Institutional Approaches to Electrification

The Experience of Rural Energy Agencies/ Rural Energy Funds in Sub-Saharan Africa

THE AFRICA ELECTRIFICATION INITIATIVE

L'INITIATIVE D'ELECTRIFICATION DE L'AFRIQUE

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November 14–16, 2011
Dakar, Senegal

THE AFRICA ELECTRIFICATION INITIATIVE

L'INITIATIVE D'ELECTRIFICATION DE L'AFRIQUE

AGENCE SENEGALAISE D'ELECTRIFICATION RURALE

euei pdf
energy for development

ESMAP

Africa Renewable Energy Access Program (AFREA)

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Abbreviations and Acronyms

ADB	Asian Development Bank
AEI	Africa Electrification Initiative
AFD	l'Agence Française de Développement
AfDB	African Development Bank
AFREA	Africa Renewable Energy Access Program
AFTEG	Africa Energy Unit, World Bank
ASER	Senegalese Rural Energy Agency
BERD	Bureau d'Électrification Rurale Décentralisée
BOT	build, operate, and transfer
CDF	Community Development Fund
CDM	Clean Development Mechanism
CEFE	Competency-based Economies through Formation of Enterprises (Ghana)
CIF	climate investment fund
COP	Conference of Parties
CPF	Carbon Partnership Facility
CTF	Clean Technology Fund
DFID	Department for International Development
EAfUP	Energy Access for the Urban Poor
EBRD	European Bank for Reconstruction and Development
EDF	Électricité de France
EEUID	Electricity End-Use Infrastructure Development
EnDev	Energising Development
ERSEN	Electrification Rurale au Sénégal
ESMAP	Energy Sector Management Assistance Program
ETSI	Solar Energy Institute Madrid University
EUEI PDF	EU Energy Initiative Partnership Dialogue Facility
EU EF	European Union Energy Facility
EWURA	Energy and Water Utility Regulation Authority
FDE	Fonds de Développement de l´Electrification, Burkina Faso
FDI	foreign direct investment
FIP	Forest Investment Program
GIS	geospatial information system
GIZ	German Agency for International Cooperation
GPOBA	Global Partnership on Output-Based Aid
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications,
HEURA	Household Energy Universal Access Project
HFO	heavy fuel oil (generator)
ICT	information and communication technology
IDA	International Development Association
IDB	Inter-American Development Bank
IPPs	independent power producers
KPLC	Kenya Power
kV	kilovolt
kWh	kilowatt hour
LA	Lighting Africa
LAC	Latin America and Caribbean
LDCs	least-developed countries
LV	low voltage
MALT	Mise A La Terre
MDB	multilateral development bank
MDG	Millennium Development Goal
MFI	microfinance institution
MHP	microhydropower
MSME	micro-, small-, and medium-size enterprise
MV	medium voltage
MVA	megavolt amperes
NGO	nongovernmental organization
O&M	operations and maintenance
OBA	output-based aid
PCASER	"spontaneous" private initiative projects
PoA	Program of Activities
PPAs	power purchase agreements
PPCR	Pilot Program for Climate Resilience
PPP	public private partnership
PRODUSE	Productive Use of Energy
PSED	Program for Sustainable Economic Development
PSP Hydro	Hydro Private Sector Participation in Micro-Hydro Power for Rural Development
PUE	productive use of electricity
PV	photovoltaic
RE	rural electrification
REA	rural energy agency
REF	rural energy fund
SCF	Strategic Climate Fund
SE4ALL	Sustainable Energy for All
SHS	solar home system
SIDA	Swedish International Development Agency
SMEs	small- and medium-size enterprise
SPD	small power distributer
SPP	small power producer
SPPA	standardized power purchase agreement
SPPT	standardized tariff methodology
SREP	Scaling Up Renewable Energy Program
SSA	sub-Saharan Africa
SSMP	Sustainable Solar Market Package
SWAP	sectorwide approach
SWER	single wire earth return
SWS	shield wire system
WBG	World Bank Group
Wp	watts peak
ZEM	rural electrification zone (Mali)

AEI Practitioner Workshop Agenda

Sunday, November 13				
18:00–21:00	Registration			
Monday, November 14				
07:45–08:30	Registration			
08:30–10:00	I. Opening Session			
10:00–10:30	Coffee Break			
10:30–12:30	II. A. Different Approaches to Rural Electrification: Real World Examples	II. B. Stand-alone PV Solutions: How to Contribute Massively to SSA National Electrification Plans	II. C. Low-Cost Solutions for Electrification	
12:30–14:00	Lunch, Poster Session, and Exhibition			
14:00–15:15	III. A. REA/REF 1: Recent Experiences with REAs/REFs—Successes, Problems, Solutions	III. B. Lighting Africa Clinic	III. C. Access Planning and SWAPs	III. D1. Prepaid and Smart Meters for Rural Electrification
15:15–15:30	Coffee Break			
15:30–17:00	Session Continues	Session Continues	Session Continues	III. D2. Discussion Group: Centralized, Decentralized, and Hybrid Approaches to Electrification
17:00–17:30	Video on Lighting Africa Program			
17:30	Groups Report Back to Plenary			
19:30	Dinner			
Tuesday, November 15				
08:30–09:00	Kick Off Day 2			
09:00–10:30	IV. A. Financing Connection Charges for Grid Scale-Up	IV. B1. Mini-Grids and Regulation	IV. C1. PV for Community Services Toolkit Workshop	IV. D1. ESMAP: Peri-Urban and Urban Access
10:30–11:00	Coffee Break			
11:00–12:30	Session Continues	IV. B2. Successful Approaches for Promoting Productive Use of Electricity	IV. C2. EDF Training Program	IV. D2. Integrating Gender into Energy Operations
12:30–14:00	Lunch, Poster Session, and Exhibition in Garden			
14:00–15:15	V.A. REA/REF 2: Group Discussion on What Can Be Done to Address Typical REF Constraints?	V.B. Clinic: Addressing Questions on Productive Uses Based on Country Cases	V. C1. Can Existing International Funding for Renewables and Carbon be “Activated” for SSA Access Scale-Up?	V. D1. Discussion Group on Regulations and Mini-Grids
15:15–15:30	Coffee Break			
15:30–17:00	Session Continues	Session Continues	V. C2. Output Based Aid for Electricity—Access, Concepts, and Challenges	V. D2. Clinic on Practical Software Tools for Designing and Evaluating Hybrid Mini-Grids
17:00–17:30	Video Documentary by Kenya Power and Light Company “Electricity Access, Innovations, and Better Jobs”			
17:30	Groups Report Back to Plenary			
19:30	Dinner hosted by ASER			
Wednesday, November 16				
09:00–10:30	VI.A. Wrap Up			
10:30–11:00	Coffee Break			
11:00–12:00	VI. B. Closing Remarks			
12:00	Lunch			

EXECUTIVE SUMMARY

Background: AEI

Energy poverty is a global problem: access to energy services is crucial to meet basic household needs, deliver and access public services, and generate income. Less than 10 percent of Sub-Saharan (SSA) rural households have access to electricity, with an overall access rate below 25 percent. One of the main obstacles for SSA electrification practitioners is the difficulty in obtaining practical and timely knowledge on how to overcome economic, technical, institutional, and political barriers to electrification in their day-to-day work.

Considering that under the business-as-usual scenario only about 50 percent of the SSA population will have access to electricity by 2030, policy makers at national and international levels are setting more ambitious targets to achieve universal access. Electrification practitioners are the ones expected to make these achievements possible.

Launched in 2008, the Africa Electrification Initiative (AEI) seeks to create and sustain a living body of practical knowledge and a network of SSA practitioners for the design, development, and implementation of rural, peri-urban, and urban on-grid and off-grid electrification programs. The initiative emphasizes mitigating barriers and promoting solutions to SSA electrification access through the provision of proven, practical information in a user friendly format, through simple and sustainable communication channels.

In the last few years, AEI has assembled a growing network of African practitioners, including representatives from rural energy agencies and funds, government ministries, and regulatory agencies and from state, community, and privately owned utilities that collectively make up a network of electrification "thinkers" and "doers" across SSA. AEI supports this network by organizing workshops and promoting online discussions and knowledge exchanges on topics important for its members. AEI also conducts and facilitates research on topics relevant to practitioners, including how-to manuals/toolkits and models, and collects and produces operational documents. In the two years since AEI formed in Maputo, there has been substantial progress, and the concept of idea exchange has taken root among the continent's leading electrification practitioners.

Dakar Workshop Objectives, Structure, and Outcomes

For this workshop, AEI gathered about 230 practitioners from 41 countries, including 33 SSA countries whose day-to-day activities concentrate on electrification. The workshop set out to address a number of relevant electrification topics previously identified through in-depth discussions and ongoing knowledge exchanges among a growing network of SSA practitioners. The workshop's main focus was on ground-level implementation of different institutional approaches to electrification, with particular focus on the experiences of **rural energy agencies/rural energy funds (REAs/REFs)** across SSA. It was designed to examine how REAs/REFs interact with national utilities, ministries and regulators, and to encourage practical knowledge sharing among REAs/REFs in the SSA region by comparing their different approaches and documenting early lessons

learned from their operations. The workshop also gave some thought as to how best to use the momentum from the upcoming United Nations 2012 International Year of Sustainable Energy for All.

The opening session began with setting the stage by Tjaarda Storm Van Leuween, Senior Consultant, World Bank, for the remarks that followed. Opening remarks were given by Aliou Niang, General Manager of the Rural Electrification Agency of Senegal (ASER), Demba Balde, Acting Country Manager for Senegal, World Bank, and Ingmar Stelter, EUEI-PDF Programme Manager. Subsequently, Mr. Karim Wade, Minister of State (Senegal) for International Cooperation, Regional Development, Air Transport, and Infrastructure, gave an opening speech emphasizing the role of energy access in reaching the Millennium Development Goals (MDGs) and the synergies of energy with other sectors, as well as described Senegal's rural energy access goals. Upon workshop kick off, an overview was given by Raluca Golumbeanu, AEI Program Coordinator, who introduced the workshop objectives and structure.

The workshop lasted two and a half days, comprising 21 sessions, including regular session panels and discussion clinics with a longer duration. It also featured exhibition space for posters submitted by participating institutions, an expo of approved lighting products from the Lighting Africa Program, and an awards ceremony to recognize the best papers submitted by SSA electrification practitioners in response to the AEI call for papers.

The main themes addressed during the workshop included:

- Adopting efficient institutional approaches to electrification for access scale-up
- Creating low-cost technical solutions for grid extension
- Making access to electricity affordable for the poor
- Setting workable tariffs for rural electricity
- Increasing the use of renewable energy for access in rural areas
- Integrating gender into energy operations
- Identifying viable long-term photovoltaic (PV) solutions
- Leveraging climate funds and carbon finance for access scale-up
- Integrating results-based approaches into operations

This workshop was co-organized by the Africa Renewable Energy Access Program (AFREA) managed by Africa Energy Unit of the World Bank and funded through a contribution from the Kingdom of the Netherlands to the ESMAP Clean Energy Investment Framework Multi-Donor Trust Fund, the Rural Electrification Agency of Senegal (ASER), and the European Union Energy Initiative Partnership Dialogue Facility (EUEI-PDF).

Participants gave very positive feedback about the usefulness of the workshop for their work. One rural energy agency participant noted, "As high connection charges are a stiff barrier to access in my country, I am planning to immediately introduce measures discussed here at the workshop."

Acting Country Manager for Senegal, World Bank, Demba Balde, concluded that "the true impact of the workshop will be demonstrated in follow-up actions at the country level, ultimately leading to increased energy access, enhanced economic and social development, and reduced poverty. Improving the lives and livelihoods of the energy poor throughout SSA will be our greatest achievement."

Following the Director General of ASER Amadou Niang's presentation on the electrification program of Senegal, the AEI team gave a wrap-up presentation summarizing the main messages that emerged from the workshop discourse. Closing remarks were given by Minister of Energy, Mr. Ibrahima Sar, who highlighted the capacity constraints for most SSA countries and the need to overcome them through exchange of ideas among practitioners. Mr. Sar expressed his gratitude to the organizers of the workshop and noted that the outcome of the workshop will be a reference to which Senegal shall look to for refining its energy policy and access scale-up strategy.

République du Sénégal
Un Peuple – Un But – Une Foi

Ministère de la Coopération
Internationale, des Transports Aériens,
des Infrastructures et de l'Energie

Atelier International sur l'Initiative d'Electrification en Afrique
Allocution d'Ouverture de Monsieur Karim Wade,
Ministre d'Etat, Ministere de la Cooperation International,
des Transports Aeriens, des Infrastructures et de l'Energie

Chapter 1 | INTRODUCTORY REMARKS

- Mesdames et Messieurs les Représentants Résidants de la Banque Mondiale, de la Banque Africaine de Développement, de la Coopération Financière Allemande
- Mesdames et Messieurs les Représentants Résidants de la Banque Mondiale, de la Banque Africaine de Développement, de la Coopération Financière Allemande (KFW), de la Coopération Technique Allemande, de l'Union Européenne et de l'Agence Française de Développement (AFD)
- Monsieur le Directeur Général de l'Agence Sénégalaise d'Electrification Rurale (ASER)
- Messieurs les Directeurs
- Mesdames et Messieurs les Experts
- Mesdames et Messieurs
- Honorables invités

Je voudrais, d'emblée, vous dire l'honneur et le plaisir que nous éprouvons de vous accueillir à Dakar.

Aussi, la tenue de la présente rencontre m'offre l'agréable occasion de vous souhaiter, au nom de Son Excellence Maître Abdoulaye WADE, Président de la République du Sénégal, de Maître Souleymane Néné NDIAYE, Premier Ministre, Chef du Gouvernement, ainsi qu'au nom du peuple sénégalais, la bienvenue en terre-africaine du Sénégal.

Mesdames, Messieurs, Honorables Invités,

Il ne viendrait à l'idée de personne de songer atteindre les objectifs de développement du millénaire (OMD), notamment la réduction, à l'horizon 2015, du nombre de personnes vivant en dessous du seuil de pauvreté, sans un accès à l'énergie, en qualité et en quantité.

Dès lors, l'accroissement de l'accès aux énergies modernes, pour répondre aux besoins de création de richesse et de promotion des services sociaux de base, devient un impératif pour lutter contre la pauvreté, notamment en Afrique où la situation est très préoccupante.

En effet, on estime que seulement la moitié de la population urbaine en Afrique subsaharienne a accès à l'électricité ; en milieu rural, le ratio n'est que de 8%. En outre, même lorsque l'énergie moderne est disponible, elle est chère et peu fiable. Ainsi, si les tendances actuelles se maintiennent, moins de la moitié des pays africains réaliseront l'accès universel à l'électricité d'ici à 2050.

Cependant, l'Afrique recèle de nombreuses ressources énergétiques non renouvelables et renouvelables, notamment le pétrole brut, le gaz naturel, le charbon, l'énergie hydroélectrique, l'énergie géothermique, la biomasse, l'énergie solaire et l'énergie éolienne. La principale difficulté rencontrée réside dans la mobilisation des financements nécessaires pour réaliser les investissements.

C'est pourquoi, la rencontre d'aujourd'hui, qui réunit les principaux partenaires techniques et financiers intervenant dans le secteur de l'énergie, revêt un intérieur particulier, en ce sens qu'elle permettra d'examiner les principales contraintes relatives notamment au financement et à l'environnement institutionnel à promouvoir pour attirer le secteur privé.

Mesdames, Messieurs, Honorables Invités,

Le Gouvernement du Sénégal, suivant les Directives de son Excellence, Maître Abdoulaye WADE, Président de la République, attache une priorité au développement de l'accès à l'électricité, aussi bien en zone rurale qu'en milieu urbain.

Dans cette perspective, il a été mis en place une politique hardie d'électrification rurale reposant sur trois (03) piliers complémentaires, à savoir :

- La mise en concessions du territoire national dans le cadre du partenariat public privé
- Le développement des projets d'électrification rurale d'initiative locale (Projets ERILs)
- La réalisation des programmes d'urgence d'électrification rurale sur financement du budget de l'Etat

Ces efforts considérables du Gouvernement ont permis de porter le taux d'électrification rurale de 8% en 2000 à 24% en 2010.

Notre objectif est de relever le taux d'électrification rurale à 50% avant 2015, et contribuer significativement à l'atteinte des objectifs du Millénaire pour le développement.

La mise en concession des zones rurales, avec la mobilisation d'importants moyens financiers d'environ 145 millions $USD des bailleurs multilatéraux, va contribuer sensiblement à atteindre cet objectif. Grâce à ces financements, Cinq (05) concessions sur 10 sont déjà attribuées à des opérateurs privés, alors que le processus d'attribution est en cours pour une sixième concession.

Je voudrais profiter de l'occasion pour remercier, au nom du Gouvernement du Sénégal, la Banque Mondiale, la Banque Africaine de Développement (BAD), la Coopération Financière Allemande (KFW), l'Agence Française de Développement (AFD), la Coopération Hollandaise (Fonds Ouwens), ainsi que le Fonds Mondial pour l'Environnement, pour leurs appuis financiers qui ont permis à notre pays de faire un pas décisif dans la réalisation de ses objectifs en matière d'électrification rurale.

Mesdames, Messieurs, Honorables Invités,

Les résultats ci-dessus traduisent la vision de son excellence Maître Abdoulaye WADE, Président de la République, dans son approche volontariste qui place l'accès à l'électricité en général, et celui des zones rurales en particulier au cœur du Développement.

En plus de l'accès à l'électricité des ménages, la nouvelle politique cible en priorité le développement des usages productifs, et l'électrification des équipements collectifs et sociaux que sont :

- les infrastructures sanitaires et scolaires
- les ouvrages hydrauliques
- les équipements de transformation et de conservation de productions locales

Par cette approche, nous comptons faire de l'accès à l'électricité un véritable instrument de réduction de la pauvreté parce que permettant la création de richesses et l'amélioration des conditions de vie des populations en général et de la femme rurale en particulier.

Mesdames, Messieurs, Honorables Invités,

Vous aurez, au cours de votre atelier de trois jours axé sur l'électrification en Afrique, à aborder plusieurs problématiques et à réfléchir notamment sur comment dans le contexte de pays à faibles moyens et dans un environnement international marqué par une crise financière aigue on peut réaliser l'accès universelle à l'électricité dans une échéance temporelle la plus courte possible.

Ce sont là des questions importantes, surtout pour des pays comme les nôtres qui ont mis en place des stratégies d'électrification rurale faisant appel à l'intervention de plusieurs acteurs.

Ces stratégies qui placent le secteur privé comme acteur majeur dans l'électrification rurale, ont conduit à l'adoption des réformes dans le secteur de l'énergie.

Aujourd'hui, après quelques années de mise en œuvre de ces réformes, il est nécessaire de faire une évaluation de celles-ci pour cerner les difficultés rencontrées et procéder aux inflexions nécessaires afin que, sur la base des leçons apprises, nous puissions progresser de manière encore plus résolue dans la réalisation de nos objectifs.

