) reported that a majority of the studies found unidirectional causality between electricity consumption and economic growth, but some studies found bidirectional causality (Calderon and Servén 2014). Where causality was unidirectional, studies in some countries found it unidirectional from electricity consumption to economic growth, but the reverse in others (Gurgul and Lach 2011; Bildirici and Kayıkçı 2012; Hu and Lin 2013; Ogundipe and Apata 2013; Nazlioglu, Kayhan, and Adiguzel 2014). The

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Independent Evaluation Group (IEG) has conducted a systematic review of the evidence on the welfare impacts of electricity access on beneficiaries. The findings, summarized in box 1.1 and detailed in appendix J, provide some evidence on welfare impacts.

Box 1.1. Systematic Review of Welfare Impacts from Electricity Access—Findings

Systematic reviews are used to answer a specific research question by identifying and screening relevant impact evaluations and synthesizing the quantitative and qualitative evidence from them to inform policy and practice.

IEG, in collaboration with the EPPI-Center, is conducting a systematic review on the welfare impacts of electricity access on beneficiaries. Using a screening process, the review has narrowed the analysis to 32 impact evaluations, including five associated with World Bank projects in Bangladesh, Nepal, India, and Vietnam. Most of the studies (63 percent) were in middle-income countries (12 in lower-middle income and 7 in upper-middle income). The regions with the largest gaps in electricity access—Sub-Saharan Africa and South Asia—are represented well with 14 and 9 studies, respectively. 24 studies covered grid-based electricity connections and the remaining 8 covered off-grid provision of electricity comprising six cases of solar home systems (SHSs) and two with mini-hydro schemes. Majority (85 percent) of impact evaluations covered rural electrification.

The findings of the systematic review show that electricity access improves children's study time at home, school enrollment and has a positive impact on years of schooling. The review finds mixed evidence on fertility and women empowerment. Two studies show significant effect of electricity access on fertility reduction, while one study found no effect. Very few studies measured the impact of electricity access on health. However, one study found evidence that electricity access significantly reduces indoor pollution. Another study found the incidence of cough, respiratory problems, eye irritation, and headache lower in electrified households than in un-electrified households. The evidence base for the impact of electricity access on microenterprise profits is also thin. Regarding household income, electricity access is found to have a positive impact on total income as well as non-farm income. No overall impact on the number of hours worked was observed.

While these emerging findings add to the knowledge of links between electricity access and welfare outcomes, they also underline the need to increase the evidence base to better understand the extent and magnitude of these links.

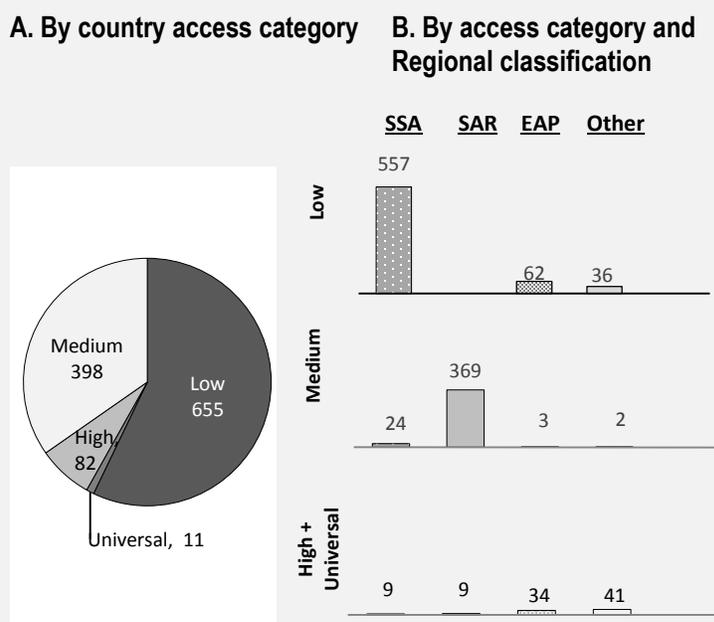
Although electricity access to households tends to be highlighted in developmental efforts, it should be noted that the household sector accounts for a relatively small portion (about 20 percent) of global and national electric power demand. Industry, business and commerce, government, health and education services, agriculture, and other economic activities account for the remaining 80 percent.² The technical

performance, financial viability, and reliability of the entire electricity delivery system (generation, transmission, and distribution) is anchored by the industrial sector, which continuously uses electricity and is capable of paying for it.

