SMART VILLAGES
New thinking for off-grid communities worldwide

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The inceptive high-level workshop on energy access in West Africa

Workshop Report 34

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Smart Villages

We aim to provide policymakers, donors, and development agencies concerned with rural energy access with new insights on the real barriers to energy access in villages in developing countries—technological, financial and political—and how they can be overcome. We have chosen to focus on remote off-grid villages, where local solutions (home- or institution-based systems and mini-grids) are both more realistic and cheaper than national grid extension. Our concern is to ensure that energy access results in development and the creation of "smart villages" in which many of the benefits of life in modern societies are available to rural communities.

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EUEI PDF

The European Union Energy Initiative Partnership Dialogue Facility (EUEI PDF) is a multi-donor facility that contributes to the achievement of the Sustainable Development Goals, and in particular, on energy. It is a flexible instrument of the European Union since 2004 to promote sustainable energy for equitable development in Africa, Latin America and Asia. The EUEI PDF offers a range of services from coordination and strategic political dialogue to implementation in partner countries and focusing on:
Strengthening the coordination of European donors and the common European contributions;
Supporting high-level political dialogue and processes;
Providing policy advice, institution and capacity building services;
Working towards accelerating the development of sustainable energy markets;
Conducting research and facilitating knowledge sharing in collaboration with academia and energy research institutions.

The EUEI PDF together with the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) are currently implementing a regional capacity building and technical assistance project on Clean Energy Mini-grids in the ECOWAS region and training on a toolbox for Renewable Energy tariff setting.

ECREEE

The Economic Community of West African States (ECOWAS) is a regional organisation of fifteen countries in West Africa. ECOWAS was established in May 1975 with the main goal of promoting economic integration among the member states. ECREEE is a specialised agency of ECOWAS which acts as an independent body, within the legal, administrative and financial framework of ECOWAS rules and regulations. The overall objective of ECREEE is to contribute to the sustainable economic, social and environmental development of West Africa by improving access to modern, reliable and affordable energy services, energy security and reduction of energy-related green house gas (GHG) emissions and climate change impacts on the energy system. ECREEE aims for the workshop were to promote the exchange of experiences on policy and regulatory framework for clean energy mini-grids among and with the ECOWAS member states and launch a multi-stakeholder partners for the provision of technical assistance and capacity building on this topic.

Publishing

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MALAYSIAN COMMONWEALTH STUDIES CENTRE

CAMBRIDGE MALAYSIAN EDUCATION AND DEVELOPMENT TRUST

Contents

Summary

With a high percentage of the West African population living in remote rural areas, clean energy mini-grids (CEMGs) have been identified as essential for achieving universal energy access. This is reflected in the national targets and renewable energy action plans across the ECOWAS (Economic Community of West African States) region, where CEMGs are featured as part of the solution. In line with this, an ambitious target of building 128,000 CEMGs in West Africa by 2030 has been set. The aim is to contribute to reaching the 400 million people that are currently without sustainable electricity access in the region. However, to reach this target considerable effort is needed to support the implementation of CEMGs in the ECOWAS states—the lack of adequate enabling environments has so far hampered progress.

In light of the above, the Smart Villages Initiative, in collaboration with the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) and the European Union Energy Initiative Partnership Dialogue Facility (EUEI PDF), held a workshop titled 'High-level workshop on energy access in West Africa' in March 2017. The inceptive workshop served as a kick-off event to a wider capacity-building engagement on CEMGs in the ECOWAS region and provided insight into the challenges faced by ECOWAS countries with regards to CEMGs. In addition, a core component of the workshop was an opportunity to reflect on, and consequently to refine, the conclusions and recommendations from the Smart Villages Initiative West Africa engagement programme. The objective was to communicate the experiences, views, and recommendations of frontline individuals and organisations to policymakers in West Africa on how off-grid energy access can be achieved so as to catalyse productive enterprise and the provision of essential services, such as healthcare and education, in rural villages.

The workshop revealed that:

- CEMGs are of great interest to all the ECOWAS member states. It was highlighted that there is a need for more appropriate energy planning, including incorporating CEMGs into the national energy plans to complement main grid extension instead of considering them in isolation. This will increase the chances of achieving the region's 2030 energy access goals.

- Energy should be seen as part of the national infrastructure, similar to education for example, and as such it is the role of national governments to provide universal access to it.

- To date, private sector involvement in CEMGs has been limited but it was found that in all ECOWAS countries there is a desire to include the private sector in the national energy plans. However, the extent to which the private sector is intended to be involved varies across the member states.

- The workshop revealed that there is a need to assess and map the experiences that ECOWAS member states have had with CEMGs. So far, reports of experiences have been limited and records of lessons learnt, also drawing on the negative experiences, are difficult to come by. There is a need for more monitoring and evaluation to help better understand what has worked, what has not, and why.

- Across the region there has been improvement in policy and regulatory frameworks. Nevertheless, further progress is necessary. There is a need for regulators to take more interest in rural electricity initiatives and for governments to implement more supportive and transparent policy and regulatory frameworks.

- Regarding tariffs, the workshop found out that there is a lot of interest in harmonising tariffs in the regional market. However, a one-size-fits-all model for the harmonisation of tariffs is not possible. Each member state has different approaches and requirements. Moreover, the costs of local electricity generation are still too high and tariffs do not enable costs to be fully covered.

- As in other regions of Africa, there is no local manufacturing of most energy system components and equipment in West Africa. Workshop participants agreed that there is a need for providing supportive policy and regulatory frameworks that make local manufacturing more attractive.

- There is a need to increase awareness about mini-grids across rural villages. The benefit of such awareness is two-fold. Firstly, if villagers understand the benefits of mini-grids they will put pressure on governments to support them. Secondly, improved awareness will help sensitise the community to the opportunities for productive enterprises arising from energy access.

Participants from every West African country--including numerous policymakers--joined Smart Villages, EUEI-PDF, and ECREEE in Abidjan for two days of workshop discussions.

Introduction

The Smart Villages Initiative closed its regional engagement programme in West Africa with a workshop in Abidjan, Ivory Coast, in March 2017. Over two days, 28 and 29 March, the workshop brought together more than 70 key stakeholders from the public sector, academia, and international agencies engaged in the off-grid energy sector across West Africa. The workshop was held in partnership with the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) and the European Union Energy Initiative Partnership Dialogue Facility (EUEI PDF), and served as a kick-off event to a wider capacity-building engagement on Clean Energy Mini-Grids (CEMGs) in the ECOWAS (Economic Community of West African States) region.

ECOWAS is a regional organisation of fifteen West African countries, established in May 1975 with the main goal of promoting economic integration among the member states. ECREEE is a specialised agency of ECOWAS that acts as an independent body within the legal, administrative, and financial framework of ECOWAS rules and regulations. The overall objective of ECREEE is to contribute to the sustainable economic, social, and environmental development of West Africa by contributing to improved access to modern, reliable, and affordable energy services, energy security, reduction of energy-related greenhouse gas (GHG) emissions, and climate change impacts on the energy system. ECREEE's aims for the workshop were to promote the exchange of experiences on policy and regulatory frameworks for clean energy mini-grids among and with the ECOWAS member states, and to launch a multi-stakeholder platform for the provision of technical assistance and capacity building on this topic.

The EUEI PDF is a multi-donor facility that contributes to the achievement of the Sustainable Development Goals (SDGs), and in particular the goal on energy, SDG 7. It is a flexible instrument of the European Union, established in 2004, to promote sustainable energy for equitable development in Africa, Latin America, and Asia. EUEI PDF offers a range of services from coordination and strategic political dialogue to implementation in partner countries and focuses on: strengthening the coordination of European donors and the common European contributions; supporting high-level political dialogue and processes; providing policy advice, institution, and capacity-building services; working towards accelerating the development of sustainable energy markets; and conducting research and facilitating knowledge-sharing in collaboration with academia and energy research institutions.

EUEI PDF, together with ECREEE, is currently implementing a regional capacity-building and technical assistance project on clean energy mini-grids in the ECOWAS region, which includes the provision of training on a toolbox for renewable energy tariff setting. EUEI PDF's participation in the workshop contributed towards the implementation of these two initiatives.

This report summarises key points arising from the presentations and discussions, and is accompanied by a policy brief that distils the main messages for the policy and development communities. Copies of the presentations are available on the Smart Villages website (www.e4sv.org). In advance of the workshop, the Smart Villages team prepared a background paper summarising key aspects of the energy situation in West Africa. This report can also be accessed on the website. The workshop agenda and the list of participants, along with their organisational affiliations, are provided in Annexes 1 and 2 of this report respectively.

Day 1: 27 March 2017

Welcome address

John Holmes (Smart Villages Initiative – SVI, UK) welcomed participants to the workshop and thanked the organising partners for all their efforts to pull together the two-day event that should provide much useful information on the issues around village-level energy access initiatives in West Africa. He briefly introduced the Smart Villages Initiative and explained that this workshop represented the conclusion of its engagement activities in West Africa, previous workshops in the region having been held in Ghana, Senegal, and Togo.