Pour ma part, il ne fait pas de doute, avec la qualité des participants et la riche expérience acquise par vous-mêmes et vos institutions respectives, que les résultats de vos travaux seront féconds et serviront grandement à nos Etats qui sont aujourd'hui, plus que jamais soucieux au bien être de leurs populations, ce qui passe nécessairement par l'accès à tous à l'électricité.

Mesdames, Messieurs, Honor7ables Invités,

Avant de terminer, permettez-moi de féliciter chaleureusement le Comité d›Organisation de ce Forum, à la tête duquel le Directeur Général de l'Agence Sénégalaise d'Electrification Rurale (ASER), qui n›a ménagé aucun effort pour assurer une totale réussite à cette importante rencontre.

Tout en souhaitant pleins succès à vos travaux, je déclare ouvert l'atelier international sur l'Initiative d'Electrification en Afrique.

Je vous remercie de votre aimable attention.

Goyola, Guinea, Mrs. Kota Béavogui, a client of the electricity company in front of her house.

Chapter 2 | SESSION OBJECTIVES IN BRIEF

Session II A and III D2 | Different Approaches to Electrification

This session presented different models for scaling up access in rural areas, including centralized and decentralized models. Special emphasis was placed on how to create "complementarities" rather than "conflicts" if a country decides to use both models. The afternoon discussion was organized around specific questions, with particular emphasis on how to combine the two basic approaches to achieve more rapid rural electrification. Special attention was also given to hybrid institutional arrangements that have emerged in Africa and Asia.

Session II B | Stand-Alone PV Solutions

Drawing on an AEI cosponsored photovoltaic (PV) symposium and sub-Saharan Africa (SSA) cases, this session covered success stories, failures, and promising news on PV-powered homes, schools, clinics, and enterprises. The session focused on opportunities and challenges when integrating stand-alone PV into national electrification goals, especially in SSA.

Session II C1 | Low-Cost Solutions to Electrification

The high cost of rural electrification is one of the key constraints preventing utilities from making more intensive electrification efforts. Case studies were presented from Namibia and Tunisia describing the technical and operational approaches that have yielded positive results as well as some of the challenges and lessons learned from the consumer perspective. The session also covered the cost reduction and economic growth properties of upgrading network standards.

Session III A and V A | Recent Experience with REAs/REFs

The rural energy agency/rural energy fund (REA/REF) model has become a way for some countries to bring in additional capital, invite new actors such as private companies and community cooperatives, and facilitate electrification of areas where the national utility does not have sufficient financial incentive to enter. The session was designed around REA case studies from Mali, Senegal and Tanzania, and was attended by about 50 workshop participants. The objective was to learn about successes, problems and solutions for REAs/REFs, as well as to identify topics for the subsequent follow-up discussion session (session V A).

A moderated discussion session followed up on the earlier panel session and included additional country cases from REAs and expanded on the lessons learned from Club ER and the REAs of Madagascar, Zambia and Zimbabwe, and discussed how the presented models for rural electrification could work better.

Session III B|Lighting Africa Clinic

This session presented the latest developments in off-grid lighting and microenergy technologies, including how they can complement rural electrification programs. The session also introduced Lighting Africa and the German Agency for International Cooperation (GIZ) Energising Development (EnDev) programs in Ghana, Kenya, and Rwanda dedicated to rural electrification product market scale up. The session was designed to create a discussion between REAs and the private sector on strategies for long-term sustainability of the off-grid lighting effort.

Session III C|Access Planning and Sectorwide Planning Processes

Sectorwide approach (SWAP) planning is a country-led, results-focused, long-term sector development program aligned with national priorities and targets. It also helps the potential financiers to engage in a coordinated, systematic manner in supporting the energy sector of a country. Compared to the project-by-project approach, SWAP uses a funding basket, is demand driven, and is aligned to national priorities. Traditionally, SWAP was used in the social development sector, but recently some countries, notably Rwanda, have started to develop SWAP for the energy sector. The objective of the session was to demonstrate how better planning can help improve energy access.

Session VI A|Financing Connection Charges

Costs of connection charges vary depending on several important factors, including technical design, procurement, financing schemes, and cost-recovery structure. Connection charge policies today vary considerably across countries, and therein provide a telling picture. Data show that there is a correlation between high connection charges and low rural electrification coverage rates, indicating that high connection charges are indeed a substantial barrier to scaling up electrification. This session presented solutions adopted by SSA countries that made connection charges more affordable.

Session IV B1 and V D1|Minigrids and Regulation

These two sessions (the presentation session in the morning and the discussion session in the afternoon) focused on common regulatory issues that arise for connected and isolated minigrids, regardless of whether the regulation is performed by a separate regulator or an REA. The issues covered include: setting both the level and structures of retail and wholesale tariffs, automatic adjustment clauses, establishing workable technical/commercial quality standards of service, and implementing light-handed regulation. These issues were discussed from the perspective of regulators, operators, and customers.

Session IV B2 and V B|Productive Uses of Electricity

The promotion of productive use of electricity (PUE) has great potential to increase both the impact and the viability of electrification programs. The objective of the two sessions was to make the audience familiar with good practices for PUE promotion and discuss experiences as well as lessons learned. It was divided into a first part with presentations of examples from Ghana, Kenya, and Zimbabwe in the morning, and a discussion session in the afternoon.

Session IV C2| Électricité de France Training Session

The purpose of this session was to raise awareness on an innovative initiative led by **Électricité de France (EDF) for sustainable capacity building for rural electrification in West Africa, focusing on two** pilot coun-

tries—Burkina Faso and Mali. The program was launched in October, and the majority of financing is sourced from the European Union Energy Facility (EU EF) in cooperation with **Électricité de France** (EDF), Fonds de Développement de l´Electrification (FDE, Burkina Faso), and AMADER (REF, Mali).

Session IV D|Energy Access for the Urban Poor

This session was led by the Energy Sector Management Assistance Program (ESMAP), which has undertaken an Energy Access for the Urban Poor (EAfUP) initiative. The session explored the difficulties faced by energy practitioners and urban slum communities in providing electricity and other infrastructure services, globally and in SSA, to derive lessons that can be applied in SSA countries looking for solutions to this increasing problem, especially considering the fast urbanization rate in SSA.

Session IV D2|Integrating Gender in Energy Operations

A gender sensitive approach and methodology were introduced, followed by presentations of two of the six pilot countries on their practical experience in applying the proposed approach in assessments and activities to strategically integrate gender into their ongoing programs. The REAs in Mali (AMADER) and Tanzania presented their experiences and discussed the challenges, opportunities, and potential impacts.

Session V C1|Funding for Renewables and Climate Finance

The objective of the session was to explore how SSA can access international funding for renewable energy development and access scale-up that incorporates climate funds such as the Scaling-Up Renewable Energy Program (SREP) for low-income countries. After an overview of different climate finance tools, two case studies from Mali and Tanzania were presented.

Session V C2|Output-Based Aid (OBA)

The session set out to make the sometimes confusing terms and definitions easily understandable for SSA access practitioners by highlighting the key issues to consider when implementing "OBA for Access." The session started with a review of the basic concepts of performance-based aid, then highlighted specific implementation challenges when working with weaker players (as is often the case in access projects), and concluded with a discussion of real-life cases on program and project levels.

Session V D2|Clinic on Practical Software Tools

The objective of this clinic was to introduce participants to three computer models that are useful for developers, banks, REAs, and regulators to assess prospective projects from a technical, economic, and financial perspective. The first was a simple spreadsheet model that assesses the financial viability of small power producers and minigrid systems. The second was the HOMER model, which allows for optimization evaluation of the leveled costs of different minigrid system configurations. The third is the financial simulation model of off-grid systems developed by the rural energy agency of Mali (AMADER).

Reading by the light of a solar street lamp, Nimba County, Liberia.

Chapter 3 |
SESSION SUMMARIES

Beauty salon in Greenville, Sinoe County, Monrovia.

3.1 Different Approaches to Electrification

Overview and Session Objective

This session presented different models for scaling up access in rural areas, including centralized and decentralized models and combinations of the two. The presentation emphasized how to create complementarities rather than conflicts if a country decides to use both models.

The afternoon discussion was organized around specific questions raised in the morning presentations, with particular focus on how to combine the three basic approaches to achieve more rapid rural electrification and on different hybrid institutional arrangements that have emerged in Africa and Asia.

Key Questions and Challenges

- National uniform tariffs provide insufficient revenue to cover the higher costs of isolated minigrids. There is a gap in funding for rural electrification; connection fees are high while customers' willingness to pay is low. This is true even though West Africa REAs often give grants of 80 percent of the project's capital costs.
- There is no incentive for efficient use of electricity if customers are charged unmetered flat monthly tariffs. However, there is a greater likelihood that operating costs will be covered using flat monthly tariffs.
- Operators will be reluctant to offer a metered per kilowatt hour (kWh) tariff if it is limited to the national uniform tariff, which is almost always below their costs.
- Vandalism—especially stealing copper wires for resale—exists in both Kenya and Senegal.
- Other challenges include fraud in purchase, staff lacking operational skills, system overloads.

Follow-up questions that were discussed include:

- If the national grid is expanding, how do you get the private sector to invest in minigrids?
- How do the different tariff methods compare: flat tariffs versus kWh tariffs?
- How does land reform relate to rural electrification in Kenya?

One Goal, Different Tracks | Scaling Up Grid-Based Rural Electrification (World Bank)

Electrification approaches can be categorized as either centralized or decentralized—or some mix of the two. Centralized tracks are top down, implemented by a national government–owned utility, a rural electrification agency, or a large private operator through a concession covering a large region. Decentralized tracks are usually bottom up—electrification by cooperatives, community user groups, or smaller private sector entities. A key issue is whether rural customers can be charged higher tariffs than urban ones. While it is worth

recognizing the political appeal of national uniform tariffs in Africa (that is, everyone is treated equally), the downside is that national uniform tariffs have been identified as the "single biggest impediment to rural electrification" because they generally provide insufficient revenues to cover the costs of rural electrification, whether achieved through grid extension or by isolated minigrids. Another important issue raised was what happens when the "big grid" expands to reach previously isolated minigrids. Examples in Asia (for example, Cambodia and Vietnam) show that these minigrids can become small power distributors (SPDs) by purchasing bulk power from the national utilities for resale to retail customers. The purchase price must allow a sufficient margin if the SPD is required to charge a national uniform tariff. Once the connection occurs, generators powering isolated minigrids may be able to earn additional revenue as grid-connected generators.

In Mali, there have been five examples of an isolated grid being shut down and private operators compensated when the grid arrived. The private operators were compensated for their investment in physical facilities (typically 20 percent of total cost), as well as for their loss of income. Allowing renewable energy generators to sell electricity back to the grid also lowers the risk for operators when the big grid reaches the minigrid.

The flat tariff system used in much of West Africa is not consistent with sustainability strategies in the energy sector; people can leave the lights on as long as they want because there is no incentive to conserve. Customers under flat monthly tariffs typically pay more than customers paying per kWh tariffs. If too many customers move to kWh tariffs and they are constrained to the national uniform tariff, then the minigrid will not be financially viable, so private operators in West Africa may be reluctant to serve kWh customers. This, in turn, will make it difficult to promote productive uses of electricity in rural areas.

The Case of Kenya (REA)

Kenya's rural electrification results from 1974 to 2003 were low, with rural electrification levels at 3 to 4 percent. A new rural electrification program began in 2003, with electrification increasing to 22 percent by 2011. Kenya is now targeting an electrification goal of greater than 65 percent by 2020. Among factors contributing to Kenya's recent success are:

- The high level of government commitment; electrification was prioritized by the head of state.
- Instead of relying on 70 percent foreign funding, Kenya aimed instead for 70 percent of internal funding; high internal funding and commitment also help galvanize support from development partners.
- Establishment of lead agencies—the REA invested in the rural electrification infrastructure (that is, transmission and distribution facilities) and then handed it over to Kenya Power (KPLC) for maintenance and operation. The tariff system allows KPLC to adjust tariffs to cover the costs of maintaining these new assets.
- Involvement of community organizations to enhance local ownership and buy-in.
- Bulk purchase of materials, which considerably lowers costs of electrification.
- Use of local labor and transport contractors.
- Promotion of land reform to encourage clustered settlements to lower costs.

Settlement and land ownership patterns continue to deter development and contribute to poverty. Because land is split into many small pieces, electrification spread over large areas becomes more challenging and expensive. Reforms for minimum acreage ownership (minimum of 2.5 acres) should be introduced for electrification to have a better chance of success. By focusing on electrifying public facilities (schools, clinics, community centers), the REA is trying to encourage people to cluster and minimize costs.

Other challenges include inadequate funding for new lines, high connection fees, and vandalism—especially stealing wires to sell as bulk copper.

Micropower Economy in Senegal (INENSUS)

A presentation by INENSUS, a local energy systems operator, focused on a decentralized, private sector approach for rural hybrid minigrids, also known as the Micropower Economy Business Model. This model has been piloted in Senegal in cooperation with GIZ and the Rural Electrification Agency of Senegal (ASER). The village minigrid configuration used in the pilot is 5 kW wind, 5 kW solar, 10 kW diesel, and 15 kW of inverters. The approach includes innovations in technology as well as in institutional delivery to address challenges that crippled many other minigrid deployments. The technological innovation focuses on a prepaid metering system that limits energy per customer (and not only power, as in many current solutions) and also includes the ability to shed customers on a one-by-one basis to avoid system overload. The institutional innovation is to have fixed assets (distribution lines, powerhouse building) owned by the local community, with the electricity generating equipment (movable assets) owned by a private sector company. The costs of this system are somewhat higher than for traditional minigrids, but INENSUS claims that these cost are offset by the advantages (better system design and modular expansion possible without subsidies). INENSUS was awaiting government approval to scale up and reach more villages.

Key Findings

- With passion, political and budgetary commitment, careful planning, and alignment of incentives, some African countries have made huge gains in rural electrification when REAs partner with the national utility.
- New sources of financing need to be developed—governments can't wait for donors to come and develop the bulk of rural electrification, they must take the lead.
- If there is local ownership or involvement, nontechnical losses will be lower.
- Ultimately, what is important is connecting unelectrified communities, regardless of whether the community is urban or rural. For example, KPLC is now electrifying Nairobi slums, which was once seen as impossible, and is now seen as very profitable.
- The fundamentals of the electrification sector are very important. Initial costs must be subsidized and rural customers may have to pay higher prices for electricity than their urban relatives. An alternative is that the government needs to provide subsidies to bring costs down to national uniform tariff levels.
- The sector cannot develop unless there are clearly defined responsibilities for actors. Practitioners have a responsibility to communicate best practices to policy makers. For off-grid electrification, it may be more effective for the REA to be both a provider of grants and a regulator (as in Mali and Guinea).
- Rural electrification institutional arrangements must address four questions: Who decides? Who funds? Who builds? Who owns and operates?

Remaining Questions

- When do concession-based approaches for both large and small concessions make sense, and when does a national utility–led approach make sense?
- What role should national uniform tariffs play in rural electrification?
- How can the gap between AEI (which is practitioner focused) and political leaders (who are choosing the approaches and the avenues for action) be bridged?

Presentations and Speakers

One Goal, Different Tracks: Scaling Up Grid-Based Rural Electrification; Bernard Tenenbaum, Senior Consultant, World Bank.

Rural Electrification Programme in Kenya; Zachary Ayieko, CEO, Rural Electrification Authority (REA) Kenya.

Micro Power Economy: The Business Model for Rural Electrification; Jakob Schmidt-Reindahl, Managing Director INENSUS West Africa.

3.2 Stand-Alone PV Solutions | How to Contribute Massively to SSA National Electrification Plans

Session Objective

Stand-alone PV systems have been technically mature for quite a while now. Based on three decades of learning from early mistakes, they have recently been diffused extensively, with great success in several countries. However, PV is not yet a significant element of most SSA electrification efforts. This might change soon: PV prices have decreased, viable business models exist, and the interest of international investors is starting to shift from less subsidized markets to the more difficult PV markets in sunbelt countries. Drawing on an AEI-cosponsored PV symposium and SSA cases, this session covered success stories, failures, and promising news on PV-powered homes, schools, clinics, and enterprises. The session was focused on opportunities and challenges of integrating stand-alone PV into national electrification goals, especially in SSA.

Key Issues and Challenges

- While PV-based rural electrification solutions are often least cost for remote rural areas (because the cost of grid-based alternatives grows exponentially with falling consumer density), operations and maintenance (O&M) costs are often neglected—how can this sustainability risk be addressed in future rural electrification programs that are bound to have a higher PV share?
- What have we learned about the typical causes of technical failures in off-grid PV programs?
- How can service providers cover their high transaction costs while keeping fees affordable for rural households and communities? When and how should direct subsidies be applied?

Case Study | Mozambique

Energy services for social infrastructure in Mozambique are generally very poor. Medical facilities located in rural areas typically rely on paraffin for light and wood fires for sterilizing medical utensils. The few medical centers that are connected to the grid often face power cuts every second week. Rural schools generally have no access to electricity to provide light for evening classes, or for teacher homes and student dormitories. Stand-alone PV systems could solve this problem, and are one of the few cases where high upfront subsidies actually

make sense and don't destroy existing private sector PV providers. Solar system installations for health centers can power refrigerators, information and communication technology (ICT) equipment, and lighting—all of which should have low energy demand and long life spans. Stand-alone PV can also power light and computers in schools. Internet access in Mozambique is relatively reliable over General packet radio service (GPRS) networks. However, many stand-alone PV pilot projects have experienced O&M difficulties in the past, often due to shortages of replacements, low-quality hardware, bad installation, or simply lack of qualified service technicians and/or O&M funding. Many installers don't receive adequate training, which results in improper installation and maintenance. In such cases, users end up overspending on failing energy services. For lasting energy service provision, system properties need to include high-quality hardware, long life spans, energy saving properties—and they still need to be affordable. In addition, training and financing for O&M technicians needs to be secured at the outset.

Defining and Controlling Solar Home System Service Quality | Solar Energy Institute Madrid University

Based on the Solar Energy Institute Madrid University's (ETSI) unique dataset on field performance of 50,000 of solar home systems (SHSs) in SSA and the Latin America and Caribbean (LAC), the key challenges for PV-based rural electrification are reliability and appropriate sizing to tackle the actual demand in question. The key to guaranteeing reliability is appropriate technical specifications, national lab testing procedures and reception tests, early field inspections, and an in-depth field evaluation after one year of operation. The lack of lasting maintenance structures is a significant weakness of PV system service delivery in many programs. This can be resolved by implementing large-scale programs with high densities of PV systems so there is enough business to support specialized local companies capable of offering professional O&M services and training for local technicians. Sizing PV systems for national electrification programs is an important but also inherently difficult and often political process. The size of system installations needs to be determined based on demand—which in turn needs to balance three often conflicting viewpoints from: (i) international financial institutions, often oriented toward basic needs and cost-benefit analysis; (ii) endusers, who often list TV viewing highest; and (iii) engineers, who typically determine standardized need levels and system sizes. The convergence of these three viewpoints is vital for success.