Electricity access is more than just a connection to a distribution network; it requires that electricity is provided adequately as demanded and in a reliable, affordable manner. The SE4All framework includes the attributes of adequacy, reliability, and affordability in its definition of electricity access (World Bank and IEA 2013). The provision of adequate and reliable electricity service on demand requires a balanced, planned expansion of generation capacity and transmission and distribution (T&D) for delivering electricity securely and efficiently, based on the location of generation plants and load centers, and coordinating with off-grid options where feasible. Policies and regulation are needed to achieve this, both to facilitate the large capital investments needed to bridge the access gap and to ensure that electricity services are financially viable and affordable for all, especially the poor. Therefore, this study assesses the range of support the World Bank Group (including IBRD, IDA, IFC, and MIGA) provides for the electricity sector that relates to electricity access, including physical infrastructure for generation and T&D, the enabling sector policy framework and policy dialogue, and technical assistance and advisory services.

Sub-Saharan Africa and South Asia have the largest populations without electricity access. Of the nearly 1.1 billion people without electricity access, 591 million are in Sub-Saharan Africa, 378 million are in South Asia, and 99 million are in East Asia, (figure 1.2).³ If all Bank Group country clients are categorized by their level of access (low, medium, high, and universal), the majority of low-access countries – 40 out of 51 – are in Sub-Saharan Africa (table 1.1).⁴ A complete list of the Bank Group’s country clients

Figure 1.2. Sub-Saharan Africa and South Asia Have the Largest Populations without Electricity Access (millions), 2010



Source: UN 2012.
Note: EAP = East Asia and the Pacific; SA = South Asia; SSA = Sub-Saharan Africa.

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with access level, category, and selected demographic and economic data is in appendix C.

Table 1.1. Bank Group Country Clients by Electricity Access Category (number of country clients)

Country access category (percent of population with electricity access)	Sub-Saharan Africa	East Asia and Pacific	Eastern Europe and Central Asia	Latin America and the Caribbean	Middle East and Northern Africa	South Asia	All
Low ($\leq 50\%$)	40	8	n.a.	1	2	n.a.	51
Medium (50–75%)	6	7	n.a.	2	n.a.	3	18
High (75–95%)	2	4	n.a.	19	3	2	30
Universal ($>95\%$)	1	5	32	12	9	1	60
Total	49	24	32	34	14	6	159

Source: UN 2012.

Note: Electricity access data are for 2010 (the latest year for which the most consistent data are available).

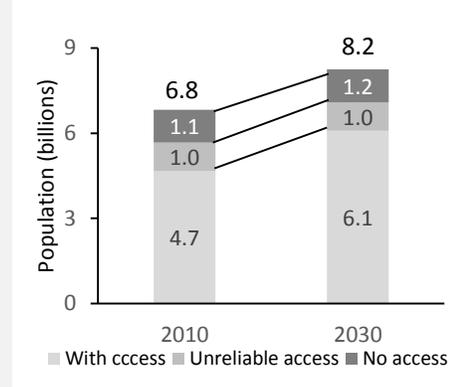
If the pace of new connections made during 2000–2010 continues for the next 15 years and population growth is taken into account, the number of people without access in low-access countries would rise by 40 percent by 2030 (box 1.2). There would still be 1.2 billion people without electricity by 2030, and another 1 billion are likely to be constrained by unreliable electricity supplies.