Crispen Zana (EU Energy Initiative Partnership Dialogue Facility – EUEI PDF, Ethiopia) thanked the hosts in Ivory Coast for supporting the workshop. He introduced the EUEI PDF as a flexible instrument of the European Union supporting the development of sustainable energy services in Africa. EUEI PDF is concerned with donor coordination, providing policy advice and implementation on the ground. It is undertaking capacity building to improve the policy framework for clean energy mini-grids (CEMGs) in West Africa and has developed a toolbox to inform the design of CEMGs.

In 2011 EUEI PDF collaborated with ECREEE (ECOWAS Centre for Renewable Energy and Energy Efficiency) to elaborate a renewable energy plan and policy, which is still referred to. An ambitious target has been set to install over 120,000 mini-grids in West Africa by 2030, but so far the deployment of mini-grids has not grown as expected. One of the reasons for the low level of deployment is that there is not a clear policy framework. The Africa-EU Renewable Energy Cooperation Programme (RECP) is a part of EUEI PDF with a focus on bringing in the private sector.

West Africa has a lot of renewable energy resources but has not so far made much use of them. Historically, electricity from renewable energy sources has been expensive, but prices have come down and solar power can now be generated for 6 US cents/kWh, which is competitive with coal-based power generation. It is important to keep up the pressure on the deployment of renewable energy in West Africa: 70% of people in sub-Saharan Africa still do not have access to electricity.

Mahama Kappiah (ECOWAS Centre for Renewable Energy and Energy Efficiency – ECREEE, Cape Verde) thanked the Smart Villages Initiative and EUEI PDF for their partnership in setting up the workshop. He explained that 42% of the population in West Africa have access to electricity, but this reduces to 8% for rural communities. This means that 175 million people in West Africa have no electricity, which is unacceptable. The Sustainable Development Goals have set the target of universal electricity access by 2030: this target guides the activities of ECREEE in West Africa.

ECOWAS recognises the importance of off-grid solutions and it is anticipated that mini-grids will provide 25% of new connections. This implies that 128,000 mini-grids need to be deployed by 2030. To date fewer than 300 clean energy mini-grids have been deployed in the region, with 200 more in progress. This is nowhere near enough. The good news is that tremendous efforts are now being made to improve the investment environment for mini-grids in West African countries. The meeting of the Alliance for Rural Electrification (ARE) in Lisbon the previous week (22 to 23 March) revealed that the off-grid energy community is ready to provide support.

ECREEE is currently discussing an initiative to carry out feasibility studies for 1000 mini-grids in West Africa. An enabling environment is needed and ECREEE is providing technical assistance to

stakeholders to increase the capacity in the region. This workshop is the first in a series planned on the subject of CEMGs. National efforts are individually too small and harmonised regional markets are needed.

Introduction to the Smart Villages Initiative

John Holmes, SVI, UK

John Holmes outlined the motivation for the Smart Villages Initiative through the global numbers on energy access, indicating that over one billion people still do not have access to electricity, and three billion people still cook on dirty and inefficient stoves. Sustainable Development Goal 7 sets the target of universal energy access by 2030. Equally important is the recognition that energy access is necessary to achieve most of the Sustainable Development Goals.

In smart villages, energy access along with modern information and communication technologies enable the provision of key services such as healthcare, education and sanitation, and stimulate the establishment of productive enterprises, including capturing more of the agricultural value chain at the village level. It also facilitates closer engagement of rural communities in democratic processes and enables rural communities to become more resilient to natural disasters and economic shocks. Technological developments are changing the balance of opportunities between villages and cities.

The Smart Villages Initiative has its base in the universities of Oxford and Cambridge, and works in partnership with a range of organisations, including the national science academies and their networks. It brings together key frontline workers in energy access for development to discuss the barriers and how they can be overcome. Its role is then to convey the arising conclusions and recommendations to key policy bodies and development organisations.

Over 30 workshops have been run in East and West Africa, South and Southeast Asia, and Central and South America. Much attention is paid to outreach, sensitising the media to the issues, and undertaking an ongoing dialogue with key policy makers and development organisations.

The Smart Villages Initiative aims to identify the framework conditions necessary to support entrepreneurial activities in the provision and use of energy in villages, and to maximise the leverage of funding provided by governments and donors. An important premise is that it is necessary to take an integrated and community-level approach to rural development, while a key concern is to catalyse rapid progression up the energy and development ladders.

Summary of findings from the Smart Villages Initiative's engagement programme in West Africa

John Holmes, SVI, UK

Summarising the findings from the Smart Villages Initiative's engagement programme in West Africa, John Holmes started by identifying a number of crosscutting issues. First of these was the need to improve access to affordable finance for companies implementing mini-grids and selling solar home systems. Supportive policy frameworks are also needed, underpinned by high-level political commitment which establishes renewable energy targets and sets out the national energy access plan, identifying which areas are planned to benefit from national grid extension on what timescales.

Initiatives to provide support to entrepreneurs are valuable, and capacity building continues to be needed at every level. Levels of awareness of the technology options for energy access and the opportunities that arise in respect of productive enterprises are generally low amongst villagers, so initiatives on awareness-raising continue to be relevant. All initiatives should make a point

of fully involving women and youth, who may otherwise be excluded. The focus should be on building markets, not giving things away.

Turning to the subject of solar home systems, John Holmes explained that there have been major developments with substantial reductions in system costs, improvements in the efficiency of appliances, and new pay-as-you-go business models. These developments have resulted in third-generation systems that require one-third of the power to support a given level of service, whose weight has been reduced from 50 kg to 6 kg, and with an overall cost reduction of 30 to 50%. Going forward, companies selling solar home systems need more access to affordable finance, to leverage distribution networks of other suppliers of goods and services to villages, and to build the skills base. Poor quality and counterfeit products continue to be a major problem: this is an issue that needs to be addressed through establishing and enforcing quality standards, and through international action on counterfeit products.

Mini-grids have made more limited progress because, with the exception of some micro-hydro projects, costs generally exceed revenues. In order to balance the books, costs need to be reduced through technological developments, economies of scale, the use of anchor loads to absorb costs, reducing set-up overheads and financing costs, and potentially well-targeted capital cost subsidies. On the revenue side, it is important to set appropriate tariffs, achieving a balance between affordability on the one hand and profitability on the other. Other actions to increase revenues include stimulating productive enterprise to increase incomes, increasing load factors and the level of connections, and potentially some form of well-targeted and time-limited operating cost subsidy.

A key concern for mini-grids is to undertake effective community engagement. Villagers should be the main drivers of schemes, which should build on local knowledge and customs. It is often useful to work with trusted local individuals and organisations who can act as champions for the project. Engagement activities should ensure that the poor have a voice and a stake, not just the powerful. Mini-grid projects are often described as being 70% social and 30% technical.

Key drivers for the adoption of clean cooking technologies are the health risks from exposure to smoke and fumes, reducing the environmental impacts in respect of deforestation and climate change, and accessing social benefits—in particular by reducing the time required to collect firewood. The design of improved cookstoves should be based on user needs and cultures. Financing schemes, and potentially subsidies, are needed to ensure the viability of all stages of the value chain for improved cookstoves. Technical and business support should be given to the actors in the value chain, and there should be a focus on enhancing and maintaining product quality.

On the important issue of the water-energy-food nexus, John Holmes pointed to the close linkages and interactions between these three areas. Regrettably, a silo approach is all too common and there is a lack of coordination between organisations concerned with water, energy, and food. Integrated and cross-ministry policies and initiatives are needed, based on a better understanding of the synergies and competing interests. A participatory and market-based approach should be taken, building on existing practices and respecting local cultures. Governments should ensure that there is a supportive environment in place for the private sector's involvement and that there is access to affordable finance. Capacity building is needed not only for the smallholder farmers, but also for the policy making community. Particular attention should be paid to smallholder farmers in poor areas for whom improvement in livelihood is more challenging. Gender issues should be addressed as women play a key role.

John Holmes ended his presentation with some reflections on the UN Sustainable Development Goals. Sustainable Development Goal 7 on energy access should have an appropriate level of ambition, providing for a level of energy services capable of supporting productive enterprise. Given the close interactions between the Sustainable Development Goals, a fully integrated approach needs to be taken otherwise synergies will be missed.

With regard to Sustainable Development Goal 17, concerned with strengthening the means of implementation, better coordination is needed between development agencies. There is value in sharing information between players in different countries and sectors, as exemplified by the workshops held by the Smart Villages Initiative. There should be better collaboration between university researchers and frontline workers who need applied research to help solve their operational problems. More needs to be done to evaluate the development outcomes of energy access initiatives.

Promoting public-private partnership mini-grids for development of private enterprises Jannik Moller, GIZ Nigerian Energy Support Programme, Nigeria

Jannik Moller began his presentation by introducing the Nigerian Energy Support Programme (NESP), funded by the European Union and Germany, with the aim of establishing an enabling framework for rural electrification in Nigeria. The programme began in 2013 and is being undertaken over a period of five years. Focusing on mini-grids, it provides technical assistance on policy and regulation, and on electrification planning. The programme also provides technical assistance and capital grants to the private sector for mini-grid development, and technical assistance to financiers and investors interested in investing in the mini grid sector.