Case Study | Ethiopia

In Ethiopia, there is very little awareness of the potential for PV to scale up rural electrification. There are also additional barriers: households and small businesses have no access to finance mechanisms, companies do not offer repair services, there are few regulations for products and contracts, and there is no national strategy to promote PV. There is a growing political consensus to steer toward a carbon neutral economy by 2020 and to achieve universal electricity access by 2025. The sustained economic growth of Ethiopia is increasing demand for electricity services.

Following is an overview of different approaches for stand-alone PV programs with potential applicability for massive diffusion:

- *Fee-for-service* approaches, where users pay a fixed amount per month and the service provider owns the systems (either temporarily or permanently). The advantages are good service delivery in the long run and a (sometimes theoretical) retrieval option in case of payment default; the disadvantages are high service cost and lack of ownership by users, which leads to careless handling and damages.
- *Microcredit* can allow users to choose their suppliers and own PV systems by letting users cover the high upfront costs over a time of 0.5 to 2 years, which improves handling and care. On the downside, microcredits typically mean high interest rates for loans and high transaction costs for fee collection. Competition in the market may not be possible in remote areas.

- Depending on the specific national market conditions, mixes of these two mechanisms can be quite successful. In Bolivia, medium-term service contracts with four-year PV concessions allow for sufficient market size and user ownership in remote markets, while ensuring high-quality service over time and well-informed service technicians and users. In other countries, PV market packages cluster a set of rural schools and clinics as subsidized PV "anchor clients," around which PicoPV can be sold commercially.
- PV battery charging stations (sometimes combined with community centers) can start at $500 and provide energy services via kiosks. Community projects have easy access to loans, but are prone to inefficiency though bureaucracy, mishandling, and neglect.

Case Study | Senegal

The Electrification Rurale au Sénégal (ERSEN) program in Senegal supports rural electrification by SHS, minigrids, and grid extension. This EnDev program has facilitated profitable operations with significant socioeconomic impact. Users benefit from five times more light at the same cost. Service delivery requires technical and administrative staff and ownership by national stakeholders. Private operators need to have five or more years of maturity to access funds/loans, regular maintenance is required, and the user payment rate is about 80 percent and rising. On the technical side, user manipulations to bypass charge controllers have occurred, maintaining installation quality is difficult, and the technology failure rate is approximately 15 percent and falling. The devotion and availability of the operators are key success factors, along with the presence of a clear legal framework for rural electrification and the involvement of institutions to assist in the growth stages.

Key Findings

- Due to its decentralized nature, rural electrification is expensive no matter what technology is used. If the issues of low quality and long-term service sustainability can be solved, PV can contribute massively to national electrification in SSA. Private sector–led PV diffusion obviously has to be profitable, and the challenge is to fit the service delivery model and market development support to each country context. The technical capacity of the private sector is crucial.
- Technical PV problems are often caused by two issues: the capacity of the service company to deliver regular maintenance services, and a lack of ownership on the part of the enduser.
- The time required in each country to achieve sustainability is often underestimated. Remote rural markets are difficult; it can take up to 10 years or more to establish really well working national schemes for massive yet sustainable PV diffusion. Governments and donors both need to be prepared to support programs over the long term.
- Large-scale programs rather than pilot projects will be necessary to reach the ambitious national and regional access goals in SSA. Pilot programs tend to suffer from inadequate maintenance infrastructure, because the transaction costs are very high for small projects.
- There is a need for more information sharing, particularly on the details of large PV programs and their successes and failures. It is relatively easy to deploy 10,000 systems; the challenge comes in keeping them running. The next challenge (on the way to universal access) will be to do the same for millions of systems.
- Stand-alone PV can be a relevant option for at least one-third of the remaining people not receiving electricity in SSA. The PV market is subdivided by very different segments, which can be ordered by sizes and uses:
    i. Over-the-counter products such as the PicoPV (solar lanterns and small SHS, as covered by the Lighting Africa Program session) can last up to a decade without O&M if the hardware is high quality. These products need only indirect subsidies for quality assurance and user information, while direct subsidies can actually have a negative impact on their diffusion.
    ii. Public stand-alone systems, such as schools and clinics are different, they can be subsidized with up

to 100 percent of the investment cost without distortive effects, and they need strong O&M support.

iii. SHSs and PV-hybrid minigrids are somewhere in between (i) and (ii) and require carefully designed diffusion strategies, especially regarding subsidies. All of these can be combined in national rural access strategies—for instance, a government can subsidize public PV systems as anchor clients for O&M technicians, who then start selling unsubsidized PicoPV systems commercially in the same areas.

- Standalone PV can and will contribute massively to the United Nations' universal access goals, if past failures in project setup, poorly designed, distortive subsidies, and O&M structures can be avoided. In that regard, it is important to continue to identify and understand failures, and make these lessons learned available to fellow practitioners.

Presentations and Speakers

"Access to Modern Energy Systems in Mozambique - Equipment of Social Infrastructure with Photovoltaic Systems," Carsten Hellpap, Director (EnDev).

"Emerging Diffusion and Business Models for Stand-Alone PV," Samson Tolessa, Deputy Director, GIZ ECO, Ethiopia.

"Defining and Controlling SHS Service Quality Lessons from SHS Technical Field Performance from 20 Years Experience and 50,000 Systems in Africa and Latin America," Luis Narvarte, Solar Energy Institute, Polytechnical University of Madrid.

"Experience with SHS Fee for Service," Gunnar Wegner, GIZ/PERACOD, Dakar, Senegal.

3.3 Low-Cost Solutions for Electrification

Overview and Session Objective

The high cost of rural electrification is one of the key constraints preventing utilities from making more intensive electrification efforts. Case studies presented from Namibia and Tunisia demonstrated some of the technical and operational approaches that have yielded positive results, as well as some of the challenges and lessons learned from the consumer perspective. The session also covered the cost reduction and economic growth properties of upgrading network standards.

Key Issues and Challenges

Many African countries have inherited European standards that were adapted for high density, high demand centers in continental Europe. Application of these approaches in the rural areas of Africa often results in poorly adapted, oversized networks carrying unnecessary high costs for connecting rural loads. Overcoming these challenges requires capacity building as well as a significant change in the managerial and operational culture of the utilities. One suggestion was to collect current knowledge and put it into a more accessible format for broader uptake by practitioners; not necessarily a toolkit, but perhaps a forum/platform for practitioners and those interested to engage in a professional dialogue.

Case Study | Low-Cost Techniques in Rural Tunisia

Before 1975, rural electrifications rates remained very low in Tunisia, and the government decided to increase rural electrification (RE) through institutional approaches using the Ministry of Economic Development and STEG, the public utility. Various technical upgrades led STEG to using low-cost reticulation techniques based on the North American model, combining a core three-phase network with single-phase tap-offs, which they called MALT (Mise A La Terre, referring to the grounding of the fourth wire). Other technical approaches such as computerization, training, network planning, operational guidelines, maintenance planning, and customer management have also contributed to cost reduction over time. The availability of loans with easy terms for STEG customers through the Agricultural Bank facilitated the affordability and sustainability of implementation through favorable tariff structures. The cheaper single-phase distribution technique facilitated increased health, security and education services, with significant increases in socioeconomic development. The national electrification rate in Tunisia is now 97 percent.

Case Study | Rural Electrification Using the Shield Wire Scheme

After Ghana built a 161 kilovolts (kV) grid to reach all but a few remote towns, it developed the shield wire system (SWS) to allow communities living close to the transmission lines to be connected without the need for expensive substations. SWSs use the existing shield wires on the top of the transmission lines as power conductors and shield wires. The shield wires are insulated using standard insulators. Single-wire earth return (SWER) technology is used to convey power up to 100 km from the source along the line and for 20 km on each side of the line for use by rural communities. Up to 9.7 megavolt ampere (MVA) of power is transmitted and up to 250 kW motors may be connected to the system. SWSs cost about 15 percent of a conventional power line and Ghana has successfully implemented 526 km of the SWS, connected over 3,000 rural communities since 1985, and achieved over 50 percent access nationally. SWSs have also been used in Brazil, Laos, Sierra Leone, Togo, Benin, and Burkina Faso.

Case Study | Upgradability of Three-Phase Networks

The call for new standards comes from the desire to reduce both initial and operational costs, improve safety, and provide better maintenance. The existing three-phase system is prone to imbalances. Four-wire systems have problems with unbalance because of the line to neutral load, but also three-phase wire lines provide unbalanced voltages if phase currents are not exactly equal, and they usually are not. Revised standards have potential for savings. Medium voltage systems already have fewer components and are less prone to failure and maintenance. Revised low voltage systems offer 40 percent savings on material costs and are easier to construct. Revised service connection lines would save 23 percent on material costs and reduce installation time by 50 percent.

Case Study | Experience with SWER Electrification in Namibia

SWER technology was implemented in 1998 for rural electrification in Namibia. Some of the advantages have been system simplicity, low capital and maintenance cost, and reliability. The main disadvantage is low power transfer; from a technical perspective, commonly used mills and pumps require special motors and systems are prone to lightening damages. Consumers sometimes perceive SWER as an inferior power supply, which calls for further consumer education. Overall, SWER has been a vital tool for rural electrification in Namibia, and an appropriate technology to roll out in areas requiring low loads.

Key Findings

- Significant cost reductions were reported with the deployment of three classes of low-cost technical solutions implemented by leading national utilities, without compromising service reliability and operations over the last 15–25 years.
- SWER is a single-wire distribution line supplying single-phase electrical power from an electrical grid to remote areas at low cost. Its distinguishing feature is that the earth, or sometimes water, is used as the return path for the current. It is principally used for rural electrification, but can also be used for larger isolated loads, such as water pumps and light rail. SWER can save 26–52 percent in investment costs over a classical three-phase network.
- Single-phase construction, delivered either by two-phase system or addition of neutral for phase/neutral is the low-cost approach for moderate density projects. Single phase with conductor neutral is the costliest of the three single-phase designs, but can still offer savings of 30–50 percent compared to many three-phase standards. It can carry higher loads than the SWER-based systems and can easily be upgraded to a bi-phase system, and further into a three-phase system with an added conductor. This makes it ideal for many African communities where initial demand is often considerably lower than the long-term forecasts.

- SWSs are suitable for distribution of power to villages close to a planned transmission line. The design uses a single-phase technique for power delivery over the one or two shield wires found on the tops of transmission towers originally installed as protection against lighting strikes. SWSs cost about 15 percent of a conventional power line.
- Highly capital-intensive programs associated with aggressive national grid-based rollout for scale-up require very high investment costs in order to sustain the program and may take anywhere from 15 to 25 years for most countries. Every 1 percent saved by the introduction of proven low-cost technical solutions will impact how fast the job can be accomplished because ongoing financing is a challenge for most countries.
- There is no longer the perception that these solutions imply lower service standards. Stakeholders are now all asking how these proven options can be integrated into their models.

Presentations and Speakers

"Low Cost Techniques in Rural Tunisia," Moncef Aissa, Senior Electrical Engineer, Private Consultant, Tunisia.

"Rural Electrification With The Shield Wire Scheme Applications In Developing Countries," Francesco Iliceto, Professor Emeritus, University of Rome "La Sapienza," Italy.

"Experience with SWER Electrification in Namibia," Henk Meyer, Senior Electrical Engineer, Meyer Consulting Engineers, Namibia.

"The Upgradability of Conventional Three Phase Delta/Star Networks," Jaap du Preez, Professional Power Systems Engineer, South Africa.

Diesel rice mill, Liberia.

3.4 Recent Experience with REAs/REFs | Successes, Problems, Solutions

Overview and Session Objective

Grid-based electrification in the past relied almost exclusively on grid extension to unelectrified areas, usually financed by utilities, while off-grid programs were often small and based on near full investment subsidies financed by donor agency grants. The REA/REF model has become a way for some countries to bring in additional capital, invite new actors such as private companies and community cooperatives, and facilitate electrification of areas where the national utility does not have sufficient financial incentive to enter.

The session was designed around REA case studies from Mali, Senegal and Tanzania, and was attended by about 50 workshop participants. The objective was to learn about successes, problems and solutions for REAs/REFs, as well as to identify topics for the subsequent follow-up discussion session (session III D2).

Key Questions and Challenges

SSA countries use both centralized and decentralized approaches for scaling up rural electrification. Even within the decentralized approach, via a REA/REF, there are considerable differences with regard to concession design, private sector participation, subsidy levels, financing mechanisms, and so forth. What are some of the more successful REA/REF models that could be replicated elsewhere in SSA and when does this make sense?

The participation of both the international and the local private sector in power projects in many SSA countries remains weak. The local private sector often does not have sufficient capital to invest in rural electrification, and foreign investors are difficult to attract.

In countries where rural electrification concessionaires are buying electricity from the national utility, there can be a difference in technical standards, which can cause delays in project implementation.

Brief Overview of REAs/REFs

The opening presentation introduced three rural electrification studies financed by the European Commission and the EU Energy Initiative Partnership Dialogue Facility (EUEI PDF) and the characteristics of the different models. The presenter categorized different countries according to the level of private sector participation in rural electrification: from “no change” (electrification by state-owned utility) to “full public private partnerships” (PPPs), such as in Senegal.

Some characteristics of the full PPP approach (such as in Mali and Senegal) are that connection fees tend to be lower (but tariffs perhaps higher) and the focus is on population density of the served areas and prioritized areas. The model is technology neutral and provides a predictable business environment with clear rules. One of the main messages was that there is no evidence of superiority for any specific institutional model, but that the best-suited model depends on a variety of other factors present in the country. For example, Ghana, Mozambique, and Zambia all succeeded in increasing access rates via grid extension and various accompanying cost-lowering mechanisms. Some takeaway messages from the three studies were success factors in five distinct areas: policy framework, supply chain, technical standards and costs, financing and sustainable operations, and electricity demand.

Lastly, key recommendations from various cases were presented, including some for general REA principles. Additional recommendations were for the Ministry of Energy to sign performance contracts with clear annual targets, that projects should be clustered to enable economies of scale, and that rural electrification be accompanied by measures to promote productive use of energy.

The Case of Tanzania

A presentation on the role of the REA/REF in increasing access to modern energy in rural Tanzania gave an overview of the REA since its establishment. The REA in Tanzania was created in 2005, part of an energy reform, and has been operational since October 2007. The REA has been cofinancing grid extension projects implemented by the state-owned utility TANESCO through connection charge subsidization. It has also developed an enabling regulatory framework for small power producers (SPPs), including standardized power purchase agreements and tariffs. The REA also supports private sector–led rural electrification activities through matching grants for pre-investment support and business development, performance grants (US$500 per connection), and a credit line for rural/renewable energy development that provides long-term financing through local commercial banks. REA is currently working with the World Bank on a CDM program of activities that is expected to improve the financial viability of the small renewable energy projects. The REA objective is to reach a national electrification rate of 30 percent by 2015, up from the current 15 percent.

The Case of Senegal

The Senegalese rural electrification model uses a concession approach via PPPs. The country is divided into 10 concessions that exist in parallel with the national utility, SENELEC. Selection of concessionaires is based on the number of connections achieved with a certain amount of subsidy during the first three years. Six concessionaires have been selected so far and contribute 45 percent of the investment cost on average; however, it took a long time to develop procedures, organize tenders, and negotiate with future concessionaires. One of the challenges reported was that it was difficult for private concessionaires to sign power purchase agreements (PPAs) with the national utility SENELEC, because the risk of load shedding constitutes a financial risk for the concessionaires. Another challenge is that the technical standards used by SENELEC and the concessionaires are different.

The Case of Mali

Mali's bottom-up approach via PPPs for rural electrification is used in parallel with two other approaches: (i) top-down award for 10 multisectoral electrification concessions (ZEMs); and (ii) tenders for underprivileged areas. Unlike Senegal, AMADER was unable to attract private companies to invest in ZEMs. However, the bottom-up approach proved successful via its spontaneous projects initiated by domestic private companies, nongovernmental organizations (NGOs), and other associations. Projects are selected based on promoters' ability to develop and operate a viable project and are given a fixed investment subsidy. The ministry of Mines, Resources, and Water authorizes operators to supply a given area for 12 to 15 years (depending on capacity

of generation assets). There are about 82 projects completed and ongoing (80 percent are diesel minigrids, 9 percent grid electricity, and 11 percent renewable energies). Eventually, some areas previously operated by small operators will need to be integrated into the concession of the national utility EDM, and the operators will need to be compensated.

Key Findings

Some of the key messages emerging from this session include:

- Rural electrification programs require strong leadership by: (i) an efficient distribution utility; or (ii) a specially designated agency as well as efficient contractors and small service providers.
- There is no superior model for centralized or decentralized electrification; the approach needs to be adapted to local conditions in the respective country.
- If successful, significant volumes of private sector capital can be leveraged with top-down concessions, such as in Senegal. However, the process of tendering and negotiating concessions in Senegal has been slow, and it would be difficult to implement in other African countries with weak institutional support and weak private sector development.
- When unable to attract international private sector investment in rural electrification, the bottom-up model used in Mali has proven successful in promoting investment in rural electrification projects.
- Coexistence of the national utility and private operators also presents the problem of uniform versus nonuniform tariffs. Tariffs need to be cost reflective to ensure sustainability and quality service, but they can also be controversial because they can create disparity among communities receiving the same type of service.
- Access to long term financing is important for the development of most of the renewable energy technologies. Since energy is a new business line for the local commercial banks in most of the SSA countries, capacity building on the appraisal of the energy projects would be needed.

Presentations and Speakers

"REAs/REFs in Rural Electrification: A Review of three EU Rural Electrification Reports," Ralph Karhammar, Consultant, EUEI-PDF.

"The Role of the REA/REF in Increasing Access to Modern Energy in Rural Tanzania," Bengiel Msofe, Director for Technical Services, REA, Tanzania.

"L'expérience sénégalaise en matière de partenariat public-privé pour l'électrification rurale," Amadou Sow, Assistant Directeur General, ASER, Senegal.

"Le Partenariat Public Privé dans l'ER : Approche Bottom-Up; Lamine Coulibaly," AMADER, Mali.

Windmills.

3.5 REA/REF 2: Group Specific Questions | What Can Be Done to Address Constraints?

Overview and Session Objective

The discussion session followed up on the earlier panel session, "Recent Experience with REAs/REFs—Successes, Problems, Solutions." It also included additional country cases from REAs and expanded on the lessons learned from Club ER and the REAs of Madagascar, Zambia, and Zimbabwe. The session was attended by about 30 participants. This moderated discussion session reflected on how the presented models for rural electrification could work better.

Key Questions and Challenges

In assessing whether the capacities of REA/REFs are adequate for the expansive phase of rural access, there are questions and challenges that need consideration:

- What are the main characteristics of country programs that are showing good results and noticeable scale up of rural access?
- How should some REAs switch from relying on government transfers to raising new capital to fund profitable projects?
- Important challenges include limited funding for projects and inability to attract private sector participation, low level of staffing, low tariff levels, low income among target population, and others.