The access challenge set by SE4All is almost exclusively concentrated in Sub-Saharan Africa. East Asia is on track to nearly close its access gap by 2030. South Asia can largely eliminate its access deficit by then if it maintains the pace of new connections it implemented in recent years. By contrast, the challenge in Sub-Saharan Africa is daunting: Of the 40 low-access countries in the Region, seven have access less than 10 percent, and another 15 countries have access less than 25 percent. Unless there is a big break from recent trends, the population without electricity access in Sub-Saharan Africa is projected to increase by 58 percent (from 591 million to 935 million) during 2015–2030. Furthermore, five countries would still have access levels below 10 percent by 2030; and another 15 countries would have access levels under 25 percent. Overall, in Sub-Saharan Africa, 39 countries would still be in the low-access category. A serious implication of continuing the current pace of access is that yet another generation of children will be denied the benefits of modern service delivery facilitated by provision of electricity, including education, health, and connectivity. And more than 40 percent of Sub-Saharan Africa’s population is under 14 years old.⁵

Box 1.2. Electricity Access Projections for 2030 at Current Pace

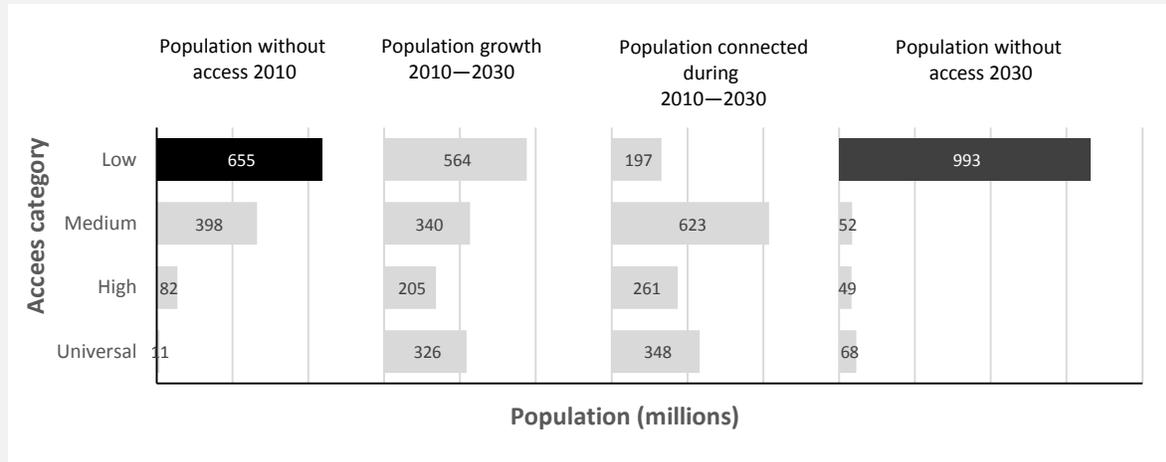
If new connections continue to be added at the average rate realized during 2000–2010, about 1.8 billion people worldwide will gain electricity connections by 2030. However, the increase in population during the period would still leave 1.2 billion people without electricity. Another 1 billion are likely to remain constrained by unreliable supply of electricity. Thus, by 2030, 2.2 billion people with no access at all or with unreliable access will be unable to share in the economic productivity and welfare improvements that can accrue from access to electricity (figure B1.2.1). Countries in the medium-, high-, and universal-access categories would likely have largely eliminated their access deficits by 2030. However, the number without access in low-access countries would rise by 50 percent, reflecting the present inability of the electrification rates in these countries – the large majority of which are in Sub-Saharan Africa – to keep pace with population growth (figure B1.2.2).

Figure B1.2.1. Electricity Access in Bank Group Country Clients at Current Pace



Sources: Electricity access: UN 2012; population: World Development Indicators and United Nations Development Programme (UNDP); IEG estimates.
Note: Assumes the average annual growth rate of connections during 2000–2010 continues to 2030.