The economic space occupied by mini-grids sits between solar home systems for dispersed communities and national grid extension for larger populations close to the grid. Mini-grids can support electricity needs Tiers 2 to 5[1]. Various models can be used for mini-grids: utility, private, community, and public-private, each with advantages and disadvantages.

The International Energy Agency (IEA) estimates that 140 million people in Africa will gain access to mini-grids, requiring the installation of 4,000 – 8,000 mini-grids a year over 25 years. In Nigeria it is estimated that there are 4,000 potentially suitable sites for mini-grids serving 13 million people. This corresponds to an investment of 2 billion euro and an installed capacity of 1.8 GW. A mapping exercise has been carried out for Nigeria, identifying promising sites for mini-grids, and also where national grid extension or solar home systems are the more appropriate solution.

Productive loads are considered to be the key to scaling-up the deployment of mini-grids: they improve the profitability of schemes. Important barriers to mini-grids include the lack of supportive regulatory frameworks and the difficulties in accessing finance. Uncertainties about the future prospects of mini-grid projects are an impediment to the financial sector's willingness to lend into the sector. Capital is also needed to invest in mechanisation in connection with establishing productive enterprises. The enabling frameworks for mini-grids should provide for compensation in the event that the national grid arrives, and should allow tariffs to be set that reflect costs.

Governments in West Africa are becoming more interested in off-grid solutions. NESP is piloting a public-private partnership model. Five pilots are being supported: NESP provides technical

1 Angelou, Nicolina; Bhatia, Mikul. 2014. Capturing the multi-dimensionality of energy access. Live wire knowledge note series; no. 2014/16. Washington, DC : World Bank Group. http://documents.worldbank.org/curated/en/937711468320944879/Capturing-the-multi-dimensionality-of-energy-access

assistance and a grant to offset around 40% of the project's capital expenditure. Private partners contribute with their manpower as well as debt or equity, and state governments contribute by covering regulatory costs.

NESP is looking next to a roll-out phase in which it will support the preparation of replication strategies. It aims to identify five private partners, each of whom would undertake up to 10 projects giving 50 projects in total. The total investment portfolio for this next phase is 25 million euro. NESP will support 20 new projects with a 40% capital grant and technical assistance. It is seeking collaborations with investors to match-make them with its private partners, and is providing technical, financial, and legal advice to investors.

More needs to be done to increase social awareness: if villagers understand the benefits of mini-grids they will put pressure on governments to support them.

Breakout session

Workshop participants divided into groups to discuss three questions: to identify the main barriers to off-grid energy access for development in West Africa, to consider the actions needed to overcome those barriers, and to identify the actions needed to support productive enterprises in villages. Key points made in the plenary feedbacks were as follows:

On barriers:

1. The costs of local electricity generation are still too high and often tariffs do not enable costs to be covered. Tariffs are too often politicised.

2. There is insufficient political will, and regulatory and policy frameworks are often inadequate or not adapted to the needs of rural communities.

3. There is insufficient collaboration between ministries and between actors.

4. There is limited investment in rural areas and the private sector is not sufficiently involved.

5. Generally, there is poor knowledge of where the funding sources are and rural people often do not have good credit ratings.

6. There is a lack of the necessary skills and capacity, and inadequate technical standards.

7. In many areas there is no mobile phone coverage and hence it is not possible to make use of mobile payment systems.

On actions to overcome the barriers:

1. Generation costs should be reduced through economies of scale, more local manufacture and installation, and through waiver of import duties.

2. Governments should invest more in rural infrastructure, prioritising off-grid renewable energy schemes and establishing measures such as tax incentives to attract private sector investment through public-private partnerships.

3. Governments should set up and enforce supportive and transparent policy and regulatory frameworks that are underpinned by reassuring judicial systems. Regulators often do not take sufficient interest in rural electricity initiatives.

4. Enabling environments should be established so that policies can be implemented in collaboration with the private sector. Initiatives should include loan schemes and micro-finance, devolving financial responsibility to local governments, and the use of de-risking tools such as guarantee mechanisms for investments.

5. Pilot projects should be undertaken to help build understanding of the stakeholders.

6. Better awareness of customer needs should be established.

On support to productive enterprise:

1. In order to prioritise support for economic activities, audits should be undertaken of the economic activities in communities and of the community's needs.

2. Capacity building should be undertaken to sensitise the community to the opportunities for productive enterprises arising from energy access.

3. Rural development planning should be undertaken in tandem with electricity access planning.

4. Access to loans to set up and to expand rural enterprises should be facilitated. Awareness of potential opportunities should be built into the micro-finance institutions.

5. Action should be ongoing to reduce the cost of power generation for rural communities.

6. Multifunction platforms should be set up to enable the local processing of commodities.

7. Administrative procedures for doing business should be improved.

8. Fiscal incentives should be established for companies investing in rural enterprise and electricity provision.

9. More monitoring and evaluation needs to be undertaken in order to better understand what has worked, what has not and why.

10. Implementation times should be speeded up.

Plenary session 1

Introduction to the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE):
Mahama Kappiah, ECREEE, Cape Verde

Mahama Kappiah spoke about the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) and its contributions to energy access across West Africa. ECREEE was established in August 2008 by the ECOWAS Heads of States (it then took office in Praia, Cape Verde, in November 2009) to promote renewable energy and energy efficiency in the region. It works in four key result areas: policy and regulatory frameworks, capacity development and certification, knowledge management and awareness raising, and project development and finance.

ECREEE's policy and regulatory frameworks achievements include a regional policy on renewable energy and another on energy efficiency, both released in 2013. These policies set targets for the region and, based on them, each member state developed a national action plan for renewable energy and energy efficiency as well as a SE4All national agenda. For capacity development, ECREEE has provided targeted training for renewable energy and energy efficiency practitioners from the member states, carried out in the region and internationally with global partners. To address the knowledge and information barriers to renewable energy and energy efficiency, ECREEE has developed a knowledge management platform called ECOWAS Observatory for Renewable Energy and Energy Efficiency (ECOWREX). ECREEE carried out resource assessments for the different forms of renewable energy (i.e. solar, hydro, wind, and bioenergy) in the region and made this information available through ECOWREX. In its project development and finance activities, ECREEE has supported project development, feasibility studies, design, tendering, and contracting activities in the dif-

ferent member states depending on their needs. Through the ECOWAS Renewable Energy Facility (EREF), ECREEE provided co-funding in the form of grants for 55 small and medium-sized projects (40 in the first round and 15 in the second round) on renewable energy and energy efficiency and businesses.

ECREEE is also the coordinating or implementing partner for a number of internationally financed projects and programmes in the region on improving energy access and energy efficiency, and on crosscutting issues of gender and environmental management.

ECREEE's renewable energy access programme has three components. The first and smallest component is solar home systems and lamps. Mahama Kappiah noted that ECREEE has a substantial investment target for solar home systems and solar lamps of almost US$800,000. Recently, they agreed to collaborate with the World Bank, which should provide US$200 million. The second component is mini-grids. ECOWAS has an ambitious goal to build 128,000 mini-grids by 2030. There are currently 4,000 mini-grids at proposal stage or already being built, with many more to come to achieve the 2030 goal. The third component is large-scale solar PV plants connected to the grid, the ECOWAS Solar Project. For this component, ECREEE has submitted proposals for projects in a number of member countries. Feasibility studies have determined that there is potential to generate 10 GW from solar in the region if the national masterplans for transmission expansion are implemented. Between now and 2020, he noted, ECREEE should be able to install 2 GW of electricity, working with IRENA and other partners.

ECREEE also has a new programme with the African Development Bank in which it will work on the energy-gender nexus over the next two years. In addition to these plans, it is signing memoranda of understanding with several other organisations. Through all of these actions ECREEE intends to bring electricity to all those in West Africa who currently do not have access.

Status and perspectives of CEMG in West Africa and regional initiative for the promotion of an enabling environment for investment in CEMG

Nicola Bugatti, ECREEE

Nicola Bugatti began his presentation by emphasising that, by 2030, 400 million people will need to have energy access in West Africa. Energy access will need to increase from 40% to 88% overall. To reach this goal, the ECOWAS Renewable Energy Policy identifies mini-grids as one option to complement other electricity access options. In all national targets and renewable energy action plans, mini-grids are featured as part of the solution.

He then shared with the audience highlights from a new report published by ECREEE in December 2016 and officially launched at the workshop: "Mapping & assessment of existing clean energy mini-grid experiences in West Africa". In this new mapping and assessment report, ECREEE found that there were 271 operational CEMGs (with a total of 21 MW installed capacity) as of December 2016, more than 90% of them based on solar. On average, these mini-grids are rather small; in fact, 197 average only 13 kW. This reflects that there are different tiers of access and different needs across the region. The larger systems are primarily in Mali. The average installed capacity is 390 W per household. In terms of who has been funding CEMGs thus far, 50% of the funding has been from development partners, mostly grants, with 54% coming from other development partners, and 26% from the EU energy facility funding. Only 3% were privately funded.