Club ER

Rural Electrification Club (Club ER) is an operational network, established in 2002, consisting of REA/REF, utilities, ministries, and regulators. The club runs two to four thematic training sessions per year and provides business-to-business exchanges as well as access to a database with socioeconomic data and equipment costs for rural electrification. For financing rural electrification, Club ER identifies three distinct phases: the development phase, the construction phase, and the repayment phase. Of these, the construction phase carries the most monetary risk, and the repayment phase the least.

In many cases, REFs remain "funds without funds," and are used merely as an account to transfer subsidies, have little to no leverage effect, and are not structured as financial intermediaries with the legal ability to borrow, issue bonds, lend to local operators, and the like. Since local banks are not committed to rural electrification, the financing for these projects remains a challenge.

The Case of Madagascar

Madagascar created ADER and REF in 2002. REF served as a bank account with public funding, including a small levy, but disappointing overall contributions. After five years, 9,962 customers and 160 towns were electrified. Size of PPP authorizations were limited in geography and customers (less than 500) and led to increased attention to private operators for large concessions. REF went through several steps of restructuring, starting by creating state/private joint ventures, with limited lenders' confidence in the state/private shareholder setup and support to the national policy implementing institution. Further fine-tuning followed, with separation between investments and operation for small operators and franchising areas for larger operators on a build, operate, and transfer (BOT) basis. A second round of restructuring of the REF is under way involving a phased approach that creates an asset-holding company and a fully-fledged financial institution/fund, providing REF with wider financial autonomy.

The Case of Zambia

An REA representative presented the agency's experience implementing rural electrification projects in Zambia. Created in 2003, the REA has so far implemented over 80 grid extension projects and installed over 200 solar PV systems for schools, clinics, and others. Among the challenges reported by REA were: limited funding, low level of staffing, poor road infrastructure in project areas, sparse population, insufficient generation capacity, low tariff levels, and low income among the targeted population.

The Case of Zimbabwe

An REA representative presented the agency's experience with centralized grid planning and implementation in scaling up rural electrification. The rural electrification program began in 1983, but was implemented slowly because RE was not a top priority for the national utility. Outsourcing through contracting was time consuming and transaction costs were high. In 2002, however, the REF and REA were established, and REA is now responsible for both national planning and actual implementation of rural electrification projects. It has established offices in every district and headquarters in each province. Its funding comes from a 6 percent consumption levy on tariffs. REA is targeting 10,000 rural institutions (such as schools, clinics, administrative offices, and more) with 100 percent capital subsidy and is granting a 60 percent capital subsidy for villagers.

REA faced a number of challenges during its operation, among which were a very low usage of electricity in rural areas, which meant small load densities with very high electrification costs; a conventional grid that was unsuitable for some remote areas; and rural institutions and households were unprepared for connecting. In response, REA developed: (i) cost-effective grid technologies, for example, SWER; (ii) a low-cost distribution board and a quick cheap connection kit; and revolving-loan schemes for; (iii) electrical machinery; and (iv) house wiring.

In areas where grid extension is too expensive, REA is turning to other solutions, such as constructing 350 solar decentralized minigrid systems, rolling out solar lamps and biogas digesters for rural schools and clinics, and constructing microhydro plants with an NGO.

Key Findings

- There is no preferred institutional structure for rural electrification: suitable models will vary based on individual (national) circumstances, relative strength of the utility, the REA/REF, source of financing, private sector participation, government capability and resolve, and other factors.
- The most successful countries in achieving noticeable scale-up of rural access are countries where strong government commitment is combined with government financing and a dedicated, capable implementation institution.
- Utility-based central planning remains relevant and leads to focused and effective project implementation wherever there is a strong utility to take the lead. However, it should be customer focused and prioritize the energy requirements of rural people, instead of top-down planning.
- To address financing deficiencies, a start-up grant can be used for early project support for developers—with the prospect of establishing a revolving fund to finance electrification access projects. Educate local banks on appropriate risk-sharing mechanisms (cofinancing counter guarantees) to encourage their participation. A gradual increase in the national contribution (bond issues, tax per kWh) can help ensure long-term sustainability of the financial mechanism.
- Mobilizing private capital and private sector actors in rural electrification is a challenge, and donors frequently prefer to work with the national utility (sometimes "by tradition"), rather than funding alternative, private sector–led rural electrification on a large scale.
- REFs should be full-fledged financial institutions capable of raising funds and financing profitable projects. REFs that do not receive private capital need to "hunt" private capital and provide suitable documentation that shows sufficient returns on investment.
- REFs' capacity to evaluate projects, prepare project pipelines, and conduct financial engineering needs to be further strengthened through collaboration with other REAs/REFs and international organizations.
- Project portfolios should comprise different risk/reward profiles, and long-term strategic business plans for REFs should be formulated that focus on a mix of projects with different profitability levels to permit "equalization."
- Cost-effective grid technologies, such as SWER, can be important in decreasing costs and improving access scale up.
- Evaluate the ramifications of changing REAs/REFs and creating asset-holding companies with distribution assigned to private operators (Madagascar model).
- Work on strategic partnerships with NGOs to offer other forms of energy planning.
- On the question of whether the current capacities of REA/REFs are adequate for the expansive phase of rural access, the participants did not reach conclusive answers. A follow-up forum/network should be provided for further exchange of views.

Presentations and Speakers

"How and what REF/REA learn from their respective experiences when they join the CLUB-ER: illustration on rural electrification financing," Denis Rambaud Méasson, Secretary, Club ER, Congo Brazzaville.

"REA's Experience in Implementing Rural Electrification Projects," Stanley Lyalabi, Senior Mini Hydropower Development Officer, REA, Zambia.

"The advantages of centralized planning and project implementation in up-scaling grid extension in rural electrification programs – the Zimbabwean Experience," Josphat Muzilikazi, Chief Executive Officer, REA, Zimbabwe.

"Expérience de PPP Perspective de révision du Fonds National de l'Electricité – Madagascar, " Hary Andriantavy, Executive Secretary, ADER, Madagascar.

3.6 Lighting Africa Clinic

Overview Session Objective

By 2030, over half of the world's projected 1.3 billion people without access to electricity will be in SSA, as population growth exceeds the pace of rural electrification. The majority of the rural population in SSA still uses kerosene, wood fuel and candles for lighting, damaging both individual health and the environment. This session presented the latest developments in off-grid lighting and microenergy technologies, including how they can complement rural electrification programs. The session also introduced the Lighting Africa (LA) and GIZ EnDev programs in Ghana, Kenya, and Rwanda, which are dedicated to the rural electrification product market scale up. The session was designed to create a discussion between REAs and the private sector on strategies for long-term sustainability of the off-grid lighting effort.

Key Issues and Challenges

- Market intelligence shows that there is an unmet demand for LED products in the region but suppliers are having difficulty securing credit to import the LED goods and lack rural distribution infrastructure.
- LED product manufacturers struggle to find business partners due to high market barriers; they perceive Africa as a high risk market with little or poor regulation and policy.
- When are subsidies appropriate and not? What is the best role for the public sector?

Case Study | Lighting Africa

LA is an energy access program designed to move the market toward cleaner lighting with diverse off-grid lighting products designed to satisfy "base-of-the-pyramid" consumer needs in Africa and Asia. LA includes five components: (i) quality assurance; (ii) market intelligence; (iii) consumer education; (iv) business support and access to finance; and (5) policy and public sector operations.

The program operates along the market development curve from quality assurance and market intelligence to catalyzing venture and mainstream financing. Quality assurance is a key component of the program's activities, with strict testing methods for system and component performance and manufacturing quality/durability.

LA's pilot projects in Ghana and Kenya have demonstrated that government policy and strategy have a significant impact on the private sector's ability to advance in these markets. Strong demand has also been a key to success in these countries. LA program expansion countries are Ethiopia, Mali, Senegal, and Tanzania.

Case Study | Rwanda

In Rwanda, GIZ has implemented a variety of results-based financing (RBF), as temporary interventions to create revenues from markets more lucrative and/or more certain than the base case, to accelerate investment. The main characteristics of the program are private sector delivery and innovation along with private sector leveraging of public funding for capital investment. RBF allows market players to overcome market barriers such as high capital costs. Three markets are targeted: LED lanterns, biogas digesters, and renewable energy powered community grids.

The benefits of an LED market would include financial and health benefits for households and small businesses, as well as the avoided dispersion of 31,000 tons of CO_2 into the environment. The presentation highlighted the various channels through which lamps were distributed in the survey countries to allow households to test products over a few nights; lending to particularly poor households; and collaboration with large local companies.

GIZ found that consumer preference changed upon familiarity with the products, and handling of newly introduced products revealed the need for more robust systems. Systems with poor quality, dim light, and/or short life spans replace much less than one kerosene lantern per household; high-quality systems can replace more than one kerosene lantern. An additional conclusion was that the weak point of most lamps was the charge controller. Further investigation into overall household needs and long-term field tests are needed to truly understand product performance.

Discussion Sessions

The first discussion session was dedicated to the private sector and service providers; the panelists represented Barefoot Power, Sun Transfer, Solaid Kenya, and Solar Sister Uganda. During this session, the participants discussed access to finance and competition with low-cost, low-quality products.

Some of the participants thought a focus on high quality was warranted, and others said the focus should be on marketing and sensitization, which helps people make an informed choice, and financing strategies, which make high-quality products accessible. Some experiences indicate that consumers sometimes start with the cheapest product, and after a bad experience may upgrade to a better performer.

The role of government and the importance of standards were also discussed during the session. Private sector stakeholders highlighted barriers encountered in customs clearing and the lack of global standards for off-grid lighting. Subsidies can also interfere with private sector activities: directly subsidizing enduser prices of small products can severely hamper market growth. Alternative assistance methods are needed, such as debt financing for containers and technical assistance.

The group also covered distribution models for reaching households at "the last mile." These households have been successfully reached through microfinance institutions (MFIs), women's groups, local technicians and NGOs, depending on the setup. Dedicated micro-entrepreneurship programs and public sector initiatives such as school campaigns have also been reaching these households.

A second discussion followed among the REAs of Senegal, Tanzania, and Mali. The REAs outlined how they are working with the private sector to nurture markets for off-grid lighting through feasibility studies and regulatory frameworks.

Key Findings

Some of the key messages emerging from this session include:

- Suitably designed dealer financing and RBF schemes may allow suppliers to overcome SSA market barriers and to accumulate the necessary capital to achieve sufficient margins to self-finance product import shipments. The issue of costly rural distribution might be alleviated through smart distribution chains cofinanced by MFIs, microfranchise enterprises, and by involving community groups, including youth groups and women, and/or by combining social infrastructure subsidies with fully commercial markets for small systems.
- It is probably possible for high-quality off-grid lighting to compete with inexpensive, low-quality products if sufficient attention is given to consumer outreach, advertising, creating an image for high-quality solar, and advertising (and possibly supporting) service delivery such as warranties.
- Virtually all private enterprises strongly argue that direct subsidies are counterproductive in the case of small lighting products such as solar lanterns and small SHSs. Furthermore, they are not needed for market growth in this segment because it will grow fast by itself. The private sector believes that government efforts in this segment of rural electrification should be centered on consumer education (on quality), access to finance, training of skilled local retailers, and creation of an enabling environment. In this line of argument, direct subsidies should only be provided for social infrastructure such as schools, clinics, and street lights.

Presentations and Speakers

"Lighting Africa: Catalyzing Markets for Modern Lighting," Leo Blyth, Energy Specialist, World Bank.

"Results-Based Financing: LED lanterns in Rwanda," Benjamin Attigah, Programme Manager, EnDev, Rwanda.

Goyola, Guinea, Mr. Alexis Kamano, owner of a business offering recharging of mobile phones.

3.7 Access Planning and Sectorwide Planning Processes

Overview and Session Objective

The sectorwide approach (SWAP) is a country-led *programmatic framework and process* for systematically planning, financing, and implementing a results-focused, long-term sector development and investment program that is aligned with national priorities and targets for electricity access nationwide and for the benefit of all.

The SWAP framework and process aims to mainstream a modus operandi of joint sector engagement and accountability across all partners and stakeholders. It represents a significant shift away from delivering aid project-by-project or donor-by-donor toward development partners directing their support to priority investments and technical assistance identified in the common sectorwide investment program of the government.

SWAPs have been commonly used in the social development sectors—health and education—and then adapted in transport, water, and agriculture sectors. Only recently have some countries, notably Rwanda, started to deploy a SWAP framework in the energy sector to scale up national electricity access. Several other countries are in the process of developing a SWAP framework because they recognize the significant advantages of a sustained national electrification program targeting at universal access in the medium term.

One objective of the session was to highlight the Rwanda SWAP electricity access case—its roadmap and preparation process, key analytical building blocks, and implementation experience to date—for those considering a shift to the SWAP approach to scale up national electrification with the goal of universal access in a specific time frame. The presentations and discussions also focused on the investment planning frameworks in use for scaling up access nationally in other SSA countries (notably Ghana and Côte d'Ivoire).

Key Challenges

Compared to other sectors, integration of SWAP in the energy sector faces several challenges. This is because many energy projects require large-scale investment and are capital intense—especially in grid generation and transmission investments—and are often "one-off" and discrete. Moreover, there are typically fewer development partners engaged compared to the social sectors. However, national electrification programs for systematically and sustainably scaling up national electricity access coverage do not share the characteristics of the generation and transmission subsectors. Achieving near universal access typically requires an ongoing and steady stream of annual and incremental investments in numerous and relatively small subprojects involving medium voltage (MV) and low voltage (LV) network extensions and intensification of affordable customer connections—and off-grid service options—underpinned by an analytically sound spatial least-cost network expansion and investment plan.

The Case of Rwanda | SWAP and Geospatial Planning for Electrification Access Scale Up

Implementation results of the Rwanda SWAP have been positive; the utility is meeting or exceeding the targets set for investment and new connections, as well as for unit cost reduction targets in the investment cost per new connection. Under the SWAP program, the national utility of Rwanda has impressively ramped up, in short order, its annual implementation rate from under 1,000 connections per year prior to the start of the program (2008) to a current annualized rate net of 60,000 new connections. Furthermore, implementation costs are in line with the target unit cost average of US$600 per new connection, compared to historical average costs of the pre-SWAP program, which started at US$2,000 per new connection.

Presentations from both the World Bank and Rwanda's Electricity, Water, and Sanitation Authority described the case for implementing SWAP in the energy sector in Rwanda; the decision to implement a SWAP arose out of a combination of different factors, including a very low electrification rate (6 percent or approximately 65,000 connections in 2008), a severe drought period that led to supply shortages, and a low available generation capacity (41 MW). The objective of the SWAP was to develop a high-level investment and capacity-building plan for sustainable and predictable financing *over the term of the program* to enable national electricity access expansion to meet Rwanda's targets, while ensuring that supply adequacy is attained by expanding generation capacity by qualified independent power producers (IPPs).

On the network side, the SWAP was designed to identify the least-cost network rollout for electricity to be extended over the next 20 years, with a medium-term target for 2014, from the broader perspective of powering growth and quality of life for the people. Specifically, the first five-year time slice of the program aims to increase electricity connections from 110,000 (2008) to 350,000 (2014), and substantially increase electricity access for social infrastructure facilities in the health and education sectors. Crucially, the spatial and rapid planning platform deployed consider social and economic characteristics of each sublocation within the country, as well as the demand conditions, while balancing access and affordability to new beneficiaries and the affordability of the investment subsidy to be borne by the government.

A notable feature of the Rwanda SWAP is the deployment of a high-level, spatial, least-cost network rollout planning and costing platform for national electrification planning to anchor the sector "Access Program Investment and TA Prospectus" document. The prospectus, which included a proposed financing structure and plan, is a high-level information document prepared in a consultative manner with key stakeholders participating in the process. The SWAP framework and process and the resulting outcome in the prospectus proved to be pivotal in rallying all major stakeholders in supporting the sectorwide "bankability" during the donor financing roundtable for the first five-year time slice of Rwanda's national electrification program (2009–14).

The Case of Côte d'Ivoire

Côte d'Ivoire presented a supply-driven planning method that involves optimal planning and development of distribution networks. The planning method involves identification and prioritization of candidate locations based on socioeconomic and administrative criteria, such as ratio of population, distance to network, location, infrastructure (schools, health, industrial units). The method uses a geospatial information system (GIS) and other software management tools to study networks and their graphical representation. Advantages are that rapid and sustained growth of national coverage was reached with the access rate reaching as high as 73.8 percent, but there is a technological limit to grid connections, leaving other small localities and scattered settlements removed from the existing network.

The Case of Ghana

Ghana research center KNUST presented its research paper, which estimates the cost of electrification technology options to aid electricity access scale up. The method is based on the concept of the Geospatial Net-

work Planner Model, a Web-based and accessible geospatial least-cost MV and LV network rollout platform developed by the Earth Institute of Columbia University. The model combines geospatial data from census data on household size and population settlement patterns, information on where the economic centers are located, locations of major health and education and administrative facilities, and relevant socioeconomic and affordability data to develop demand estimates for each sublocation and its ability to pay monthly bills. These data are represented in the model by inputting several "layers" of GIS-referenced data with corresponding datasets on each category of input parameters selected. For example, one layer captures the existing MV grid and higher voltage grid network in a digitized format. Another layer defines relevant model input costs—investment and operating—associated with all technology options defined, such as MV network extension, LV reticulation investment cost per unit of materials, household density in each sublocation for LV reticulation, as well as generation supply options, including decentralized options such as solar PV systems and small hydro if potential exists in a given sublocation. The model computes cost projections for three different electrification options (grid, minigrid, and off-grid) and, utilizing optimizing algorithms, identifies the optimal least-cost-effective option for electrifying communities within a specific time period.

By 2020, the model results reveal that the majority of unelectrified communities in Ghana will be viable for grid electrification and that the cost-optimized option for the majority of the unelectrified communities in Ghana should be grid based, which accounts for more than 70 percent of the total unelectrified communities in each region.

Key Findings

- A SWAP in the context of a national electrification *program* for scaling up access consistent with national targets and policies is a useful framework for preparing a comprehensive and consistent high-level investment and implementation plan that sets the stage for proposing a sound platform for a bankable financing structure and financing plan for the program, around which major stakeholders and key development partners can rally in support.
- The spatial least-cost integrated (grid and off-grid) rollout investment and implementation planning platform used in Rwanda proved to be effective because: (i) it was seen as a national development plan rather than a electricity sector plan; (ii) it was inclusive in that all key stakeholders (in country and external) participated on an ongoing basis during preparation of the spatial plan and preparation of the prospectus document based on that plan; (iii) rallying development partner contributions in a coordinated manner as well as increasing the number of donors, and the total financing support pledged at the donor financing roundtable was a success. Other key benefits from a well-prepared SWAP potentially include: increased predictability (and possibly scale) of sector funding from donors; increased transparency and accountability; more effective partnerships; increased donor coordination—alignment—leading to lower transaction costs for disbursing and receiving donor funds; and results that track national targets and priorities.
- Moving to a SWAP framework and process requires a shift from project-by-project and donor-by-donor aid delivery to sectorwide development and investment planning focused on results and aligning financing contributions across partners to achieve targeted electrification rates and support capacity building. This shift can be facilitated over time via increased harmonization of processes and procedures across donors; joint accountability for regular monitoring of implementation results; and coordinated action to address related policy and logistical challenges as and when they may arise. Necessary enabling conditions are strong country ownership and leadership to steer the SWAP, sustained for the term of the national electrification program.
- The Rwanda SWAP experience highlighted that the classical, top-down style "RE master plan" genre study framework pursued in many countries is limiting on several essential counts. The latter style is overly cumbersome in comparison to the new genre spatial planning platform deployed in Rwanda—which provides a dynamic platform with rapid capability at modest cost to input changes in key variables

and update the plan results and costing in real time (two to three years to complete a report compared to well under six months) and costs substantially more (at around US$1–2 million plus for a classical RE master plan study, they are anywhere from four- to eightfold more expensive). One consequence is that the conventional master plan genre reports are hard to update on a timely basis in response to constantly changing ground conditions and can be out of date in the time it takes to update them.