Figure B1.2.2. Projected Electricity Access by Country Access Category at Current Pace



Source: Electricity access: UN 2012; population: World Development Indicators and UNDP; IEG estimates.
Note: Projections assume new connections are added at the average annual rate achieved during 2000–2010. Assumes five persons per connection/household.

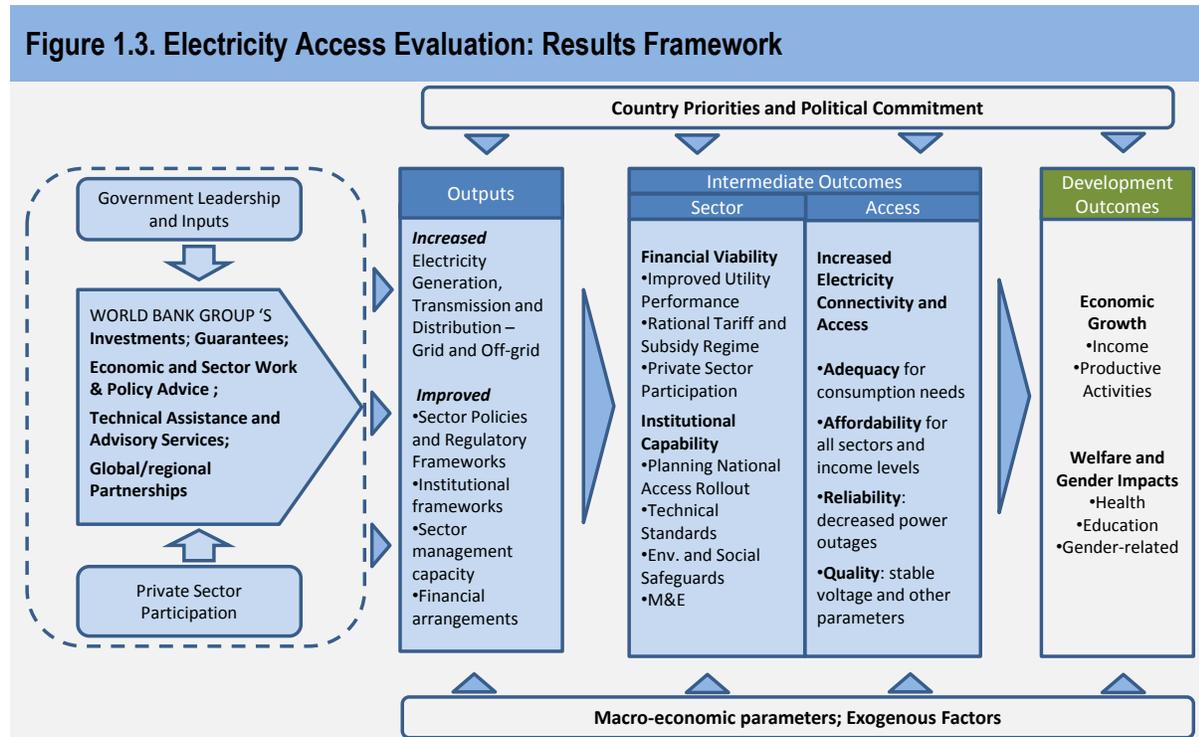
The World Bank Group's Evolving Strategy for Electricity Access