In terms of the regional CEMG electrification project, an enabling environment is needed and is still not fully in place, but the ultimate goal must be actual infrastructure on the ground. ECREEE is currently working on establishing

4,000 clean energy mini-grids around the region through providing technical assistance to the member states and facilitating investment. To support this goal and the regional goal of 128,000 CEMGs by 2030, ECREEE has launched the West Africa Clean Energy Forum, a business plan competition. Only three of 43 shortlisted business plans involve CEMGs, however, which may reflect entrepreneurs' reticence to go into mini-grid businesses.

ECREEE is also working with IRENA to carry out capacity needs assessments in the entire ECOWAS region, while also working alongside others such as institutional actors, the private sector, and finance institutions. Based on the results of the assessments with IRENA, they are also designing capacity building and technical assistance for CEMGs, and there will be a workshop in Abuja later in 2017. In 2018, capacity-building efforts will continue.

Q&A

Audience members asked Nicola Bugatti how ECREEE involved the private sector in its work. He noted that ECREEE wants to strengthen the capacity of businesses from the region. Its business plan competition is a clear indicator that there is a lot of private sector potential in West Africa because the competition is now in its third round. It was hard to find companies from the region in the first round, but businesses are becoming more competitive.

He also noted that in Mali 97 studies are being carried out by a local private company.

In response to another question, Nicola Bugatti emphasised that it is not technology that is expensive but rather project development. Often a subsidy only allows one to build three mini-grids, and then another organisation builds the next three with a different subsidy. This is inefficient and expensive.

He also noted that mini- and micro-hydro projects have a lot of potential, and there is a special part of ECREEE that focuses on mini- and micro-hydro. It is important to diversify energy sources.

Interactive discussion sessions on the policy and regulatory framework for CEMGs, including successes and challenges of ECOWAS national experiences

Moderator: Peggy Mischke, RECP Policy Advisory Team, Germany

Peggy Mischke, an engineer with 15 years of experience in the energy sector across Africa and China, chaired the discussion sessions. The discussions were divided into three interactive sessions as follows:

Session 1: Energy and Electricity Policy for Clean Energy Mini-Grids (CEMGs):

- A. Energy and Electricity Policy

Session 2: Economic, Customer and Environmental Policy and Regulation for CEMGs:

- B. Economic Policy and Regulation
- C. Customer Protection and Environmental Policy and Regulation

Session 3: Licences, Contract Regulation and Financial Support Schemes for CEMGs:

- D. Licences and Contract Regulation
- E. Financial Support Schemes, and
- F. Technical Assistance

After giving brief introductions to a number of energy and electricity topics (see headings and subheadings), she introduced the speakers who each gave brief five-minute perspectives on the issues in their respective countries.

A. Energy and electricity policy
Moderator: Peggy Mischke

National Electricity or Electrification Policy: This session included examples from Liberia, Ivory Coast, Cape Verde, and Sierra Leone, and asked the core question: "What barriers must be overcome for a quick scale-up of rural energy access programmes?" Peggy Mischke emphasised that a olicy and regulatory framework conducive to clean energy mini-grids (CEMG) is needed. Moreover, market intelligence and benchmarking—especially regarding costs and business models—are still developing and will be crucial to this burgeoning sector.

To lay the groundwork for the next four speakers, Peggy Mischke asked the question, "How many mini-grids and rural energy initiatives are already included in national electrification policies?" She noted that she has rarely seen national policies that have sub-chapters on mini-grids, other than Mali and, possibly soon, Tanzania. A national master plan is necessary for both grid and off-grid electrification, and the more detail the better. It must have up-to-date data on population density, and these data need to be reviewed frequently. Moreover, there needs to be an agreement on who is responsible, which institutions issue permits and licences, etc.

Rural electrification strategy and master plan: It is good practice to have a strategy specifically for rural electrification, with zones that are clearly allocated to mini-grid developers. Before they invest, they need to have assurance that the site is allocated and that there is a sound legal basis for the operation of a mini-grid over 10-15 years.

Liberian National Energy Policy
Dele Shobayo, Ministry of Lands, Mines and Energy (MLME), Liberia

Dele Shobayo began by describing Liberia's National Energy Policy (NEP) of May 2009, which addresses energy access, quality, cost, and institutional framework. He noted that the NEP was created to facilitate and accelerate the economic transformation of rural Liberia by establishing a semi-autonomous agency dedicated to the commercial development and supply of modern energy services to rural areas, with an emphasis on locally available renewable resources. In addition, it helps to create a basis for an enabling legal and regulatory framework that should guarantee that an efficient operator can profitably provide affordable and environmentally friendly energy services and products of the highest quality to the whole population. Lastly, the NEP was created to encourage the establishment of a transparent and independent regulatory process by separating the roles of policy setting, policy implementation, and policy monitoring.

The action plan and rural energy projects are structured under five main programmes that aim to support on-grid solutions; decentralised grids; the electrification of community services, households, and public buildings where the grid is not expected to reach before 2025 via solar off-grid solutions; energy efficiency in buildings and cooking; and capacity-building efforts.

He noted that the electrification rate for the population outside of Monrovia would be 10% in 2020, 20% in 2025 and 35% in 2030. Moreover, all county capitals, health facilities and secondary schools will be electrified by 2025. They are also targeting renewable energy: no less than 75% of all electricity will be generated from renewables by 2030, with 19% coming from mini-hydro, solar, and biomass. In addition, there will be universal access to affordable solar lamps, efficient appliances, and clean cookstoves.

To close, he noted that US$935 million of investment would be required for the implementation of the rural electrification strategy. A funding gap of US$746 million exists, with additional US$102 million being required until 2020, US$303 million between 2020 and 2025, and US$344 million until

2030. In addition, the application of current tax exemptions to the energy sector is not clear. A tax regime for rural electrification and renewable energy investments needs to be developed to limit the impact of import duties and Goods and Services Tax on investment.

Ivory Coast rural electrification master plan

Ghislain Tanoh, Société Cote d'Ivoire Energy Corporation

Ghislain Tanoh presented the current state of rural electrification in Ivory Coast. By the end of 2016, the number of localities that were electrified jumped from 2,847 (in 2011) to 4,537, a 59% increase. The national coverage rate increased from 33% in 2011 to 53% in 2016, while the national access rate increased from 74% in 2011 to 80% in 2016.

The Ivory Coast (through the state-owned energy company, CI-ENERGIES) has drawn up a Master Plan of Rural Electrification (PDER), which aims to plan for the development of the electricity distribution system. In this master plan, decentralised solutions are viewed as a solution for communities that are far from the grid.

The technical solution adopted by the electricity sector is based on solar PV-diesel hybrid electrical mini-grids with storage. Ninety-six localities are eligible for rural electrification through this option, including 70 localities for which voltage drops exceed 10% and 26 communities with fewer than 250 inhabitants, where decentralised options are more economically beneficial than a grid connection.

At the end of 2016, mini-grid pilot projects and solutions were initiated by the electricity sector, including the distribution of 173 solar kits in the locality of Péré, Djamdjankro and Lararekro in Prikro (a gift of the People's Republic of China); and the establishment of hybrid mini-grids for seven localities in the Nassian department (with financing from the European Union).

In 2017, funding from the West African Economic and Monetary Union (UEMOA) and the European Union (Project to support the energy sector-ENERGOS 2) will establish hybrid mini-grids based on solar PV and diesel in 49 localities in Ivory Coast (out of a total of 96 localities). Forty-seven additional hybrid mini-grids will have to be built over the period 2017-2020.

Tariff policy and regulation (including connection fee)

Moving to the question of tariff policy and regulation, Peggy Mischke asked what tariff model one should have. Should they be national, site specific, or some combination of the two? She advised West African countries to get creative and look at other regions of the world. There are interesting tariff models in Latin American countries, for example. One can also look to utility-based tariffs in cities and use these as a channel to fund mini-grid tariffs in rural areas with poorer households. Crucially, one must include the private sector in any tariff discussions. In Tanzania, its uniform national tariff has a detailed methodology behind it and will be adjusted each year. It also has a consultative group with the private sector included.

Cape Verde mini-grid tariff policy

Karine Monteiro, Economic Regulatory Agency (ARE), Cape Verde

Karine Monteiro introduced two mini-grid projects that run on near 100% renewable energy in Cape Verde: one in Vale da Custa (photovoltaic and wind electricity generation, with a storage system and a backup genset) and the other in Monte Trigo (photovoltaic electricity generation and a backup genset). These projects include both public and private bodies in their finance, operation, and management. Consumers still pay the same tariffs as they used to pay for gen-

set-supplied electricity. There are concerns that while the tariffs cover most of the operational and maintenance costs for the projects they will not be sufficient to repay the capital investment. This poses a serious threat to the sustainability of the projects and the wider roll-out of CEMGs in Cape Verde.