Presentations and Speakers

"Sector Wide Approach for Planning and Expanding Electricity Access Rwanda case study," Arun P. Sanghvi, Consultant, World Bank.

"SWAP Implementation, Rwanda's Experience," Edward Kasumba, Coordinator, Electricity Energy Access Rollo-out Program, Energy, Water and Sanitation Authority (EWSA), Rwanda.

"Planification de l'accès à l'électricité en Côte d'Ivoire," Yves Serge Ahoussou, Responsable des Etudes Générales – SOPIE / Coordonnateur Thématique, CLUB-ER.

"Estimating the Cost of Electrification Technology Options to Aid Electricity Access Scale Up: The Case of Ghana," Isaac Adu-Poku, Research Associate, Energy Center, KNUST, Kumasi, Ghana.

3.8 Financing Connection Charges

Overview and Objective of the Session

Connection charges in SSA are very high compared to other regions and they represent a major barrier to access scale-up. There are various factors explaining high connection charges in SSA, including complex technical design reflected in high distribution cost; procurement; recovery of distribution cost through connection charges rather than monthly bills; and others. This session presented various potential solutions that have been adopted by SSA countries to make connection charges more affordable for the poor.

Key Questions and Challenges

- Connection charges and internal house wiring costs present a major out-of-pocket barrier to poor households connecting to the electricity grid, even in areas that are within easy reach of the network reticulation today. Many of these households can afford to pay their monthly consumption bill otherwise, but high upfront connection charges impede their access to electricity.
- Connection subsidies would help poor households have access to electricity. However, connection subsidies raise sustainability issues and they need to be properly designed.
- In many countries, it is difficult to recover connection charges via monthly bills since many utilities do not even fully recover the operational cost.
- Various credit schemes can be implemented by utilities and/or financing institutions to make access to electricity possible for the poor. Many SSA countries are piloting or plan to implement credit plans for the poor. What are the lessons learned from their experiences?
- Rural, low-income households struggle to afford internal wiring payments, which may be a deterrent to obtaining a connection. What can be done to facilitate payments for internal wiring?

Five cases were presented during this session describing how countries are beginning to address these challenges through a variety of promising financing schemes for access scale up.

The Case of Kenya

Kenya Power (KPLC) has implemented various subsidy and credit schemes to increase electricity access from the current rate of 29 percent to 40 percent by 2020. In urban and peri-urban areas, KPLC has implemented group schemes (*umeme pamoja*) for the supply network design for potential customers and the maximization of the utilization of the line by installing transformers in high density areas traversed by power lines to increase the connectivity potential in the existing network. In both cases, the targeted customers share the cost of connection to the grid. For slum electrification, KPLC has implemented a subsidized connection program facilitated by the World Bank, with support of the Global Partnership on Output-Based Aid (GPOBA). Pre-

paid meters have been installed for all households connected under the GPOBA. Special financing schemes have been implemented by the REA for rural customers that benefit from subsidized connection charges and pay the connection in installments over a year. Ready board units are used for internal wiring. In addition to the options presented above, two credit schemes are available to facilitate the connection of households to the grid: (i) Equity Stima Loans, managed by Equity Bank, are available to all customers regardless of income as long as they meet the terms of the bank (30 percent upfront, 15 percent annual interest rate, payment in installments over 36 months); and (ii) KPLC Stima Loans for customers who can only afford to pay 20 percent of the connection charge upfront and 80 percent in installments over 24 months, with a 2 percent administration fee charged on the amount of the loan. A revolving fund funded by the French Development Agency (AFD) which targets low-income customers of KPLC and the REA, has been implemented on a pilot basis and is planned to be rolled out into a national revolving fund. To facilitate repayment of loans, various initiatives are underway, including setting up payment points and/or payment through mobile phones.

The Case of Senegal

Two private concessions, Dagana/Podor/St-Lois and Kaffrine/Tambacounda/Kedougou, have yet to meet connection targets specified in their concession agreements and hence are able to recover costs via regulated tariffs. The operators recover the connection charges (including connection to the grid and internal wiring) through monthly bills over a period of 10 years, with annual interest rate of 15–20 percent. This prefinancing plan is expected to increase electricity coverage by making connection charges affordable for the poor. Also, this is a sustainable financing solution for access that does not involve subsidies.

The Case of Uganda

Uganda has piloted various approaches subsidizing connection charges with mixed success, partly because in previous access programs, subsidies have not been reflected at the final user level. Several private operators for grid extension (Ferdsult Engineering Services Ltd. and two cooperatives, Bundibugyo-Ntoroko and Pader-Abim-Agago Cooperatives) have benefited from a capital subsidy of up to 80 percent in a program funded by the Swedish International Development Agency (SIDA). Although the initial connectivity response was significant, the pace of electrification has slowed down due to the high wiring cost in rural areas. The West Nile Rural Electrification Co. Ltd. is among the first minigrid operators to benefit from REA's support since 2004, with financing from the International Development Association (IDA). The operator received US$100 per connection, but the customers paid the full connection charge (US$148 for no pole service and US$548 for single-pole connection). The pace of connection remained low, largely constrained by the electricity supply.

The recently designed output-based aid (OBA) scheme is expected to increase access of poor households to electricity. The program is financed by the GPOBA and targets households that have not been able to connect to the grid in the 18 months after the distribution network was installed. The program provides a one-time connection subsidy to poor households located from no-pole distance from the existing grid. The program reaches customers that cannot afford to pay the connection charge but are willing to pay for internal wiring and energy consumption once the households are connected to the grid.

The Case of South Africa

National electrification in South Africa is viewed by the government as a social service. The programmatic approach that the government has been following includes a transparent capital subsidy transfers program for electrification, which is financed by the national treasury. However, insufficient capital subsidies (only 50 percent of the planned allocation over the last seven years) have slowed down the pace of electrification. Although capital subsidies are important to ensure affordability of the electricity service for the poor, customers have to make financial contributions to ensure responsibility for infrastructure. Prepaid meters are important for revenue collection.

South Africa's "nongrid program," based on SHSs, is implemented mainly by concessionaires that benefit from capital subsidies. The customers pay a monthly service fee and municipalities subsidize the customers' maintenance fee, while the concessionaires repair, maintain, and replace SHSs until the grid arrives.

One of the continuing challenges South Africa is experiencing is the high demand from new households, which is outpacing the number of new connections made. With more households added, the electrification programs' marginal investment costs are also rising very rapidly, because financing increasing subsidy transfer payments poses a growing challenge.

The Case of Mali

A pilot project in Mali implemented by SharedSolar is currently implementing a pay-as-you-go rural electrification program using solar modules of 1,400 watts peak (Wp), with the capability of holding two days of backup storage. The connection of customers to the microgrid is recovered over time, on top of the energy consumption cost through the pay as you go system. Prepayments are possible through several channels, such as cards with codes that can be sent through Internet and mobile (GPRS/GSM) networks to the server, which then automatically give the household credit for energy use. Other payment methods include local vendors with wireless tablets and Internet top up. SMS notifications are sent to inform the customers of the balance.

Key Findings

- Various options to address affordability (connection subsidies, credit schemes, group schemes, revolving fund, recovery of connection charges through monthly bills) have been piloted in many SSA countries. The design of a financing scheme should primarily consider the country context: the level of the connection charge, institutional setup, regulatory policies, available funding, and targeted population.
- Addressing high connection charges should be part of a holistic approach aimed at reducing distribution cost. This entails working aggressively to reduce the capital costs of connections and metering, including LV and MV via low-cost technical equipment designs and internal wiring.
- When the objective is universal access, poor consumers will require assistance in paying the connection charges—otherwise this target cannot be met. Specifically, SSA countries are increasingly pursuing a policy aimed at achieving majority access or near-universal access, many within the next two decades. With this objective, poor consumers, who are a growing segment of households in many countries, will require financing solutions for paying the connection charges—even if low-cost grid solutions and off-grid technologies are applied to reduce costs (see respective sessions on these topics).
- While the idea of rural electrification as a social service is motivating, considering the significant demand for connections, sustainable financing solutions are needed.

Presentations and Speakers

"Connection Charges in SSA," Raluca Golumbeanu, AEI Coordinator, World Bank.

"Enhancing Connectivity Through Affordable Connection Schemes,"Benson Muriithi Chief Manager, Distribution, KPLC, Kenya.

"Préfinancement et remboursement des frais d'installations intérieures dans les concessions d'électrification rurale," Paule Marie Sagna, Junior Expert Electrician, Regulatory Commission, Senegal.

"Uganda's Experience with Promotion of Rural Electrification—Connection subsidies," Benon M. Mutambi, Ag. Chief Executive Officer, Electricity Regulatory Authority, Uganda.

"Background to South Africa's Electrification Programme," Wolsey Barnard, Executive Manager, National Electrification Programme, Department of Energy, South Africa.

"Pay-as-you-go Rural Electrification Tiby, Mali" Sebastian Rodriguez-Sanchez, Consultant, World Bank and SharedSolar Team Member.

Power lines.

3.9 Minigrids and Regulation

Overview and Session Objective

These two sessions (the presentation session in the morning and the discussion session in the afternoon) focused on common regulatory issues that arise for connected and isolated minigrids, regardless of whether the regulation is performed by a separate regulator or an REA. Among the issues covered were: setting both the level and structures of retail and wholesale tariffs, automatic adjustment clauses, establishing workable technical/commercial quality standards of service, and implementing light-handed regulation. These issues were discussed from the perspective of regulators, operators, and customers. The two sessions were attended by about 45 participants.

Key Issues and Challenges

- A major barrier to minigrid development is the absence of clear regulatory rules and difficulty in obtaining debt and equity. These barriers have impeded private sector investments in minigrids. Private operators and households face high interest rates and short payback periods for loans, which raise costs. West African REAs typically offer up to 80 percent of investment costs as grants, but there still remains the issue of debt and equity financing for the remaining investment costs.
- National power utilities are often reluctant to shoulder the transaction costs associated with taking on many small customers in rural areas, each with generally low kWh consumption. Hence, the hybrid approach, the national utility selling to power to private operators of mini distribution grids (used in several countries in Asia), may be a viable option for Africa as well.
- The typical West African tariff structure creates problems for minigrids. Most minigrids in West Africa offer a mix of unmetered, flat, fixed monthly tariffs and a metered per kWh tariff. The flat fixed monthly fee tariffs obscure the reality of very high per kWh charges. In contrast, the per kWh charge for metered customers is often constrained to the non-cost-recovering levels of the kWh tariff charged main grid-connected customers of the national utility. This creates an incentive for flat tariff customers to try to become metered per kWh customers to lower their monthly electricity bills. But the operator will usually oppose this because it will lower overall revenues. This mixed pricing structure of flat and per kWh tariffs, combined with political constraints on the latter, makes operators reluctant to offer metered kWh tariffs that would be needed to support productive uses.
- The unintended effect of tenders' connection criteria for large regional concessions—if the main criterion is the number of customers connected after three years with a fixed amount of subsidies— is that the operator is incentivized to choose the lowest investment cost solution (for example, household solar PVs), which might not be the best economic solution and would favor the smaller customers rather than the larger ones.

Case Study | Regulatory and Technical Issues in Operating Hybrid Minigrids (Senegal)

Regulation should have several aims, including commercial sustainability for investors, and protecting consumers from inefficiencies and monopoly profit. Rural electrification needs to be rolled out using thorough socioeconomic studies with measurement on current energy expenditures and arrangements for payment, and market segmentation to produce an estimate of the size of the market to be served by each type of service. Optimum connection charges can be based on two factors: ability and willingness to pay. The barrier of access fees and installation costs has been overcome by having the consumer pay one or several installments before being connected. On the supply side, the service provided must match the consumer's ability to pay. Service quality is specified in both the concession contract and the service agreement with the enduser.

Case Study | Tanzania (EWURA)

Tanzania's legislative framework for SPPs was created in 2003 under the Energy and Water Utilities Regulatory Authority Act. The act established the Energy and Water Utility Regulation Authority (EWURA) as a multisectoral regulator. EWURA has established small power purchase agreements (SPPAs) and created a standardized tariff methodology (SPPT). EWURA has created different SPPAs and SPPTs for SPPs connected to the main grid and existing isolated minigrids. The tariff calculations begin with EWURA revising annual data from TANESCO (the national utility), results are then reviewed by a working group and submitted to the EWURA board for approval. Some of the common barriers in Tanzania are high interest rates and SPPs' difficulties in acquiring land and water rights; this is why the inclusion of land ownership and water rights is recommended for any future national energy policy, along with the promotion of multiple source funding for projects, such as mixed grants and loans.

Case Study | Mali

The rural electrification framework in Mali has been designed to give private operators a role in electrifying an area and operating it over the long term. AMADER, the REA, carries out its mandate to promote and regulate rural electrification through PPAs, individual programs for small- and large-scale markets (PCASER and ZEM), and subsidies limited to 80 percent of investment. Using this framework, **Électricité de France** (EDF) as a developer, established four service types for different consumers based on fixed fees and fees per kWh. Tariffs are regulated through an automatic adjustment formula that considers materials' cost, a manpower index, inflation, and the cost of gasoline. The formula is further linked with the choice of technology, whether it is grid connection, minigrid, diesel, hybrid plant, or SHS. Experience has shown that further incentives are needed for RE development, and that during the first 5 to 10 years of operation, the REA should be performing both grant giving and regulatory functions.

Case Study | Guinea

The presenter outlined ways that the Bureau d'Électrification Rurale Décentralisée (BERD) reduced the cost of rural electrification. Within a 3 to 4 year period, BERD reduced the connection prices of 24 operators in the country. Like AMADER in Mali, BERD plays a dual role as the REA and the economic regulator. Connection charges were reduced by using equipment produced locally by small and medium enterprises (SMEs); using locally produces poles; reducing the cost of lighting by billing per bulb and using local workers; having micro-shut-off points on meters; and negotiating with the Ministry of Finance to reduce taxes on imports for rural electrification products. At present, the customers of all 24 operators are on unmetered, fixed monthly tariffs.

Following the presentations, participants in the session were given the opportunity to ask questions and begin discussions on issues of interest. Some of the participants noted that access to electricity should not be made at the expense of the environment, and also include cost considerations; the environmental impact of

technologies needs to be considered before they are chosen, along with their cost and benefits. Another point of the discussion was the need for "light-handed" regulation to not overburden stakeholders in the market, and that governments should develop sound policies to facilitate RE development with well-designed tariffs.

Key Findings

Some of the key messages emerging from the two sessions include:

- During the first 5 to 10 years of a rural electrification program, a combination of two roles—promotion/grant giving and regulation—within the same body (Guinea and Mali) is probably more effective than having these functions performed by separate entities.
- Maintain the principle of free technological choice. Do not force operators to use only renewable energy. Hybrid generation options (that is, renewable energy plus diesel fuel) may offer lower costs and better service for consumers.
- If the per kWh tariff is set too low (for example, at the level of the national utility's kWh tariff), minigrid operators will have a disincentive to offer per kWh tariffs, and therefore it will be difficult to promote productive uses that are more energy intensive.
- Flat, fixed monthly tariffs may facilitate commercial sustainability (that is, provide revenue to the operator), but often hide relatively high per kWh charges.
- A major impediment to expanding access is the payment of an access or connection fee. A new user not only pays for the right to access a service, but also has to cover the cost of installation of indoor equipment. Operators should offer consumers the option of making one or more payments before being connected. In addition, the new user should be allowed to cover these costs over time with a small surcharge to the monthly bill.
- For minigrids, cost reductions can be made through simplifications in the cable structure, minigrid length, and pole specifications (for example, using 8 m poles instead of 12 m poles).
- The use of locally produced equipment can help reduce distribution prices. BERD significantly reduces its distribution cost by using locally produced poles after negotiating an agreement with the forestry department.

Presentations and Speakers

"Tanzania's Experience in Establishing a Regulatory System for Promoting Grid and Off-Grid Small Power Producers (SPPs)," Norbert Kahyoza, Commercial Manager EWURA, Tanzania, and Chris Greacen, Consultant, World Bank.

"Mini Grids and Regulatory Issues EDF's Experience in Mali," Guy Marboeuf, Head of Access to Energy Programme, EDF, France.

"Regulatory and Technical Issues in Operating Hybrid Mini-Grids," Mansour Assani Dahouénon, GIZ/PERACOD.

"Mini-Grid Tariff Summaries-Senegal-Mali and Guinea," Nava Toure, Directeur, BERD, Guinea, and Alphadio Barry, BERD, Guinea.

Solar panel installation.

3.10 Successful Approaches for Promoting Productive Use of Electricity

Overview and Session Objective

The promotion of productive use of electricity (PUE) has great potential to increase both the impact and the viability of electrification programs. The objective of the two sessions was to familiarize the audience with good practices for PUE promotion and discuss experiences as well as lessons learned. The session was divided in two, with the morning session presenting country examples from Ghana, Kenya and Zimbabwe, and a discussion session in the afternoon.

Key Issues and Challenges

- Productive use promotion is crucial for project viability and impact. However, PUE promotion is a complex endeavor that requires "know-how" and experience with promotion of economic development.
- The examples from Ghana, Kenya, and Zimbabwe all show different avenues for PUE promotion, including: (i) marketing of PUE opportunities; (ii) user education regarding PUE opportunities and equipment selection; (iii) demonstration of electric appliances; (iv) business development services; and (v) financing of electric appliances.

Productive Use Manual

The *Productive Use of Energy (PRODUSE)–A Manual for Electrification Practitioners,* presented during this session, was developed by the EUEI Partnership Dialogue Facility (PDF) and GIZ and provides a simple framework and a systematic step-by-step approach on how to plan, design, and implement productive use components in various electrification programs.

Case Study | Ghana

The Program for Sustainable Economic Development (PSED), presented by the Ghanaian Ministry of Trade and Industry, combines the provision of electricity and business training to SMEs. PSED is promoting local economic development through the establishment of light industrial zones with access to electricity and other services for SMEs. Among other objectives, the program seeks to help SMEs improve business management by offering training in: (i) business management; (ii) ecoefficiency; and (iii) occupational health and safety aspects, including in relation to electricity use. So far, eight industrial zones have been set up and seven more are being developed; 550 companies with 1,970 employees are operating in the supported zones.