The Bank Group gradually sharpened its focus on electricity access, as seen in its approach to the electricity sector during the past few decades. In the 1970s and 1980s the Bank Group concentrated on investments in generation, transmission, and distribution in vertically integrated national electricity companies. Some of the key policy and guidance documents governing this period were the Operational Manual Statement OMS3.72 (World Bank 1978), power sector support strategy (World Bank 1983), and the corresponding operations directive (1987). In the 1990s the Bank Group financed a wave of rural electrification projects that carried into the 2000s, informed by lessons learned from the initial cohort of operations. The policy paper on power sector governed Bank Group support during the 1990s (World Bank 1993). Starting in the 2000s, the strategy focused on unbundling and privatization. In the latter part of the decade, those strategies emphasized electrification and increased support to national utilities for renewable energy and off-grid options as technologies improved and became less expensive. The Bank Group aimed to improve focus on the environmental concerns and impacts of the power sector covered in the report *Fuel for Thought: An Environmental Strategy for the Energy Sector* (World Bank 2000), which led to the policy guidelines in *Development and Climate Change: A Strategic Framework for the World Bank Group* (World Bank 2008). More recently, the Bank Group shifted again toward scaling up access nationwide by supporting the full range of electricity infrastructure. It began with sectorwide approaches using a comprehensive planning approach backed by geospatial planning and pooled resources for balanced access growth. In 2012 the Bank Group partnered with the SE4All global initiative. And in July 2013 the Bank Group outlined its future sector directions for energy access, energy efficiency, and renewable energy in the Board Report *Toward a Sustainable Energy Future for All: Directions for the World Bank Group's Energy Sector*, which contains actions and initiatives to improve electricity access (World Bank 2013f).

Evaluation Questions and Methodology

This evaluation considered the question: To what extent has the World Bank Group been effective in the past and, going forward, how well is it equipped to put its country clients on track to achieve universal access to electricity that is adequate, affordable, and of the required quality and reliability? The focus is on drawing upon the Bank Group's experience in the last 15 years to inform strategy as it prepares to face the access challenge.

The evaluation was guided by a results framework consisting of the logically linked inputs, outputs, intermediate outcomes, and development outcomes for electricity access, shown in figure 1.3. The results framework reflects the development objectives, components, and key performance indicators of lending, technical assistance, and advisory services implemented by the World Bank Group for the electricity sector, and the core development indicators adopted by the energy practice in the Bank Group.⁶



Source: IEG.

Note: Env. = environmental; M&E = monitoring and evaluation.

The results framework implicitly assumes that with the requisite government leadership and private sector participation, the Bank Group's support and interventions would lead to increased electricity generation, transmission, and distribution, and to improved sector frameworks (policies, regulations, and institutions), sector management capacity, and financial arrangements. These outputs are assumed to lead to intermediate outcomes through improved financial viability and institutional capacity in the sector, and increased connectivity and access for the population and businesses. Finally, the increased access that is financially and technically sustainable is expected to lead to development outcomes through improved economic growth, human development aspects, and welfare. To investigate the linkages in the theory of change implied by the results framework, this evaluation drew upon project data and knowledge products from the Bank

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Group, and macroeconomic, human development, and electricity sector data from World Development Indicators, the IEA, and other sources.

The evaluation assessed both quantitative and qualitative results for individual projects during FY2000–2014. The portfolio review covered all projects for the World Bank, IFC, and MIGA that were approved or closed/matured during FY2000–2014 as shown in table 1.2. Field-based Project Performance Assessment Reports (PPARs) were prepared for 10 projects in four countries. Detailed Country Electricity Sector Profiles were prepared for a sample of 35 countries covering nearly 60 percent of the Bank Group’s lending for the electricity sector, and more than 75 percent of the world’s population without electricity access. Key performance indicators for projects completed and reported in the 35 sample countries from FY2000–2014 were rated. More than 25 interviews were conducted with staff, task team leaders, and management of the Bank Group’s Global Practice for Energy and Extractives. The list of sample countries with selected data, list of PPARs, a detailed note on methodology, and the task team leaders templates are in appendixes C, D, E, and F, respectively.

Table 1.2. Bank Group Electricity Sector Projects Covered by the Evaluation, FY2000–2014

World Bank		IFC		MIGA	
Approved	Closed	Active	Closed	Active	Non-Active
278	255	275	148	36	36

Source: WB Business Intelligence; IFC and MIGA databases.

Note: IFC = International Finance Corporation; MIGA = Multilateral Investment Guarantee Agency.