The Ministry of Tourism, Investment and Development and the Economic Regulator Agency are currently looking at clarifying the mini-grids' tariff framework for the current and future CEMG projects. They are considering the following proposal: the final tariff will be equal to the national tariff for electricity provided through the main grid, and a cross-subsidy will be applied to the national tariff in cases where the revenues collected by the mini-grid operators do not cover the electricity production costs. Additionally, pre-payment meters will be installed for mini-grid consumers.

Off-grid Revolution in Sierra Leone

Benjamin Kamara, Ministry of Energy, Sierra Leone

There is currently a great deal of support for an energy and off-grid revolution in Sierra Leone. To date, they have constructed four mini-grids across the country, including a hybrid system of three 1.5 kW eco hydro and 6 kW solar power in Freetown, two mini-grids, one of 63 kW and another of 128 kW in the southeast, and a 63 kW mini-grid in the north.

In May 2016, Sierra Leone signed an energy compact agreement with the UK Government, and Sierra Leone's President launched the energy revolution of the country. The revolution aims to revolutionise the energy mind-set of rural communities and to stimulate the renewable energy market to support social and environmental improvements. Alongside the UK's Department for International Development (DfID), they are currently running the Rural Renewable Energy Project, which is implemented by the United Nations Office for Project Services (UNOPS). The project's short-term objective is to meet the targets of the President's Delivery Plan by setting up solar PV systems for 50 community health centres by June 2017, while its mid-term objective is to extend the solar PV systems to 50 (small) mini-grids and connect the villages close to the community healthcare centres by December 2017, whilst also implementing another 40 (large) mini-grids by 2019. Their long-term objective is to create an enabling environment for a large-scale rollout of mini-grids based on public-private partnerships. They also plan to use experience and lessons learned from other countries to establish a tariff framework that attracts private investments and facilitates economically viable mini-grid operation.

They are working closely with Power for All on advocacy issues to promote renewable energy and teach people about its benefits. Additionally, they have held 18 renewable energy workshops in 18 chiefdoms.

Discussion

A Power for All representative noted that he was glad that Benjamin Kamara mentioned the work they are doing together. Benjamin Kamara responded that he wanted to recognise the tremendous role that Power for All has been playing in Sierra Leone since May 2016. Just the previous week, the secretariat in Freetown invited relevant stakeholders to make commitments to take forward off-grid solutions. The Ministry cannot do it all, and it is helpful that they hold media training, for example.

B. Economic policy and regulation

Moderator: Peggy Mischke

Fiscal Policy and Regulation (Taxation, Import Duty, etc.): Peggy Mischke started the second interactive discussion session by discussing how fiscal policy and regulatory initiatives can be implemented to ensure energy access and support

mini-grid implementation. This can be achieved through specific taxes on mini-grid **developers**' income, profits, sales, property, etc. and specific duty, tax and fees for mini-grid **equipment or components**. Clear and reliable fiscal policy and regulation leads to investor trust and lower mini-grid electricity tariffs. Kwabena Ampadu Otu-Danquah presented an example of how this is being implemented in Ghana.

Fiscal policies and regulations in Ghana in relation to CEMGs

Ampadu Otu-Danquah, Energy Commission, Ghana

Ghana has a target of universal electricity access by 2020. The current electricity access rate is estimated at over 85% and national grid extension is gradually giving way to mini-grid and off-grid solutions, as it is no longer economic or feasible to reach the remaining 15% through the national grid. In line with the government's policy on improving the economic wellbeing of Ghanaians wherever they are, mini-grid solutions are being implemented to provide round-the-clock electricity supply in areas not serviced by the national grid.

The **fiscal policy** to support the National Electrification Scheme includes import duty exemption for solar panels. Additionally, the Renewable Energy Act tasks the Energy Commission with recommending suitable equipment and machinery used by the renewable energy sector for reduced or zero-rated import tariffs. The tariffs will be reviewed once local production of the equipment, machinery and parts is able to supply the demand. The Ghana Investment Center can also make recommendations for renewable energy technologies that should be excluded from import tariffs.

The **regulatory framework** (under the Renewable Energy Act) has put in place a licensing framework for mini-grid installation, operation, and maintenance, i.e. developers require construction and operating licences for individual mini-grid plants. The framework also sets technical specifications (mini-grids should be 3-phase and deliver 220-415v on a 24/7 service) and allows for regulation of tariffs (i.e. there is a cross-subsidy mechanism to ensure that everyone pays the same tariff nationwide, which should be the same as the national grid tariff).

C. Customer protection and environmental policy and regulation

Peggy Mischke discussed the basis for customer and environmental policies and regulations and then introduced Ian Baring-Gould, who presented an example of a quality assurance framework from the USA, and Alfred Dieng, who spoke about experiences from Senegal.

Technical regulations (including grid connection): These exist to ensure that supply is safe and reliable, meeting regulations, technical standards, and interconnection (between the main grid and mini-grids) rules. Adherence to technical regulations, codes, and standards can be linked to access and disbursement of public subsidies to ensure compliance. Unfortunately, regulations increase costs for mini-grids, as they are very different from main grid procedures. Usually technical standards are not sufficient and the regulations should be reflected in the issuance of licences to increase compliance rates.

Quality of service regulations and standards: Quality of service and regulation standards need to strike a balance between quality and availability for (1) energy products and services, (2) energy supply, and (3) commercial service for the customer. The processes may be different for mini-grids than for the main grid so it may be necessary to have separate specialised rural energy agencies regulating rural (mini-grid or off-grid) energy. The regulatory schemes must be realistic and affordable and include a scheme for handling customer complaints, particularly

on quality of services—for example, the number of hours of service per day.

Environmental policy and regulation: These are meant to protect the local environment and the community from harmful project impacts. They lay out procedures for environmental and social impact assessments and obtaining environmental permits, and assist in defining risk mitigation measures. Ideally these should vary with the size of the project and be simpler than those for the main grid so that they are not too onerous.

Quality assurance framework for mini-grids

Ian Baring-Gould, National Renewable Energy Laboratory (NREL), USA

Ian Baring-Gould spoke about standards in general and then discussed the quality assurance systems for mini-grids framework produced by NREL. The framework provides structure for the mini-grid sector that is different and learns from main grid models to provide energy to the off-grid population, while recognising that there are many ideas and procedures already in place for the national grids that do not need reinvention.

Standards are important to ensure (1) safety and interoperability, (2) replicability or standardisation of products, and (3) minimum specifications for product construction. Thus standards ensure that new products and services work as specified. This process is still in its nascent phase for the mini-grids sector. To implement the emerging standards, there is need for training and certifying the practitioners that implement them and harmonising the process across national boundaries.

There are technical mini-grid standards for project planning (load assessments), level of service (energy availability, quality, and reliability), equipment specification, distribution systems, metering technology, household wiring and interconnectivity (between mini and main grids), reporting, and cyber security. Most of these standards are established in the main grid sector and there is a need to apply the knowledge to mini-grid projects. Isolated power systems incorporate multiple national and international technical standards for most of the processes mentioned above to the different parts that are assembled to form a mini-grid (however, only a few include standards for cyber security or power system implementer certification).

The Quality Assurance Framework developed by NREL (available at https://cleanenergysolutions.org/) incorporates definitions for Levels of Service (tailored to consumer tiers, with thresholds for power quality, availability and reliability) and an Accountability Framework (a clear process to verify power delivery and assessment/reporting protocol for mini-grid operators):

Levels of service: Power **quality** for rural energy does not mean power parity, because achieving power parity is expensive. The goal should be having and achieving different power quality threshold levels for rural areas. **Availability** goals should seek to ensure that power is provided in the amount and for a period of time that meets expectations, depending on specific customer need, ability to pay, and other factors. **Reliability** criteria should take into account planned and unplanned power outages, and strive to ensure that service providers make commitments to the consumer and live up to those commitments.

Accountability framework: This helps regulators, customers and financiers to gain a good understanding of the mini-grid business. It is made up of a **consumer accountability** framework (i.e. level of service verification aligned to an established service agreement between provider and customer), and a **utility account-**

ability framework (i.e. information about the performance of the mini-grid aligned to technical and business reporting templates). The utility accountability framework helps regulators and financiers to understand the mini-grid business and what it is they are paying for.

Alfred Dieng, Rural Electrification Agency of Senegal (ASER)

Alfred Dieng presented an example of how standards are being applied in Senegal's energy sector. Senegal has minimum standards and technical specifications for three options: national grid extension, mini-grids (about 300 villages, 300,000 people, connected to mini-grids in Senegal), and standalone photovoltaic systems. The standards apply to the generator, batteries and invertors, distribution cables, and measures for safety and protection against lightning. There are also environmental rules, applicable to the installation, operation, and declassification phases of photovoltaic projects. The standards consider disposal or recycling of used batteries, containment of chemical leaks, system maintenance, environmental and social impact analysis, etc. There are calls for the 2005 standards to be updated to align with the new technologies that have now come onto the market.