Experience has shown that the provision of business development services such as Competency-based Economies through Formation of Enterprises (CEFE) trainings has been crucial for improving the performance of SMEs. The move to industrial zones has considerably enhanced electricity use among targeted SMEs.

Case Study | Kenya

KenyaPower has been promoting PUE through their customer base extension efforts, specifically targeting SMEs through pre-electrification customer education on PUE opportunities, and through partnerships with equipment manufacturers, financial institutions, and other stakeholders. These partnerships have provided access to a number of forums in which PUE is discussed, including shows of the Agricultural Society of Kenya, various exhibitions and trade fairs, and public bazaars and housing expos. During these events, Kenya Power facilitates the demonstration of PUE equipment by manufacturers.

Case Study | Zimbabwe

The REA has implemented an Electricity End-Use Infrastructure Development (EEUID) Program, a revolving fund that extends loans to new and existing rural customers to buy electrical machinery for small-scale businesses. Targeted sectors include small-scale agroprocessing and farming (irrigation). In response to low loan repayment rates in the first phase of the program, when the fund was managed by the REA, a commercial bank has been engaged to manage the facility and train business operators in basic business skills. The bank advertises the fund as part of its marketing programs.

Individuals submit project proposals to their nearest REA office, which in turn forwards them to the nearest branch of the partner bank. The bank assesses proposals using set commercial criteria, and successful applicants must make a 35 percent down payment.

Key Findings

- Productive use promotion should start even before customers are connected and include consumer education on energy efficiency.
- Energy efficiency standards and labels are vital to guide consumers in the selection of efficient appliances. National agencies overseeing product standards (for example, a national bureau of standards) can be key partners in improving transparency on the quality and energy efficiency of equipment for micro-, small-, and medium-size enterprises (MSMEs).
- Depending on the maturity of the local banking and MFI sector, there may be a need to implement stand-alone credit schemes for electric appliances and other investments related to PUE.
- The case of Zimbabwe's loan scheme for electric appliances showed that PUE promotion must follow a commercial approach and should not be perceived by customers as a social service.
- There is a wide range of possible actors who can take a lead role in PUE promotion. Corresponding to the cross-sectoral nature of PUE, successful approaches have involved different stakeholders from the private sector, civil society, and public agencies.
- There are mixed opinions about the PUE potential of solar PV, especially small-scale PicoPV. However, an important example of a small-scale PV-powered business that flourishes in many rural places (often independent of promotion efforts) is mobile phone charging.

Presentations and Speakers

"Productive Use Promotion: Rationale, Instruments, Structured Approach to Designing a Productive Use Component," Anna Brüderle and Lucius Mayer-Tasch, Consultants, EUEI-PDF.

"Marketing Productive Use of Electricity and Linking New Customers to Vendors of Electric Appliance,"

Rosemary Gitonga, Chief Manager, Commercial Services, KPLC, Kenya.

"An REA Operated Loan Scheme to Help Rural Business to Acquire Electrical Machinery," Clif Nhandara, Executive Director for Business Development, REA, Zimbabwe.

"Successful Approaches for Promoting Productive Use of Electricity: Ghana's Experience," Kofi Addo, Senior Commercial Officer, Ministry of Industry and Trade, Ghana.

Guinea, where a public-private partnership allows villagers to pay for electricity with produce instead of cash.

For rural schools in remote areas, PV systems may offer the least-cost solution for electricity access. Eastern Cape Province, South Africa.

3.11 The PV for Community Services Toolkit | A Workshop

Overview and Session Objective

Solar PV has been used in SSA to provide electricity for community services such as water pumping, schools, and health clinics in remote areas. PV is identified as a good technology for rural energy because it is a mature technology suitable for scattered, low-demand areas; it is modular, low maintenance; and good for stand-alone uses. Grid power, by contrast, is too expensive for many of these remote villages and households.

The PV for Community Services Toolkit is designed to guide electrification project managers through the design and implementation of PV operations and ensure that the tough choices regarding management, maintenance, ownership, and funding are considered from the beginning. The toolkit was written by PV experts, with consultation from local practitioners, to ensure that it is focused, relevant, and easy to understand.

Key Issues and Challenges

- Solar solutions for rural communities have been hampered by a number of challenges in the past, including: (i) high capital costs; (ii) low incomes of rural population; (iii) high transaction costs; (iv) limited numbers of supply outlets and skilled technicians; (v) lack of infrastructure; (vi) lack of financial sustainability and markets for management and support services; and (vii) difficulty in ensuring high-quality products and reliable postsale service.
- Most of the smaller solar systems available in the market today are still expensive for villagers to afford, especially considering their high upfront costs and the often low income levels of the population. On the other hand, products supplied by professional contractors are often of high quality and expensive. Thus, people tend to go for the cheaper products and are often disappointed.
- Many of the PV systems installed in off-grid rural community facilities stop working after three to five years. These system failures lead to issues concerning ownership, maintenance, and component replacements. After installation, institutional weaknesses often lead to misuse, maintenance failures, and weak supervision. Maintenance and system reliability are rarely tracked because project monitoring does not report on PV systems' performance.

Case Study | Sudan

Rural energy demand in SSA is generally centered around lighting, ICT, cooling, social infrastructure operation, security, and drinking water. The Community Development Fund (CDF) targets general health, basic education, and water supply in war-affected states. The program is financed through a multidonor trust fund

administered by the World Bank. The CDF approach consists of establishing baseline data in target communities, providing technical training at the community level, assisting in building business relations between Khartoum and regionally based PV companies/installers, and ensuring participation of state-based technicians in project implementation. The CDF PV program has covered 80 communities so far, and trained 70 technicians on system installation and maintenance.

Case Study | Senegal

The purpose of the Sustainable Solar Market Package (SSMP) is to aid sustainable development by designing contracts that are financially attractive to the private sector. It focuses explicitly on the commercial viability and long-term sustainability of the PV market. The program introduces financial incentives to improve affordability and assist firms in overcoming market barriers with a strong focus on postsales service and continued marketing. The implementation of SSMP highlighted the need for clearly assigned responsibilities along the supply chain. Other observations included the benefit of introducing lighting products approved by Lighting Africa and collaborating with agricultural cooperatives for PV system application in that sector.

Case Study | Ethiopia

The EnDev PV pilot program successfully completed over 100 functioning installations in health centers, enabling these facilities to have light in the evenings, power medical equipment, and offer additional medical services. Two system sizes are used: monocrystalline 17 KWp installations and amorphous 1.44 KWp installations. Power control is installed in a dedicated room with a battery charge regulator, battery bank, and a main distribution board.

EnDev, in collaboration with the Selam Vocational Training Center and the German Solar Energy Association, also launched a "solar school" where technicians can receive training on solar system installation.

Moving forward, the EnDev experience has shown that the establishment of minimum standards, with routine maintenance, institutional capacity building and awareness creation, is essential for maintaining the proper functioning of plants.

Case Study | PV Toolkit

The PV toolkit was created to address the often poor PV sustainability and to provide technical guidance for PV system configuration. PV technology is mature, and well-designed systems can work over a long lifespan; however, robust institutional arrangements must be put in place for O&M, especially for social systems. Establishing strong institutional arrangements for postproject ownership and maintenance funding are the main issues to maintain continuity. The toolkit provides guidance in comparing the cost of technologies; assessing local markets (size and performance of local PV market, including prices, quantities, quality, local capacities to support PV, country PV experience, and more); analyzing institutional arrangements; and identifying cooperation opportunities with other projects/organizations.

Key Findings

- Clearly assigning ownership of the communal PV systems establishes a frame for maintenance options and responsibilities with regard to replacing lights and batteries, fixing broken switches, and so forth. If facility staff and community members are to contribute to recurrent costs, project developers should consult with them in determining feasibility beforehand, settle how recurrent costs are financed before any procurement, and settle any ownership and funding issues before systems are installed.

- Though many programs have sought to standardize system design to simplify procurement and installation, there is probably a need to rethink this strategy. It can lead to systems that are too large to be replicated in scale due to their upfront cost, or inadequate systems that do not serve the specific needs. In fact, a recurring theme of the sessions has been to focus first on needs, rather than on technology.
- Correctly targeting subsidies, as well as correctly understanding the market, is critical. Subsidizing social PV services is a viable, suitable, and sustainable strategy; on the other hand, subsidizing lighting products for the private market is not.
- Thinking of private customers as individuals who make purchasing decisions can be inaccurate in rural settings where individuals will often look to their local leaders for direction. Introducing new products to rural communities should consider this point.
- A decidedly long-term approach needs to be taken in PV project and market development. It helps if practitioners approach projects from an investor stand point and supervise operations to intervene in the case of difficulties.
- Universities and other local training centers need to be supported to institutionalize the information on PV quality assurance, sustainability, and O&M. It is important to train sufficient local technicians when there are no existing maintenance companies near installations.

Presentations and Speakers

"PV Toolkit for Community Facilities: Guidance for Sustainability," Tjaarda Storm van Leeuwen, World Bank.

"PV for health Centers in EnDev, The GIZ Energy Intervention in Ethiopia," Samson Tolessa, Deputy Director, GIZ, Ethiopia and Uganda.

"PV for Community Services: Deployment and Sustainability," Mohamed Ali Hamid, PV Consultant, Community Development Fund, Sudan.

"Sustainable Solar Market Packages (SSMP) for Community Services," Frank Mejooli, Ministry of Energy and Minerals, Tanzania.

Children from Goyala, Guinea go to a video club in the village now to watch films and TV programs.

3.12 Électricité de France Training Session

Overview and Session Objective

The session objective was to raise awareness on an innovative initiative led by Électricité de France (EDF) for sustainable capacity building for rural electrification in West Africa, focusing on two pilot countries—Mali and Burkina Faso. The program was launched in October 2011, and the majority of financing is sourced from the European Union Energy Facility (EU EF) in cooperation with EDF, Fonds de Développement de l´Electrification (FDE, Burkina Faso), and AMADER (Mali).

The countries' views on their future capacity-building needs and examples of existing training activities in the field of the electro-technical education in general, and rural electrification in particular, were discussed with the audience. The audience of about 20 participants should be considered large due to the session's focus on West African countries.

Key Questions and Challenges

- Is the assumption of new needs for capacity building relevant for the West African countries?
- Does increasing awareness about the need of capacity building in the electricity sector lead to efficiency and sustainability of electrification programs?
- Results from the preproject survey undertaken by the EDF show: weak supply chains for electricity training, especially for more practically oriented education; lack of activities for sustaining/updating skills; and gaps in providing of new skills requested for decentralized and private sector–operated electrification.
- The obvious lack of educational and professional training is particularly endangering the success of rural electrification initiatives.

Solutions Presented by the Program

- Establishing necessary networks between schools on various levels of electro-technical education.
- Creating a catalogue of the existing training supply chain, accessible for all actors in the electricity sector (online access is planned).
- Providing situational analysis, defining capacity needs for the electricity sector, and developing upgraded/transformed/strengthened services and capacities at existing educational suppliers.
- Raising awareness of the need for cross-sectoral cooperation, particularly related to mobilizing funds and political support for sustainable capacity building and involving government institutions responsible for education, employment, energy, and other related sectors.

Audience Discussion Points

- Countries with experiences from decentralized electrification emphasized the need for training in the private sector, particularly small-scale operators. This should be offered locally and adapted to the specific training needs for O&M, customer care, metering, and billing.
- Electricity sector administration, including the specialized institutions for rural electrification (for example, REAs), needs to build up and sustain capacity related to adapted institutional framework and general policy, procurement, contracting consultants and constructors, and project results' monitoring.
- Many of the national power utilities have established training centers for their professionals, but the question is if these are/can be made accessible to private operators.
- The establishment of regional versus national training centers adapted to the specific needs of the country was discussed. Even if the need of scaling up and looking for technical and financial synergies was recognized as an advantage for the regional approach, many countries emphasized the need of national and even local training options, especially in the view of decentralized electrification in a number of West African countries.

Key Findings

- The EDF-led training program offers a pilot solution for building capacities in two countries, Mali and Burkina Faso, with replication for other countries envisaged.
- The aim of the program is not to replace the existing educational supply chain, but rather to expand, adapt, and strengthen their capacity for meeting the new training requirements.
- Capacity building will be needed in the areas of practical operation of decentralized electrification to provide customers with reliable service as well as for government institutions so that they can fulfill their new responsibilities in expanding electricity access.
- Regional, national, and local training options will have to complement each other. It is important to use the pilot countries' experiences to define a best model for complementarities and synergies.

Additional Follow-Up Discussion Questions

Follow-up discussion covered the early stages of the project, including the very first steps of the initial activities already started in both pilot countries: identification of needs and existing schools/capacity-building facilities, creation of a Web catalog, and preparation of 40 test-training sessions for trainers. Nevertheless, some key questions remain:

- How to collect complementary funds to extend the initiative to other countries (EU financing only covers two pilot countries)?
- How could the relevant public authorities (for example, agencies relating to education and employment) be more deeply involved? Their support remains a key factor for a quick and successful project.

Presentation and Speaker

Christine Heuraux, Director, Energy Access Programme, EDF.

3.13 Energy Access for the Urban Poor

Overview and Session Objective

As the fastest urbanizing region in the world at 4.5 percent per year, SSA continues to grapple with numerous challenges to accommodate economic migrants from rural areas seeking ways to earn a living near urban areas. By 2030, urban populations in SSA will exceed rural populations, and 70 percent of urban population is projected to be living in slums. The ways in which these people will earn income is through micro- and small-scale enterprises in the informal sector. The development of these opportunities is much below their potential considering the unsustainable use patterns. This session is led by the Energy Sector Management Assistance Program (ESMAP), which has implemented an Energy Access for the Urban Poor (EAfUP) initiative. The session explored the difficulties faced by energy practitioners and urban slum communities in the provision of electricity and other infrastructure services, globally and in SSA, to derive lessons that can be implemented by SSA countries looking for solutions to this growing problem.

Key Questions and Challenges

There are numerous challenges surrounding provision of energy services, particularly electricity services, to the urban poor, who primarily live in the slums. These challenges include:

- Legal tenure—lack of recognition of slums by authorities and the associated insecurity of lack of housing and squatting.
- Affordability—high costs for connection, internal wiring, and the like.
- Lack of adequate infrastructure increases costs of making investments to fix roads and other infrastructure to improve energy services.
- Lack of trust between service providers and slum communities; political sensitivity around the recognition or formalization of slums.
- Haphazard, illegal, and dangerous connections of peri-urban and urban dwellers to distribution lines.

Energy Access for the Urban Poor Program

The first presentation by the ESMAP EAfUP program provided an overview of the challenges faced by the urban and peri-urban sectors and discussed the particular challenges emerging in growing slums. Urbanization rates continue to rise, particularly in SSA, where people are moving into cities for better employment opportunities, but then face higher costs of living and lack of infrastructure and energy services.

Opportunities for productive uses of energy are one response to the increasing needs for energy services. Access to modern energy services for the urban poor is key to reducing poverty through productive uses that can provide employment, formalize small-scale enterprises, provide access to finance, develop business

skills, and increase tax revenue for the government. The presentation also discussed the peri-urban development that is taking place in Africa; peri-urban development is playing a mediating role between rural and urban, due to the unplanned growth of cities. Peri-urban areas are also places of dynamic social change, which, through agricultural activities, create significant opportunities for food production and security.

In discussing how to overcome barriers, two cases of slum electrification from India were presented providing examples of how to create champions within slums and create methods of payments and formal cycles to improve the service and access to electricity. ESMAP and the World Bank will be focusing on identifying work that is still needed to improve energy access for the urban poor and will be organizing a workshop in the coming year to provide a platform for practitioners for further dialogue.

The Case of Ghana

The second presentation of an ESMAP-funded scoping study developed by research center KNUST of Ghana, focused on Ghana's energy access and productive uses for slum dwellers. The study focused on three slums in Ghana, examining pro-poor energy policies in relation to slum access to energy. The presentation highlighted the productive uses of energy in the slums and provided an insight into the challenges confronting slum dwellers in their access to energy.

Metropolitan and municipal assemblies do not consider needs of slums in exercising their planning function, because that could mean legitimizing them. As a result, utility companies are unwilling to extend their services to the slums. This creates a challenge between the needs of slum dwellers and access to services, especially given the diverse uses for electricity in the slums due to different enterprises and activities such as hair salons, electronic shops auto mechanics, etc., which were identified by a KNUST survey.

However, even with these barriers, there are a variety of ways in which slum dwellers use energy productively, despite limited access to services. Dwellers pay and will continue to pay electricity bills, therefore their electricity access should be formalized to support their productive activities.

Key Findings

- There are successes stories to be shared and understood, but there is more work to be done to develop programs that cater to the specific needs of urban areas.
- There is increasing urgency to understand urban realities, specifically in urban slums, because they are a growing challenge, especially in the African context.
- Energy access programs should be developed that link into city development strategies.
- There is a need for multistakeholder collaboration: successful partnerships between civil society groups, utilities, community-based groups, and local government.
- Strong political will is needed, and specific government programs need to consider the needs of slums in their access planning and implementation, and begin proposing solutions as well as providing a regulatory framework that supports electricity access for the urban poor.
- More data, examples, and research are needed on urban access challenges to better understand the scale and scope of what's been accomplished, the remaining gaps and challenges, and what lies ahead.
- AEI participants demonstrated interest in a separate workshop on urban access challenges organized by ESMAP.

Presentations and Speakers

"Energy Access for Poor in Urban and Peri-urban Areas – An Emerging Challenge," Venkata Ramana Putti Senior Energy Specialist, ESMAP.

"Energy Access and Productive Uses for Slum Dwellers in Ghana," Owusu Amponsah, Lecturer, KNUST, Ghana.

3.14 Integrating Gender into Energy Operations

Overview and Objective of the Session

The session first introduced the gender sensitive approach and methodology, followed by two presentations of practical experience in applying the proposed approach through assessments and activities to strategically integrate gender into the ongoing programs; the presentations were from two of the six pilot countries. The REAs—AMADER in Mali and REA in Tanzania—discussed their experiences as well as challenges, opportunities, and potential impacts. A discussion followed giving the opportunity to other REAs and rural electrification experts to share their experiences on gender approach and help them gain practical tools and approaches for their own programs and projects. The session was well attended, with about 30 participants representing various agencies within Africa.

Key Questions and Challenges

- Gender is part of the REAs, however, it is not systematically integrated into planning processes, it is not measured with indicators or targets, and the full benefits are not understood due to lack of data and attention in the projects and programs.
- Gender is also a cultural/social/national issue, and so must be addressed while considering the broader challenges faced by both women and men.
- There are key areas to be addressed: more balanced participation in projects, more gender disaggregated data and monitoring, and sharing of tools and methodologies with other countries and programs for their integration.

Introduction

The session was opened by the Senegalese Rural Energy Agency (ASER) Director General, who discussed the drudgery that women face in rural communities, and how if the drudgery were reduced, they would be able to spend more time on income-generating activities. He noted it is important to understand from the start that the issue of gender is cultural, but that programs must move forward in testing approaches on how to improve the benefits of electricity access for both women and men.