The evaluation complements and builds on the findings from parallel, recent, and older IEG evaluations. It complements the earlier IEG reports *Power for Development: A Review of the World Bank Group’s Experience with Private Participation in the Electricity Sector* (IEG 2003) and *New Renewable Energy: A Review of the World Bank’s Assistance* (IEG 2006), and it adds to the relevant findings of *The Welfare Impact of Rural Electrification: A Reassessment of the Costs and Benefits, An IEG Impact Evaluation* (IEG 2008b) through an analysis of economic and welfare outcomes from World Bank projects. The evaluation also complements the findings of *Safeguards and Sustainability Policies in a Changing World: An Independent Evaluation of World Bank Group Experience* (IEG 2010), which covered electricity sector projects, and two evaluations on climate change (IEG 2008a; Chomitz 2010), which covered energy policies and energy efficiency issues. Relevant findings of *The Big Business of Small Enterprises: Evaluation of the World Bank Group Experience with Targeted Support to SMEs, 2006–12*, which identified electricity access as a major constraint in this sector, were taken into account (IEG 2014e). The findings of *World Bank Group Support to Public-Private Partnerships – Lessons from Experience in Client Countries, FY02–12* (IEG

2014c) and the *World Bank Group Assistance to Low-Income Fragile and Conflict-Affected States* (IEG 2014g), where relevant to the electricity sector, were also considered by this study.

IEG conducted a cluster review of four partnership programs: the Energy Sector Management Assistance Program (ESMAP), Asia Sustainable and Alternative Energy Program (ASTAE), Global Partnership on Output-based Aid (GPOBA), and Lighting Africa (IEG 2005). These four programs were selected because they are the largest partnership programs contributing to the Bank Group's work in energy access. The findings from this cluster review are reflected in the analysis of portfolio focus and performance (ESMAP, ASTAE, and Lighting Africa) and of affordability of access to the poor (GPOBA).

IEG's 2008 study of Bank Group activities related to climate change covered the World Bank's win-win energy policy reforms: energy price reform and policies for energy efficiency – both of which offer potentially large gains at the country level, together with significant reductions in greenhouse gas emissions. One of the report's conclusions is that "there is no significant trade-off between climate change mitigation and energy access for the poorest. Basic electricity services for the world's unconnected households, under the most unfavorable assumptions, would add only one-third of a percent to global greenhouse gas emissions, and much less if renewable energy and efficient light bulbs could be deployed. The welfare benefits of electricity access are of the order of \$0.50 to \$1 per kilowatt-hour, while a stringent valuation of the corresponding carbon damages, in a worst case scenario, is a few cents per kilowatt-hour." Others note that universal energy access can be achieved with essentially no increase in the global emissions of CO₂ only if the billions of people without access to energy services (or with poor quality service) demand only a minimal amount of energy services (Bazilian and Pielke 2013).

The report is organized as follows:

Chapter 2 analyzes the Bank Group's interventions and support for electricity access (lending, policy advice, and knowledge development) in country clients through the lens of electricity access categories and assesses the portfolio's electricity access relevance, outcomes and impacts, and efficiency.

Chapter 3 evaluates the Bank Group's role and effectiveness in improving institutional frameworks for electricity access, focusing on the financial viability of electricity sectors, and addressing the affordability of electricity access for the poor.

Chapter 4 evaluates Bank Group support for national access expansion programs through grid and off-grid means. It also examines recent efforts for systematic

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national access rollout and syndicating financial resources using sectorwide frameworks and processes.

Chapter 5 presents the main findings of the evaluation and makes recommendations for World Bank Group management.

Notes

¹ See appendix A: Sustainable Energy for All (SE4All).

² <http://www.eia.gov/tools/faqs/faq.cfm?id=447&t=3>

³ Electricity Access Data relates to 2010, the latest year for which consistent and comprehensive data was compiled by SE4All resources.

⁴ This evaluation classifies Bank Group country clients according to four electricity access categories based on the percentage of population with electricity access: low (up to 50 percent), medium (>50–75 percent), high (>75–95 percent), and universal (>95 percent).

⁵ World Development Indicators.

⁶ Operations Policy and Country Services, World Bank Group.