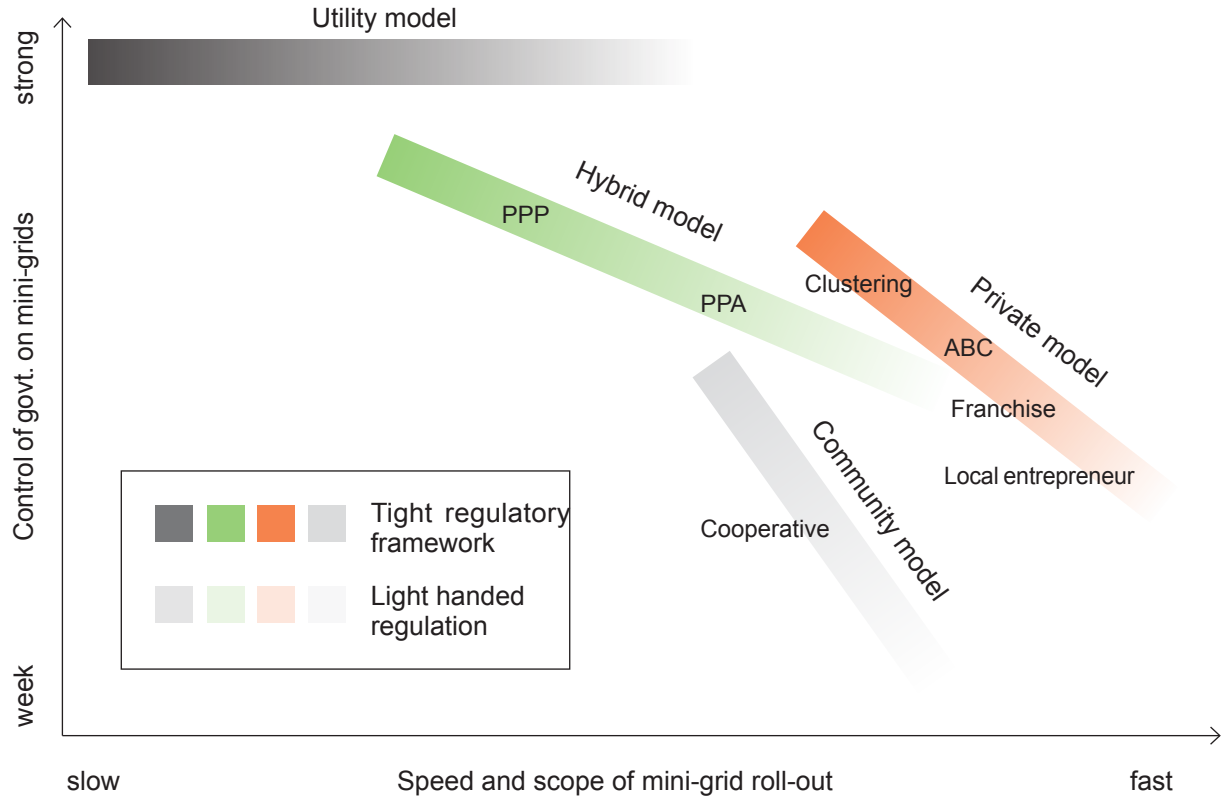
Day 2: 28 March 2017

D. Licences and contract regulation
Peggy Mischke

The initial part of the session focused on **licences and contract regulation.** As moderator for the session, Peggy Mischke introduced a diagram showing where the different mini-grid management models—utility, hybrid community, and private—lay in relation to two parameters: the level of government control and the speed and scope of roll-out.

Generation and distribution permits and licences: With regard to generation and distribution permits and licences, governments can grant non-exclusive rights to generate, distribute, and sell electricity in a certain area for a certain period of time. An energy sector regulator, a dedicated rural energy agency or a ministry in charge of energy, usually grants such rights. They can include detailed preconditions (like land leases/ permits or environmental impact assessments) and may specify mini-grid operating conditions. The form of the rights impacts the transaction costs, financial viability, access to finance, and scalability of a mini-grid business model.

Concession contracts and schemes: Concession contracts and schemes are formalised between public and private entities granting the exclusive right to invest, operate, and maintain the distribution assets and sell electricity to end-users for a given number of years in a specified geographic service area. They bind a private operator to deliver a specified quality of service and electricity access targets and in turn often entail favourable terms. They may be awarded after a competitive bidding process, particularly for large-scale concessions that aggregate several mini-grid projects. Concession contracts need to ensure that the terms and conditions are suitable for the local context.



Power purchase agreements (PPA): Power purchase agreements may be put in place which are multi-year contracts detailing the rights and obligations of two parties—a generator and a buyer of electricity. They are needed for a mini-grid when independently produced electricity is sold in bulk under a feed-in tariff to a distribution grid operator, the national grid utility or an anchor customer. They should be fair, binding, ban unilateral changes, and protect parties to the contract equally. They could be standardised for mini-grids to facilitate approvals of grants and loans from financial institutions and development partners.

Peggy Mischke introduced the two panel members speaking on the issues around licences and contract regulation.

Thienta Thiero, Malian Agency for the Development of Household Energy and Rural Electrification (AMADER), Mali

Thienta Thiero introduced AMADER, the Malian government agency established in 2006 which is responsible for rural electrification. To date AMADER has provided power to 255 areas in Mali. AMADER's strategy for supporting mini-grids is to use public-private partnerships. Initially these were funded 80% from the state and 20% from the private sector partner. There have been three rounds of funding; the first from the World Bank which identified 50 localities, the second funded by the French development agency which identified 60 locations, and the third supported by a fund based in Abu Dhabi which identified 32 locations.

The private sector operator for a particular site makes a joint approach to AMADER with the mayor of the village for a permit. They are given four months to undertake a study. If the project is given the go-ahead they are given a licence for 15 years, after which the operator can withdraw or apply for a new permit. If the community is not satisfied that the operator is giving the promised level of service they can complain to AMADER. Initially a warning is issued and if that does not rectify the situation the operator can be replaced. One of the problems encountered is that the operators do not engage qualified staff. The schemes are now required to provide 18 hours of power each day.

Mali is a landlocked, non-oil producing country that has no control over fuel prices. The price of diesel fuel recently increased sharply, which has challenged the financial viability of diesel mini-grids. AMADER is therefore leading a process of hybridisation, adding solar PV to existing gen-sets. Over 100 schemes have so far been retrofitted out of a total of 250.

Many benefits have been seen in the villages powered by mini-grids. A lot of new income-generating activities have been set up, women are relieved of time-consuming activities through labour saving devices, and school attendance has improved through the electrification of schools.

Abayomi Adebisi, Federal Ministry of Power, Works and Housing, Nigeria

Abayomi Adebisi explained that a regulatory framework has been established in Nigeria for off-grid electricity schemes. No licence is required for clean energy mini-grids with a generating capacity below 1 MW or a distribution capacity less than 100 kW. In line with the government policy, six small hydropower schemes with a total generating capacity of 17.3 MW are being procured to establish concessions.

Power purchase agreements have been signed with 14 solar power producers to generate 1125 MW. Future power purchase agreements will be set up through a competitive bidding process. A price of 11.5 c/kWh has been negotiated.

A Renewable Energy Micro-Utility (REMU) concept has been developed: each system would generate 50 kW and supply 1,000 households with a basic level of electricity services. It is hoped that

this will be an attractive model for the private sector.

E. Financial support schemes

Peggy Mischke

Grants and subsidies (including CapEx, OpEx, and performance-based): In the second part of the session attention turned to **financial support schemes** for clean energy mini-grids. Peggy Mischke indicated that grants and subsidies are financial support instruments that incentivise actors to provide electricity in regions, and to population groups, that lack the financial means to afford the full costs of electricity by themselves. Grants and subsidies can be provided during different project phases (pre-investment, construction, or operation) and are frequently made available to a mini-grid operator upon reaching certain milestones (results-based financing). They may result in lower tariffs for certain mini-grid customers. A balanced approach requires that grants and subsidies should be as low as possible, and as high as necessary.

Loan support and risk mitigation instruments: Loan Support and Risk Mitigation Instruments are mechanisms to facilitate lending, each of which may be supported by a specific policy and regulation, to enhance access to debt finance for mini-grid developers. They may provide or facilitate long-tenure, low-interest loans that commercial lenders would currently not offer to mini-grid projects, and may be administered by a national rural energy agency or another public entity in charge of energy access. Instruments include, for example, a donor-backed line of credit to a local financial institution that increases the duration of loans offered to mini-grid developers.

Burama Jammeh, Public Utilities Regulatory Authority (PURA), The Gambia

Burama Jammeh from the Public Utilities Regulatory Authority of the Gambia explained that electricity supply in the Gambia is still government controlled and is both vertically and horizontally integrated (including water and sewerage services). A law was passed in 2013 which has as a key objective the incentivisation of renewable energy in the Gambia.

A standard national feed-in tariff has been established: the national utility will buy the surplus electricity from a renewable energy mini-grid. However, the rate is too low to enable most mini-grids to be economically viable.