The presentations were introduced by the session chair who put them into context by informing participants about the gender and energy program, funded through the World Bank Africa Renewable Energy Access Program (AFREA) and ESMAP that support the practical integration of gender within energy projects through a learning-by-doing approach. The session had two presentations that highlighted the approaches taking place in Mali and Tanzania to systematically integrate gender into their programs and discussed the challenges, lessons learned, and next steps.

The Case of Mali

The first presentation focused on identifying opportunities for integrating gender into AMADER's program and project. The gender focal point of, AMADER, the Malian REA, explained that progress on gender at the national level within Mali has been ongoing: a national gender policy was established and gender sensitive budgets are currently being developed. It was also noted that AMADER, and through the support of the World Bank's Household Energy Universal Access Project, has been working on improving energy access and service for men and women, focusing on household energy and specifically multifunctional platforms. However, the speaker noted that the work being conducted was not very systematic and was not measured with indicators or targets.

The AFREA Gender and Energy Program team then introduced the recently conducted field assessment of AMADER's programs in 12 villages in Mali, which were conducted to better understand how to systematically integrate gender into the program. The assessment and findings were just recently presented on November 10, 2011, during a workshop chaired by the President Director General of AMADER with about 30 AMADER staff. During that workshop, after hearing the findings, it was agreed that a full action plan would be developed jointly by AMADER and the World Bank team.

The first presentation by the AFREA team ended with highlights of some of the early results that are emerging from the work in Mali, particularly noting the achievement of having a gender focal point formally appointed within AMADER, with a concrete role and responsibilities, and having gender integrated into the project design and also future projects' preparation. In the coming year, there will be more results from Mali, because pilot activities will be launched to demonstrate approaches and impacts within the communities.

A presentation by UNWomen Mali briefly introduced its approach and some of the work it has undertaken as well as how to move its action plan forward. The presentation noted that it is important to identify the real needs of both women and men, and then match the technology to address these needs, instead of the other way around. UNWomen has considerable experience in capacity building and training on gender issues and has been working with various ministries and programs within Mali to help build awareness and institutional capacity.

The Case of Tanzania

A presentation by the REA in Tanzania focused on Initiatives in Mainstreaming Gender in the Delivery of Modern Energy Services to Rural Areas of Tanzania. Men and women have different roles within the communities and it is critical to better understand these roles (who pays, decision making, head of households) to better survey, design, and plan for programs and increased impact. REA in Tanzania has already incorporated gender aspects into its work, but it is informal and nontargeted, so additional insight by the participants was sought to help improve the REA's impact on delivering and increasing its energy services to both men and women.

Continuing on the case of Tanzania, the World Bank Gender and Energy Program team presented the initial work taking place in Tanzania, which is one of the pilot countries in the program. The team is conducting an assessment of the organization and projects and, with the REA, developing an action plan. One of the key aspects of the pilot programs is that "learning-by-doing" includes exchanging ideas and information with other pilot countries on approaches, methodologies, and tools for assessing, planning, and implementing work with the REAs. Because the work in Tanzania started fairly recently, it will quickly build upon what was accomplished in other countries to improve the process of systematically integrating gender within the REA's program. There is an opportunity to integrate gender at the energy policy level in Tanzania, which will be further discussed in the future.

The AFREA Gender and Energy Program led the session wrap up with some additional discussion questions and a presentation reflecting on the progress made in Mali and Tanzania, but also noted that other countries are piloting strategic integration of gender into the energy projects—including Kenya and Senegal, with work potentially beginning in Benin, Liberia, and Mozambique too. One of the main messages was that it is possible to transform theory and the good advocacy work from past decades into practical action and activities within

the countries. However, results are surfacing—with formal gender focal points established in different institutions, assessments being conducted in the coming months, activities to be piloted in various countries, and experts engaging with various partners going forward.

Key Findings

- The gender dimension of the role of energy in development is becoming more evident; men and women have different energy needs. Meeting these needs is not only an equity issue, it's also a demand-side issue, which means incorporating gender into the analysis makes good business sense.
- Communities and gender teams should be involved in project design to ensure their needs are incorporated to create programs that are tailored and relevant; some of the programs were not initially designed to consider the impacts of the gender dimension.
- This work takes time, relies on considerable dialogue with energy teams and country clients, and needs the support of sound methodologies and approaches and a focus on indicators to monitor outcomes and impact.
- The question for energy sector practitioners has moved from "why do it?" to "how to do it?" The AFREA Gender and Energy Program team has been working on the answer to the "how" question through the development of tools and a practical approach for mainstreaming gender into energy policies and projects.
- The participants commended the work being conducted to systematize the integration of gender and create models, methods, and approaches that can be shared with other countries and programs.
- The ESMAP Gender and Energy team has now begun to work with existing World Bank energy projects in the practical integration of gender into energy projects. The country cases from this session are examples of this work.
- In Mali, the Household Energy Universal Access Project had gender integrated after the project design, and has since established a formal gender focal point with specific duties within its REA, AMADER. AMADER will now pilot specific activities within targeted villages and monitor the impact on the ground to help demonstrate results and learning by doing.
- In Tanzania, the REA is also conducting assessment work action planning and has key opportunities to engage in policy dialogue and pilot activities in the near future.
- In Senegal, gender activities have been mainstreamed with many gender and energy activities currently taking place. The program was launched, results are emerging, and the program will continue to engage in dialogue and feedback with country partners and experts to learn, share, and exchange experiences.
- Finally, it is important to always discuss gender in the context of both women and men. Real needs for both men and women should be identified, and then a source of energy/technology can be selected to fulfill these needs.

Presentations and Speakers

"Identifying Opportunities for Integrating Gender into AMADER's Program and Projects," Emma Niang Kouruma, Head of the Household Energy Demand Control Department, AMADER, Mali, and Sebastian Rodriguez Gender and Energy Consultant, World Bank.

"Rural Energy Agency Initiatives in Mainstreaming Gender in the Delivery of Modern Energy Services to Rural Areas of Tanzania," Justina Uisso, Project Manager, REA, Tanzania and Erneus Kaijage, Gender and Energy Consultant, World Bank.

"Genre et énergie: états des lieux et domaines de changement," Adama Moussa, ONU Femmes/Mali.

"Integrating Gender into Energy Policies and Projects: Questions for Group Discussion," Joy Clancy, Senior Gender and Energy Consultant, World Bank.

For speaker bios, please download the session agenda.

Low sustainability has been a challenge in remote communities.
Eastern Cape Province, South Africa.

3.15 Funding for Renewables and Climate Finance

Overview and Session Objective

The objective of the session was to see how SSA can access international funding for renewable energy development and access scale-up that incorporates climate funds such as the Scaling-Up Renewable Energy Program (SREP) for low-income countries, and others. After an overview of different climate finance tools, case studies from Mali and Tanzania were presented.

Key Questions and Challenges

- The process to access climate and carbon funds remains too complex for many countries that might otherwise be interested in tapping these funds for energy development.
- Can public funds be leveraged and multiplied by mixing with private, public, and carbon market funding?
- What type of climate investment funds exist and can be accessed by the least-developed countries?
- What can be done to garner political will and support to achieve a consensus on climate financing?

Overview of Climate Investment Funds

ESMAP presented an overview of the different climate finance funds (CIFs) for energy access. These funds have a variety of sources, including public, private, bilateral, and multilateral. Partnership among development banks such as the African Development Bank (AfDB), the Asian Development Bank (ADB), the European Bank for Reconstruction and Development (EBRD), the Inter-American Development Bank (IDB), and the World Bank Group (WBG) to support mitigation and adaptation in a coherent and integrated way is instrumental to the success of the program.

Among CIFs, the two main funds are the Clean Technology Fund (CTF) and the Strategic Climate Fund (SCF). The CTF promotes scaled-up financing for demonstration, deployment, and transfer of low-carbon technologies with significant potential for long-term greenhouse gas emissions savings. The CTF finances programs in 12 countries and one region. It leverages financial products of multilateral development banks (MDBs) to stimulate private sector engagement.

The SCF hosts a number of programs with dedicated funding to pilot new approaches with potential for scaling up: the Pilot Program for Climate Resilience (PPCR), the Forest Investment Program (FIP), and SREP. For SREP, only low-income countries are eligible, and SREP has been piloted in several African countries. SREP's objective is to initiate transformational change by piloting and demonstrating the economic, social, and environmental viability of low carbon development pathways in the energy sector and creating new economic opportunities to increase energy access through the use of renewable energy. The funds are blended with financing available from MDBs, bilateral agencies/banks, and other public and private sector resources.

Programatic Clean Development Mechanism (CDM), which established a framework to support the international trading of carbon credits, includes a program of activities (PoA) that is becoming a strong tool for energy access, and increasingly more attractive for smaller projects. Some examples of CDM projects include: off-grid renewables (Bangladesh), grid renewables (Egypt), energy efficiency (Mexico), improved cook stoves (Uganda), biogas digesters (Nepal), urban transport (Egypt).

Energy+ is an initiative launched by Norway in Oslo in October 2011 to support developing countries in implementing sustainable energy strategies that incorporate the use of renewable energy. Energy+ aims at leveraging private resources for access scale-up. It is consistent with the results-based financing model and requires compliance with social and environmental safeguards.

Mali SREP

The Malian REA AMADER discussed SREP and its implementation to date. Among the six SREP pilots in the world, Mali was selected because of the critical issues facing the country (the impact of climate change and land degradation; high population growth and thus high energy demand; and the rising prices of fossil fuels) and the government's efforts to create an institutional and regulatory framework, develop renewable energy projects and stimulate private sector participation, among others.

In December 2010, Mali set up a national committee to prepare an SREP plan, and has received an initial US$40 million for the program, with a reserve of US$20 million after the first phase. The investment plan has been the result of an intense consultative process, which included a detailed study that reflected the priority sectors for SREP investments, several workshops, a Web site, and more.

Five priority areas were identified during this process: the legislative, regulatory and institutional framework of the energy sector; studies on impacts and the status of the development of renewable energy technologies; information sharing and capacity building of all the parties involved; priority investments for renewable energy development; and efficient administrative and monitoring systems.

The priority investments were selected based on the assessment for potential development of renewable energy technologies in Mali, including both grid and off-grid access, public and private participation, and "soft" activities for maximizing the transformational impact of the proposed investment.

Therefore, in Mali, SREP finances:

- A PV project to increase the contribution of renewable energy to domestic energy production. The project includes installation of additional generating capacity of approximately 20 MW of PV electricity for the grid. The project is structured as an IPP with a tariff that allows the investment cost recovery.
- Hybrid systems for rural electrification, which include 4.5 MW of additional installed capacity and solar home systems as well as energy efficiency and demand management measures.
- Minihydro projects providing an additional generation capacity of 14.6 MW.
- Technical assistance for the implementation of the projects mentioned above.

Tanzania Renewable Energy Program Financing

The Rural Energy Agency (REA) was established in Tanzania to lead the development of a rural access strategy that encompasses grid and off-grid expansions. The World Bank–funded Tanzania Energy Development and Access Expansion Project (TEDAP) has assisted REA in supporting small, rural, and renewable energy initiatives in several ways: (i) an enabling policy and regulatory framework, including standardized power purchase agreements and simplified regulatory rules that ease some of the transaction costs for small renewable power projects; (ii) a subsidy scheme for new connections in rural areas (performance grants) and technical assistance/pre-investment support (matching grants) for project developers; and (iii) a line of credit to Tanzanian financial institutions that allows long-term financing (10–15 year loans) to small renewable energy projects.

However, despite this support, the Tanzanian renewable energy sector is still in the very early stages, its development still constrained by enduring administrative and financial barriers and uncertainties. Within the current rural electrification development framework, a typical grid-based renewable energy project faces three main constraints that impede its implementation: (i) private investors' difficulty in mobilizing the required equity for the financing closure; (ii) power sector regulations for distributed power and tariff-setting methods; (iii) and insufficient technological capacity for renewable energy projects.

To further encourage projects developers to invest in and implement renewable energy projects, REA is developing a Renewable Energy Programme of Activity (PoA) under which individual projects could claim carbon credit benefits. The PoA will mainly help develop a platform for overcoming institutional, financial, and structural hurdles for the development of small-scale renewable energy projects including hydro-, solar, wind, and biomass power projects.

REA will implement the PoA and act as a coordinating and managing entity. REA will enter into a contractual agreement with each individual power project (CPA). The contract would give REA the legal right to deal with the carbon credits that will be generated from these projects and monitor project implementation and all necessary parameters that are required for the calculation of emission reductions from each CPA.

To address one of the key challenges posed by the carbon finance—carbon credit payment after commissioning—while responding to the immediate needs of the developers to address the equity gap, a new facility funded by the Russian Trust Fund for Energy SME Development in SSA, executed by the World Bank, has been designed. The ESME project establishes a financing mechanism managed by REA to advance green generation performance grants to small renewable energy projects based on MWs of renewable energy. These grants under the ESME project will be in the value of expected future certified emission reductions (CERs). The REA's Performance Grant Facility set up by the ESME project is expected to be replenished by carbon revenues once they are generated.

Key Findings

- Climate finance serves to catalyze sustainable investments, enhance capacity and policy, and leverage other sources of finance. SSA has great renewable energy potential, thus there is an opportunity to access carbon finance to improve the financial viability of energy projects.
- Climate finance is large on promise, but so far there hasn't been sufficient commitment, given the outcome of recent COP climate change meetings. It needs stronger collective political will.
- This the United Nations 2012 International Year of Sustainable Energy for All (SE4ALL), and the momentum from this event is a great opportunity to garner political support for financing access in SSA.
- Because the process to access climate and carbon funds is complex and needs to be simplified, more outreach and information exchange on the possibilities of tapping into these funds are necessary.
- The SSA practitioners requested capacity building for carbon finance. AEI plans to organize, in cooperation with UNFCCC, a training program on carbon finance opportunities for rural energy development in SSA in the context of 2012 Africa Carbon Forum.

Presentations and Speakers

"Climate Finance for Energy Access," Venkata Ramana Putti, Senior Energy Specialist, ESMAP.

"La démarche du Mali pour la Valorisation des Energies Renouvelables à Grande Echelle; Alassane Agalassou," Chief, Rural Electrification Project Development, AMADER, Mali.

"Financing Windows for Rural/Renewable Energy Development in Tanzania: Matching Grants, Performance Grants, Technical Assistance, Credit Line and Renewable Energy, Programme of Activities," George Nchwali, Director of Finance and Administration, REA, Tanzania.

Mama Mboga now able to open her small business at night.

3.16 Output-Based Aid for Electricity Access | Concepts and Challenges

Session Objective

Output-based aid (OBA) has been as a performance-based subsidy to facilitate access to basic services that is payable upon achievement of measurable results. Results-based financing (RBF) is often used in a broader sense for any "temporary financial intervention to create revenues from markets more lucrative and more certain to accelerate investment." The "OBA for Electricity Access" session explored what such performance-based approaches to foreign direct investment (FDI) can do to help increase electricity access in SSA. The session set out to make the sometimes confusing terms and definitions clearer for SSA access practitioners by highlighting the key issues of importance to practitioners when implementing OBA for electricity access. The session started with a review of the basic concepts of performance-based aid, then highlighted specific implementation challenges when working with weaker players (as is often the case in access projects), and concluded with a discussion of real-life cases on program and project levels.

Key Issues and Challenges

- *Balancing risks and responsibilities:* A good OBA project depends on a well-balanced structure of the contracts between all parties involved in the provision of access, connection, and service. There are contracts on several levels, between donors, governments, municipalities, service supply companies, and users. For proper functioning of the supply chain, each party must be very clear on who can take on which specific responsibilities and risks.
- *Define outputs and service levels carefully:* It is important to define (minimum) levels of access and service as well as the actual project outputs by government and provider level carefully and consider the unique setup of each market and transaction.
- *Universal access means ever more difficult setups:* Future electrification interventions in SSA will push the frontier closer to universal access, and thus increasingly involve poorer and more dispersed clients, as well as players who are technically or financially weaker than some of the past high-performing OBA pioneers. OBA for access has to respond to the challenges presented by low managerial, technical, and financial capacities of developers, BOT bidders, and service providers.

Introduction

The terms involved in RBF/OBA for access can be confusing, but the basic principles are similar: different forms and modalities of FDI are linked more directly to specific results. There are six core issues related to RBF/OBA:

i. Targeted subsidies reach relatively more poor beneficiaries.

ii. Governments and providers (and in some projects even the users) are more accountable.

iii. Output definition and monitoring are more explicit, which in turn can increase effectiveness.

iv. Ex post payments provide more incentive.

v. Cost efficiency may increase.

vi. Sustainability is singled out as a key challenge.

The variations in OBA delivery reflect the type of transaction (including market structure, access technology, and the specific players involved) as well as the differing aid modalities of donors and governments.

A good, intuitive approach for practitioners to better understand different models and modalities of RBF and OBA is to study the flow of subsidies along the service delivery chain, as defined in a series of contracts. Outputs should be chosen for any given intervention as closely to the desired outcome of the project under consideration as possible—however, they need to be concrete, attributable, and controllable. There is usually a trade-off between these two objectives.

OBA interventions must strive to find the right structure of incentives and risks, usually involving several levels of intermediate goals and related payments, not one final payment. While indicators and monitoring are essential for measuring performance, typical access players can easily be overburdened with reporting and administration requirements, if the standards established for urban utilities and the reporting standards of regulators and international donors are simply passed on to the sometimes very small access players.

OBA for access requires special attention and effort during implementation, not only during design, because a multitude of unexpected questions tend to arise during the procurement and disbursement process—this is because OBA methods and contracts are often new to national stakeholders, such as regulators and energy ministries.

At the end of the session's introduction, a quick overview of GPOBA was given; and several participants requested additional information and possibly more extensive training on OBA for access in general, and on the implementation challenges specific to (universal) access projects, in light of the upcoming 2012 International Year of SE4All. Participants expect that the latter will probably define a whole set of new political mandates for AEI practitioners—but may leave them without concrete help on how to achieve these new mandates with sound projects.

Case Study | The EnDev Program: A Concrete Example of Implementing a Performance-Based Energy Access Portfolio across 20+ Least-Developed Countries

The EnDev program, funded by the Netherlands and Germany and implemented by GIZ, is responsible for providing modern energy access for households, institutions and SMEs, predominantly in rural areas of least-developed countries (LDCs). To do so, EnDev uses a performance-based approach defined by clearly quantified and explicit global objectives in terms of direct beneficiaries—which in turn are directly built on country objectives. The budgets for EnDev programs in each country depend largely on their respective contributions to the global access objective. The average grant funding available to provide energy access (mainly via indirect subsidies such as technical assistance) is approximately *€19 per person*. Success is measured by the number of people connected against the cost of impact.

A key feature of the EnDev approach is that funds are allocated based on annual performance—that is, those countries, technologies, and local players who have performed best (that is, have highest number of users with

new access while meeting the cost threshold and specific sustainability criteria) will receive more funding in the next disbursement round. EnDev considers this explicit, transparent "yardstick" competition of projects, countries, players, technologies, and approaches as one of the main reasons for its impressive success to date: so far EnDev has connected *8 million people, 11,000 social institutions, and 26,000 enterprises*.