A renewable energy fund has been set up which can support standalone, mini-grid and grid-connected electricity generation. A national policy on mini-grids has established an enabling framework and an incentive programme on financing. An important issue is to set up training schemes for installers.

Nouhou Zakaouanou, Ministry of Energy and Petroleum, Niger

Nouhou Zakaouanou spoke about instruments to support the development of mini-grids that are currently being put in place by the Niger government. A law was established in June 2015 through which a tax of two francs/kWh is levied on all subscribers to the national grid. Sixty per cent of the revenues from this tax go to the Niger agency for the promotion of rural electrification projects. A financial instrument will soon establish criteria for the eligibility of renewable energy projects for villages. A fund is to be established to support such projects.

In the ensuing Q&A it was observed that in Mali farmers had been encouraged to grow *Jatropha* as an alternative to fossil diesel for mini-grids. However, the farmers generally found that this was not profitable given the price of diesel fuel. A few mini-grids still use biofuel in Mali. In Niger feasibility and environmental impact studies must first be carried out for all mini-grid projects; the Niger government is negotiating with the World Bank to get funds for such studies. In Nigeria

the government established an agency to buy power from independent generators. Issues of grid stability will be addressed in the feasibility studies for the 14 mini-grid projects in Nigeria.

Panel session 1: The project developer perspective on CEMGs

Moderator: Thera Aminata Fofana, Ministry of Energy and Water, Mali

Thera Fofana from the Ministry of Energy and Water in Mali moderated the panel session, which explored the project developer perspective on clean energy mini-grids. The panel focused on experiences in four countries: Senegal, Ivory Coast, Burkina Faso, and Mali.

Abdoulaye Ba, COOSER, Senegal

Abdoulaye Ba spoke of his experience in Senegal in the COOSER Company, which has installed three mini-grids with a total of 400 clients. He considered that the policy framework in Senegal is good but not perfect. There have been tax incentives. Governments should look to the private sector through public-private partnerships, and should undertake joint ventures with foreign partners. In order to work up profitable projects COOSER must consider carefully where to locate them. If a project is more than 10 km from the national grid it can be considered independent. Hybrid schemes should have access to the special diesel price available to other industries, such as bakeries.

Assanyo Alfred Atta, Fondation Akwaba, Ivory Coast

Assanyo Atta indicated that his Fondation Akwaba has been actively working on solar mini-grids in the northeast of Ivory Coast for 10 years. Mini-grids have been installed in seven villages with a total capacity of 210 kW. The European Union provided a grant of 75% of the capital cost. The villagers also made a financial contribution and are partners in the project. The local town council had been a partner but withdrew from the project early on.

In addition to the power system, public lighting has been installed and support given to income-generating activities such as freezers and solar dryers, which are run by the villagers. Such facilities enable the villagers to increase their incomes, making them better able to pay their electricity bills, and so the developer can recover costs. A community-based approach is taken. Their main concern is the regulatory framework, which is detailed but does not provide for mini-grids or their management by the community.

Yacouba Camara, Rural Electrification Development Fund (FDE), Burkina Faso

Yacouba Camara expressed concern about the regulatory framework in Burkina Faso, which has not kept up with technological developments. A law to put in place appropriate reforms is now with the Burkina Faso Parliament for adoption. The electrification master plan is currently being updated: private sector developers need to know when the grid will arrive. At present, there is a lack of clarity, which is a problem.

Tariffs are harmonised across the country, which means that private sector developers are not entering the mini-grid sector in Burkina Faso as they are unable to develop profitable schemes. The conditions for competition in rural areas are not adequately specified. Regulatory processes are very slow: the regulators need to be given the resources to fulfil their mission. What is needed is a clear political will to deploy mini-grids, capacity building in rural areas, and tax incentives, for example, on imported equipment. Rural electrification funds could be used to guarantee loans from the private sector.

Fousseyni Diarra, Mali National Electricity Utility, Mali

Fousseyni Diarra described the Mali National Electricity Utility, which is 66% owned by the Mali state. It has concessions in 98 localities. As Mali does not have oil resources, renewable energy is an appropriate choice and diesel-powered mini-grids have been hybridised since 2011. The generating cost is 110 francs/kWh and the price to the customer is 60-138 francs/kWh. Most customers are on prepayment meters. The biggest challenge for the Mali National Electricity Utility is accessing funding, and new sources are needed.

Responding to a question, Assanyo Atta explained that a tiered tariff structure is being put in place in Ivory Coast in which customers will pay lump sums of 750, 1500, 2500 and 3500 francs per month. As in Niger, a levy of two francs/kWh is being used in Burkina Faso to fund mini-grids. In Mali the tariff is set by the regulatory commission and is uniform irrespective of whether a scheme is grid-connected or standalone.

Panel session 2: Is public investment key to scaling-up business models for CEMGs?

Moderator: Safiatou Alzouma, International Renewable Energy Agency (IRENA), UAE

The overall aim of the session was to share experiences and visions from different angles on the role of public investment for the sustainability of CEMGs and to debate its role in the promotion of private investment. Safiatou Alzouma from IRENA asked set questions to spark discussion. These questions are identified as bold sub-headings in the following text.

Before starting the panel discussion, Safiatou gave a brief introduction. She enunciated that, in order to achieve universal access, 60% of energy has to come from off-grid energy solutions. The majority of these will need to be CEMGs. Nowadays, mini-grids are cost competitive—over the years there has been a substantial cost reduction. Since 2010 the cost of solar PV has decreased by 80%, for example. It is predicated that technical innovation and new business models will reduce costs in the next two decades by a further 60%. It is noteworthy that from 2012 to 2015 investments into mini-grids increased fifteen-fold.

Olowo Olasunkanmi, Ecobank, Nigeria

Olowo Olasunkanmi is currently working with private enterprises that are investing in CEMGs in Nigeria. Although the Nigerian government has opted for CEMGs under 1 MW to be unregulated, the government is offering grants of more than 30% of the capital expenditure (CapEx) of CEMG projects to achieve cost-reflective tariffs.

What is the thinking behind Nigeria's current policy regarding grants for CEMGs?

In Nigeria there are some CEMG projects that are still ongoing beyond their completion dates. The projects remain uncompleted because in recent years the country has faced a number of issues. One main issue has been the instability in the Nigerian currency (the naira). The fluctuation in the naira has led to a high-risk investment environment. Therefore, to overcome this the government has introduced grants. However, businesses cannot rely on grants alone. In order to be sustainable, they must pay for themselves.

It is noteworthy that there has been a reduction in CapEx for CEMGs in recent years. The cost per kWh of CEMGs may even be cheaper than the cost per kWh of electricity supplied from the main grid—in such a case there will be no need for grants.

Is a future where companies will not need subsidies foreseeable, and what would need to happen?

Subsidies are good to kick-start projects and achieve progress. Therefore, once the project has

started, it may be possible to operate without grants. However, the funds available for subsidies are not enough to serve many projects. In Nigeria, there are instances where projects operate without subsidies. This is particularly true where the micro-economic situation is right. Macro-economic factors are often outside the control of the different stakeholders and are, for example, linked to the currency instability, which results in a very unstable environment for investment. Here it is paramount that project developers (or other key stakeholders) are assured that there will be a return on their investment. Concerns regarding investment risk are currently very high in Nigeria, and if the financial model for a project is unrealistic no one is willing to fund the project. Therefore, public investment is required to facilitate an improvement of the enabling environment.

Dean Cooper, Parallax Sustainable Development Solutions

Dean Cooper is chair of the Sustainable Energy for All (SEforALL) CEMGs Partnership and as such he is exposed to a variety of experiences in the promotion of these systems from all around the globe.

What is the role of public investments for CEMGs at a global level, with a focus on approaches used to successfully promote CEMGs outside West Africa?

Dean Cooper said that there is a problem concerning the need to scale-up activities. Mini-grids are not being scaled-up as there is a lack of private sector investment, so we must ask the following: what is interesting for the private sector? There are four areas of activities that need to be considered to attract the private sector:

- **Technological match:** While CEMG technology is well developed, it is the technological match that is important. For example, solar systems are in good supply but solar may not always be the right solution to ensure a continuous supply of electricity. Therefore it is important to identify technologies that are the most appropriate for a particular environment. More consideration should be given to hybrid models, for example.

- **Financial business models:** There is a need to consider the risk of investment. In uncertain environments it is important to question whether the different financial models—which may vary for different project developers—are going to work. It is therefore important that the governments commit their own resources. The private sector can support these developments by putting together business models for the government to help them identify the right project. One key issue is that individual project developers are not willing to share their business models. Considering this dilemma, it is even more important that information on what works and what does not is shared across the sector.

- **Large capital cost**: Poorer people have a longer payback for high upfront costs. They therefore must be sure of a country's stability. This links back to the point made by Olowo Olasunkanmi from Ecobank.

- **Policy environment:** Putting in place a favourable policy environment is key for the development of CEMGs across Africa.