According to EnDev, the performance-based approach results in strong local commitment and significant contributions from all local parties, leading to speedy implementation, aggressive stimulation of knowledge exchange between programs, and rapid scale-up of innovations (that is, things that work in one country are quickly copied by others), and rigorous as well as cost-efficient monitoring systems (via energypedia).

The EnDev approach includes not just direct subsidies, but also on indirect subsidies, such as capacity building, training, quality testing, and raising awareness on the institutional, educational, consumer, government, and service levels. This is important because of specific weaknesses of universal access players and markets.

Case Study | Rwanda Project: Private Sector Service Provision for Small Rural Hydros

The Private Sector Participation in Micro-Hydro Power for Rural Development (PSP Hydro) project was presented as a concrete example of the EnDev program; it cooperates selectively with parallel projects by the United Kingdom's Department for International Development (DFID) and the World Bank. PSP Hydro is the first effort in Rwanda to attract private commercial participation in microhydropower (MHP); currently six power plants are being supported.

The objective is to develop private entrepreneurship for building and operating MHP plants and to provide support in the creation of a conducive regulatory framework for the MHP sector. Activities include support for SMEs, including business plan development assistance, technical and engineering assistance, and also financial support (a maximum 50 percent subsidy). In parallel, the program provides assistance for institutional development, tutoring for sector consolidation, and better cooperation between stakeholders.

Key Points and Conclusions

- *OBA and RBF* are promising instruments for rapidly expanding access. However, especially when working with weaker players, they must be tailored to the specific players and markets.
- *Competition* by projects and players—with varying technologies and approaches but measured by the same "access yardstick," that is, with the same, well-defined performance measures—can be a powerful tool for access program efficiency, impacts, and speed. In this case, the "yardstick" is the number of beneficiaries with new access using precisely defined counting methods, and at an average grant amount per person. As shown by the EnDev example, a fast, streamlined program monitoring process allows for immediate cross-country benchmarking and thus inspires cross-border learning that further contributes to growth.
- *Financial aid* should not be the only focus of (universal) access programs; accompanying *technical aid* measures such as training, capacity building, and quality testing are needed to address the typical weaknesses of access players and markets.
- *Strong institutions* are important for supporting and maintaining progress, as are fund administrators that insist on good and competitive conditions.
- Participants expressed strong interest in further support to learn how the specific implementation challenges of OBA/RBF can be overcome for their national electrification programs and how OBA/RBF-based approaches can help them reach the ambitious access targets that will probably be defined on national and international levels in 2012.

Presentations and Speakers

"Output-Based Aid for Energy Access in SSA: Design Concepts and Implementation Challenges," Kilian Reiche, Senior Consultant, World Bank (on behalf of GPOBA).

"OBA on Program Level Performance Based Aid for Access Practical experiences from the Energising Development (EnDev) Programme," Carsten Hellpap, Director, EnDev.

"Private Sector Participation in Micro-Hydro Power for Rural Development (PSP Hydro)," Benjamin Attigah, Programme Manager, EnDev, Rwanda.

3.17 Clinic on Practical Software Tools

Overview and Session Objective

The objective of this clinic was to introduce participants to three computer models that are useful for developers, banks, REAs, and regulators to assess prospective projects from a technical, economic, and financial perspective. The first is a simple spreadsheet model that assesses the financial viability of SPPs and minigrid systems. The second is the HOMER model, which allows for optimization evaluation of the leveled costs of different minigrid system configurations. The third is the financial simulation model of off-grid systems developed by AMADER.

Key Questions and Challenges

- Rural electrification is capital intensive and requires careful planning to find affordable ways to increase access. SPP developers can use financial models and software tools to optimize costs for rural electrification planning, given certain inputs and constraints. Some of the questions considered when running these models include:
- How does the financial viability of an off-grid or on-grid SPP project vary under different assumptions of tariffs, subsidies, carbon revenues, exchange rates, and so forth?
- Does cash flow meet debt service requirements?
- How much of which technologies to use?
- What are fuel consumption, runtime, and project economics?

Financial Viability of Minigrid Systems

The session overview began by distinguishing between two models: the Excel financial model and HOMER. While both models can be used by project developers, regulators and researchers, HOMER is more suitable for engineers because it optimizes component selection to minimize leveled cost of energy (LCOE) in hybrid minigrids. The Excel financial model on the other hand can model cash flow and return on investment, project and equity internal rate of return, and net present value.

The main inputs used in the Excel financial model include: plant capacity, capacity factor, number of connections, investment costs, operating costs, construction time, collection efficiency, Consumer Price Index (CPI), terminal value, exchange rate, capital structure, depreciation period, and tax holiday (temporary elimination of a tax as an incentive for businesses to invest).

The outputs on the other hand include: operating cash flow, depreciation, loan payment, loan balance, effective tax, equity cash flow, debt service coverage ratio, weighted average cost of capital, number of connections, collection efficiency, CPI, and terminal value.

The second part of the presentation introduced HOMER, which is software used to minimize LCOE in hybrid minigrids. A hybrid system consists of two or more renewable energy sources used together to provide increased system efficiency as well as greater balance in energy supply.

With the right inputs, HOMER can help answer the following questions:

- How much of which technologies to use?
- How do these answers depend on assumptions?
- What are fuel prices, interest rates, equipment costs, and utility tariffs?
- What are electric and thermal load shapes, reliability requirements, and load management responsibilities?
- What is the resource quality and availability?
- What are the sensitivities and variations in prices?

AMADER Model

The Malian Rural Energy Agency (AMADER) introduced its software, Nour, which it uses for economic modeling of financial rural electrification projects.

It is essential before embarking on the modeling itself that the user studies the project and notes the main parameters of the project. The model includes 30 different Excel sheets, including inputs, assumptions, results, and so forth.

Key Findings

- Models need to be developed based on project's anticipated components, activities, and outputs.
- Models provide good indications if they are based on quality data.
- Models are useful when there is capacity to use their results.
- Financial models can be rerun when there are significant changes in project hypotheses.
- A French user group for HOMER exists, but it is uncertain as to whether a French version of HOMER exits.

Follow-Up Questions

- Can financial models be run during project implementation?
- Participants wanted to know if there is a French version of HOMER.

Presentations and Speakers

"Using HOMER to Evaluate the Levelized Costs of Different Mini-grid Generation Options and A Simple Excel-based Model to Assess the Financial Viability of Mini-grid Models," Chris Greacen, Consultant, World Bank.

"Progiciel de Simulation de Business Plan d'entreprises de Service Electrique en Milieu Rural," Alassane Agalassou, Chief, Rural Electrification Project Development and Lamine Coulibaly, Rural Electrification Project Development, Amader, Mali.

Additional Resources

Simple project viability evaluation model download:

www.palangthai.org/docs/SPP-SimpleProjectViabilityEvaluationModel.xlsx

Free HOMER download: http://homerenergy.com/download.asp

The HOMER file from the presentation example can be downloaded from: www.palangthai.org/docs/KohPo.hmr

PV panel installed for small village.

République du Sénégal
Un Peuple – Un But – Une Foi

Ministère de la Coopération
Internationale, des Transports Aériens,
des Infrastructures et de l'Energie

Atelier International sur l'Initiative d'Electrification en Afrique
Allocution d'Ouverture de Monsieur Karim Wade,
Ministre d'Etat, Ministere de la Cooperation International,
des Transports Aeriens, des Infrastructures et de l'Energie

Chapter 4 | CLOSING REMARKS

Mesdames et Messieurs les Représentants Résidants de

- la Banque Mondiale
- la Banque Africaine de Développement
- la Coopération Financière Allemande (KFW)
- la Coopération Technique Allemande
- l'Union Européenne et de l'Agence Française de Développement (AFD)
- Monsieur le Directeur Général de l'Agence Sénégalaise d'Electrification Rurale (ASER)
- Messieurs les Directeurs
- Mesdames et Messieurs les Experts
- Mesdames et Messieurs
- Honorables invités

Permettez moi tout d'abord de vous réaffirmer, au nom de Son Excellence Maître Abdoulaye WADE, Président de la République du Sénégal, de Maître Souleymane Néné NDIAYE, Premier Ministre, Chef du Gouvernement, et de Monsieur Karim WADE, Ministre d'Etat, Ministre de la Coopération Internationale, des Transports Aériens, des Infrastructures et de l'Energie, ainsi qu'au nom du peuple sénégalais, l'honneur et le plaisir que nous avons eus de vous accueillir en terre sénégalaise.

Nous voici donc arrivés, au terme de l'atelier international sur l'Initiative d'Electrification en Afrique, après trois jours d'intenses travaux, au cours desquels vous avez passé en revue les problématiques liées à l'accès à l'électricité dans notre continent, notamment des questions substantielles telles que (i) les différentes approches institutionnelles de l'électrification rurale et leurs combinaisons possibles ; (ii) les options technologiques et techniques existantes, permettant d'optimiser le coût de l'investissement ; (iii) les implications économiques et sociales de l'accès à l'électricité ; (iv) les contraintes liées à la planification et au financement et à la mise en œuvre des projets et programmes, entre autres.

Il me plaît de constater qu'après trois jours riches en échange d'expériences, vous êtes arrivés identifier un ensemble de bonnes pratiques et à formuler des recommandations qui, si elles sont mises en œuvre, contribueront, sans aucun doute, à une meilleure prise en compte des différentes préoccupations des parties prenantes dans le développement de l'électrification en Afrique, principalement en zone périurbaine et rurale où ils existent encore des franges très importantes de la population qui n'ont pas accès à l'électricité.

Mesdames, Messieurs, Honorables Invités,

Qu'il me soit permis de vous remercier sincèrement, au nom du Gouvernement de la République du Sénégal, pour le travail accompli et, également, de faire quelques remarques sur les thèmes que vous avez développés.

Comme vous le savez si bien, en Afrique, l'accès à l'électricité est un problème majeur qui freine considérablement son développement. En effet, elle est de très loin le continent où le taux d'électrification est le plus faible au monde. A titre de comparaison, moins d'un quart de la population de l'Afrique subsaharienne a accès à l'électricité, contre près de la moitié en Asie du Sud et plus de 80% en Amérique Latine. Ainsi, comme vous l'avez relevé durant vos travaux, si les tendances actuelles se poursuivent, moins de 40% des pays africains atteindront l'accès universel à l'électricité d'ici à 2050.

Fort de ce constat, beaucoup de pays africains ont entrepris une série de réformes pour développer l'électrification rurale dont la plus importante est la reconnaissance du rôle que doit y jouer le secteur privé. Toutefois, la portée, ainsi que la mise en œuvre et les résultats de ces réformes n'ont pas été à la hauteur des attentes dans la plupart des pays de l'Afrique subsaharienne pour des raisons liées en grande partie à l'inadéquation des schémas mis en place, à l'insuffisance de la planification, au manque de ressources financières et de capacités de mise en œuvre.

Aussi, les facteurs déterminants de l'accessibilité de l'électricité en Afrique, à savoir le coût des services et la capacité de paiement des ménages constituent des obstacles à franchir le plus rapidement possible.

D'autant plus que l'électrification rurale, lorsqu'elle s'inscrit dans une approche globale et intégrée, peut déclencher le cercle vertueux de l'émergence car étant un gisement important de croissance économique et de développement social pour nos pays dont la majorité de la population reste rurale.

Par ailleurs, il demeure que tous les efforts visant à améliorer l'accès des populations à l'électricité resteraient vains si des mesures d'accompagnement appropriées destinées à accroître la capacité production d'électricité ne sont pas adoptées dans le souci de satisfaire une demande en forte croissance.

A cet effet, le Gouvernement du Sénégal a initié un Plan de restructuration et de relance du secteur de l'énergie, dénommé «Plan Takkal», dont un volet important concerne le renforcement des capacités de production d'électricité. Les premiers résultats de ce Plan ont permis de mettre fin aux délestages liés au déficit de production d'électricité, ce qui constitue un atout de taille pour nous permettre de nous tourner maintenant, résolument, vers la généralisation de l'accès à l'électricité des populations rurale dans une échéance temporelle réduite.

Mesdames, Messieurs, Honorables Invités,

Les thèmes que vous avez abordés, ont le mérite de souligner les contraintes auxquels les pays de l'Afrique subsaharienne doivent faire face, afin de garantir aux populations un accès universel aux services énergétiques à un coût moindre et façon durable.

Vos recommandations indiquent clairement que des solutions et des stratégies pertinentes à tout point de vue peuvent être élaborées pour surmonter ce dilemme fondamental.

La publication, que l'on souhaite, de vos différentes contributions constituera une référence à laquelle nos pays accorderont, sans aucun doute, une grande importance, dans l'affinement de leur politique et de leur stratégie pour élargir l'accès à l'électricité.

Au nom du Gouvernement du Sénégal, du Ministre d'Etat, Ministre d'Etat, Ministre de la Coopération Internationale, des Transport Aérien, des Infrastructures et de l'Energie, et en mon nom propre, je voudrais remercier très sincèrement les bailleurs de fonds qui ont aidé au financement de cet atelier.

A ces remerciements, j'associe les organisateurs de cette rencontre pour l'intérêt du sujet et le travail accompli pour la réussite de l'atelier, ainsi que tous ceux qui, de près ou de loin, y ont contribué.

Tout en vous souhaitant un bon retour dans vos différents pays et familles, je déclare clos les travaux de l'atelier sur l'Initiative de l'Electrification en Afrique.

Je vous remercie de votre attention.

Mini hydro installation.

Chapter 5 | CONCLUSIONS

The AEI Practitioners Workshop in Dakar produced fruitful discussion and exchange of specific implementation strategies and techniques among SSA electrification practitioners. The combination of presentation and discussion sessions facilitated in-depth analysis of ground-level actions that could be applied by practitioners. Face-to-face interactions and "live" online knowledge exchanges of SSA electrification practitioners will continue as the core task of the AEI program. AEI will continue to strengthen its partnerships with existing and new stakeholders, including EUEI-PDF, GIZ/EnDev, ESMAP, African national and regional organizations, and the private sector. Consultations with these stakeholders will shape the agenda for future workshops and activities.

Institutional models need to be flexible, because there is not just a single solution, but rather several models that can coexist. Because SSA countries are at different stages of electrification and face different barriers, a number of different rural electrification models were explored during this workshop (centralized and decentralized, service areas based on large and small concessions, and so forth). Even within a single country, different approaches such as public, private, and hybrid methods to provide electricity access can and should coexist. For example, the government must specify in advance what should happen "when the big grid connects to a previously isolated little grid." Any national electrification strategy must allow for different approaches for different on-the-ground situations. One of the fundamental lessons for improving institutional design is to clearly define the responsibilities of actors. Best practices must be communicated to policy makers in terms that they will understand and find compelling. Last but not least, to successfully integrate gender issues into project design, it is necessary to identify the needs of both women and men to ensure the resulting programs are tailored and relevant. In the past, energy programs did not formally integrate gender considerations into project design.

Rural electrification programs require strong leadership. The countries most successful at achieving noticeable scale-up of rural access have strong government commitment combined with government financing and a dedicated, capable implementation institution. They also have either an efficient distribution utility or a specially designated agency, as well as efficient contractors and small service providers. There is no superior model for centralized or for decentralized electrification: the approach needs to be adapted to local conditions in the respective country.

Utility-based central planning remains relevant and leads to focused and effective project implementation when there is a strong utility to take the lead. However, there should be more focus on customers, particularly the energy requirements of rural people, instead of top-down planning.

Leveraging off-grid electrification technologies is significant for rural areas. Complementary technologies such as PV systems and minigrid systems are especially relevant for off-grid areas because SSA settlement patterns are often dispersed and the costs of building and operating main grid extensions to service these communities are high. PV systems can make a substantial contribution to meeting universal energy access targets, however, relatively high costs and sustainability issues remain issues for some PV systems, so subsidy

schemes would have to be well tailored. But when it comes to promoting lighting products specifically, private enterprises consider subsidies counterproductive, and instead encourage governments to educate endusers about the benefits and importance of investing in such products. It is possible for high-quality, off-grid lighting to compete with cheap, low-quality products through effective consumer outreach. There should also be a mechanism to support local buy-in for the different programs.

REFs should be capable of raising funds. REFs, where appropriate, should be established as full-fledged financial institutions capable of raising funds and financing profitable projects. REFs need to raise private capital sources for access scale-up, taking into consideration the huge investment needs of the countries. REFs' capacity to evaluate projects, prepare project pipelines, and conduct financial engineering should be further strengthened through technical assistance and collaboration with other REAs/REFs and international organizations.

Low-cost, high-quality technical solutions in distribution and financing schemes for the poor should be applied broadly in SSA to address the current high capital costs and connection charges. Countries in SSA have piloted various financing schemes to reach the poor, taking into consideration the low ability to pay. These include capital subsidies, credit schemes, revolving funds, connection cost recovery through tariff, and others. New climate finance mechanisms may eventually provide new sources of financing the use of available renewable energy for access scale-up, but at present, available funding levels are still uncertain.

Balanced subsidies are important for offsetting some high capital costs. Recommendations emerging from the workshop include selective subsidization of capital costs and flexible repayment methods for customer connection costs. On the other hand, subsidizing operating costs and postconnection consumption is often counterproductive and has led to fiscally unsustainable situations. Most SSA governments do not have the ability to fund operational costs and rural tariffs on an ongoing basis. Private investment in isolated minigrids is not likely to be forthcoming unless private investors are allowed to cover their operating and replacement costs after they receive initial subsidies for their capital costs, which means not being constrained to charging the same tariffs as state-owned national utilities. Cost recovery after subsidies is important to ensure the implementing agencies remain financially strong.

Under a business-as-usual scenario, the electrification rate in SSA will reach only about 50 percent by 2030. The medium-term goal of AEI is to provide the how-to help to meet the United Nations 2012 International Year of SE4ALL access goals, namely to achieve universal access to clean, reliable and affordable energy services for lighting, cooking, heating, communications, and productive uses by 2030. This is a big challenge for the national governments that are setting ambitious targets, but it is an even greater challenge for SSA electrification practitioners to reach these targets. AEI is determined to facilitate this process by providing the tools and the space for practitioners to gain access to best practices and bridge the knowledge gap.

For more information on AEI and upcoming activities, please visit the Web site at http://go.worldbank.org/WCEDP90SZ0, and participate in the AEI blog discussions at http://AfricaElectrificationInitiative.ning.com

ANNEX 1 | RELEVANT LINKS

Workshop Resources

- Agenda
- Call for Papers Results
- Posters
- PV Manuals
- List of Participants
- Evaluation Report

Other Links

- Africa Electrification Initiative (AEI)
- Africa Renewable Energy Access Program (AFREA)
- The World Bank Africa Energy Unit
- Energy Sector Management Assistance Program (ESMAP)
- AEI Social Collaboration Space (membership by invitation only – please contact AEI Coordinator Raluca Golumbeanu at rgolumbeanu@worldbank.org to request an invitation)
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)
- EU Energy Initiative – Partnership Dialogue Facility (EUEI-PDF)
- Agence Sénégalaise d'Électrification Rurale (ASER)



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