Outside West Africa, there are a number of examples where energy access is improving. Rwanda and Mali are doing well. Uganda and Tanzania have set up renewable energy funds. Internationally, Sri Lanka has had success with mini-grids and 99% of China is now electrified. However, particularly in China, the question is how the energy sector is maintained in the long run—at present there is no plan in place.

For Africa it is important to look at CEMG partnerships (public and private) and see what

everyone is doing. Experiences need to be shared amongst the different players. Nevertheless, it is important to consider that every country is different and everyone has different needs. Understanding how a strategy fits into specific national circumstances is crucial.

El Hadji Diakhate, Commission de Régulation du Secteur de l'Electricité (CRSE), Senegal

With more than 140 CEMGs currently operational, Senegal is a successful example for the deployment of such systems. They represent more than 50% of the total number of systems existing in the whole ECOWAS region. One reason for their comparative success is the favourable policy and regulatory framework in the country. However, to improve this further, the government is currently reviewing the tariffs with a view to harmonising them for urban and rural areas. It is estimated that this harmonisation will cost the government 31 billion West African CFA francs (47 million euro) over the next three years.

Why was this review of tariffs needed, and what does your vision on public investment for electrification of rural areas, particularly for mini-grids, entail?

El Hadji Diakhate explained that since 1998 the government has opted for the promotion of private sector investment in rural electrification, which led to the creation of CRSE. There are currently two kinds of tariffs for rural electrification: a) ceiling pricing and b) a flat rate. However, there are a number of issues with this. Firstly, there is no clear guidance as to when each tariff applies. Secondly, the tariffs differ between different locations. Finally, SENELEC (the national electricity company of Senegal) offers lower tariffs thanks to central government subsides.

This lack of clarity about tariffs in Senegal has led to the government requesting a review process to harmonise energy prices. This includes the consideration of tariff structures where the government pays the difference between the revenues required to sustain the systems and the national uniform tariff, as the principle is the fair remuneration of private investment. Similar approaches are being applied or considered in Ghana, Cape Verde, Mali and Niger.

Wisdom Ahiataku-Togobo, Ministry of Power, Ghana

Ghana has embarked on an ambitious programme of promoting CEMGs for specific locations in rural areas through public investment. This has shown quick results, with several systems already operational.

What has motivated this decision and what are the roles of the private sector and the government of Ghana in the mini-grid sector?

Wisdom Ahiataku-Togobo pointed out that in order for Ghana to achieve universal access to energy, the country has to extend the national grid by 25%. However, not everyone is reachable by the grid. It is the responsibility of the government to extend access to the unreachable areas through CEMGs. In Ghana, energy infrastructure is considered in the same way as other infrastructure, such as roads, healthcare, and education.

A public sector-led model is the best choice for most countries to achieve their electricity access targets by 2030. In Ghana the government builds the projects and hands them over, free of charge, to the operators, who are then responsible for their operation. As might be expected, these projects are a burden to the utility companies and they are not always happy with them, probably because they are comparatively high maintenance. Once electricity is generated for the public, it must be treated as a public scheme and follow a universal pricing scheme.

According to the World Energy Outlook (WEO), 34 out of 55 countries in Africa had a national electrification rate below 50% in 2016. In these countries, the private sector energy companies will give priority to the areas with larger populations, such as towns or large trading centres. Therefore, the public sector should take some comfort in investing in energy systems in the rural areas, as the main grid will not be extended there in the near future. For a high access rate in rural areas, public investment should be the main driver.

Discussion and Q&A

While the role of the public sector varies from place to place, there needs to be a policy framework that generates an enabling environment. The private sector is not going to provide all the solutions to national infrastructure problems, particular if support from governments is lacking.

Does there need to be a regulatory framework concerning tariffs?

El Hadji Diakhate, Senegal, said that many risks accompany such systems and therefore the investment required to establish them. The sustainability of a project depends on funding. In the case of Senegal, harmonising the tariffs could help; the Senegalese government also brings in grants to support the private sector when it cannot financially sustain itself due to, for example, a lack of income. This public sector support is important if the goal of universal access by 2030 is to be achieved. However, there are other sectors that still need resources and therefore energy access cannot be the sole focus. Public resources are somewhat limited; private companies have to compete for these 'support' grants and there are systems that can take care of their own costs. This is a matter of defining a financial model and creating a balanced tariff.

If an operative comes to Ecobank would there be a window for finance and how much would it cost?

In finance each project is different and is evaluated based on its feasibility within the current economic situation. Power projects are particularly complex. However, an essential consideration is that the net present value of the project return must be positive. This will ensure it receives finance from the bank. Ecobank operates in 36 countries, with charges varying depending on the country of operation. Each country has different rates of financing, as determined by the government. The cost of finance is high for large projects. In light of the above, if all things are right then yes, there is a window.

There needs to be clarity over the longer-term plans for national grid extension. Cost-reflective tariffs are most cost-effective in the long term, but costs are unlikely to be covered in rural areas. It is important to assess the demand and supply, and take a bottom-up approach that considers what is needed in specific communities.

Is public investment key to redress the balance with regards to rural electrification?

All panellists agreed that there is not a clear yes or no answer. Public funding is required but it should not be relied upon solely; there have to be other means of finance. Furthermore, it was highlighted that it also depends on the current electrification rate. For example, if a country is already above 80% electrified then public investment should play the main role.

The private sector is key for raising a country's energy access to a certain level and from there the public sector has to take it further.

Harmonisation of the regional market: Different approaches to technical standards for CEMGs

Ian Baring-Gould, US National Renewable Energy Laboratory

Standards, in the general sense, are initially there to ensure a certain level of safety. The second element is to design them around certain specifications. There are a lot of existing standards and these should be seen to provide guidance for developing packages around CEMGs. Tanzania, for example, is doing well on this. There are different levels of standards and specifications, and the adequate conditions for regional harmonisation have to be sought.

Standards are also required to foster local manufacturing of CEMG equipment. Here again, minimum specifications are key. This raises the question: what is the minimum level of agreement that is needed and what direction should these specifications take?

Discussion

Moderators: Nicola Bugatti (ECREEE), Ian Baring-Gould (NREL)

The floor was then opened to the attendees and the following points were raised:

- In Nigeria, for example, poor quality equipment is a problem. Many systems have stopped working and panels are not installed correctly. There is also a problem with the quality of batteries. These issues make people lose confidence. The market is filled with all sorts of different products, many of which are sub-quality and prone to failure, which destroys the reputation of the market. This needs to be urgently addressed and there is a clear need for national standards.

- It is important to understand that we do not separate quality from the products; the quality must be an integral part of it.

- The African Electrotechnical Standardisation Commission (AFSEC) will define continental standards, which will act as a minimum threshold, although individual countries can go further than AFSEC.

- Appropriate installers and equipment are needed, as bad equipment limits investment.

- In the case of Ghana and Nigeria, there are already standards, and utility companies have standards for their mini-grids. Off-grid projects and developers must follow these standards, but this can be difficult for the operator as there is no money for renewing the equipment.

- It is clear that if you want to professionalise the sector you have to set some minimum requirements. But these standards must be adapted to the rural electrification needs and the characteristics of the different countries.

Discussion summary: There is a huge problem with regards to low quality products which is shaking people's confidence in the market. Minimum standards are absolutely necessary. AFSEC will define some at a continental level, but individual countries should try to go further. Ghana and Nigeria, as well as individual utility companies, already have standards which must be adhered to. However, it should be considered that this can be difficult for operators when there is insufficient funding to maintain and renew equipment to a suitable standard.

In conclusion, there was a clear consensus amongst participants that there is a need to introduce standards at a regional level. A preference was given to the establishment of minimum specifications, although it was not agreed whether they should target the systems and/or the individual equipment. This will have to be done by building on what several countries have already implemented, as in the case of Ghana. Already existing international standards will have to be

adapted to the regional context (*tropicalisation* of international standards) and there is a need to coordinate with the continental process currently being promoted by AFSEC.

Plenary session 2 and Q&A

Supporting productive enterprise

Billy Yarro, Practical Action Consulting West Africa

Practical Action seeks to influence policy and practice in the provision of energy to those who lack access, believing that energy access is vital for sustainable human social and economic development. They generate and share knowledge on energy access needs in developing countries and implement projects that seek to improve energy access.

There are different levels of electricity access necessary for sustainable poverty reduction through applications of energy for productive uses, ranging from lighting and ICT through to space heating and cooling. Energy access impacts people's wellbeing in a number of ways, e.g. improved product or service quality, better revenue or wages, extended operating hours, and higher revenues.

The most significant enabling factors that need to be addressed to achieve this impact and deliver the benefits of energy access in productive enterprises are (1) costs and access to finance, (2) knowledge and skills, and (3) access to markets.

Costs and access to finance: Rural enterprises often cannot afford or access funds to pay for connection fees or access tariffs for electricity and capital investment for equipment and appliances for use in productive enterprises. Practical Action helps enterprises to come up with viable and bankable projects. There is also a need to ensure that there is a sustainable local electricity market and adequate equipment to support the population so that the electricity tariffs will be affordable and productive enterprises will be able to pay for the provision using their new revenue.

The project planning stages ought to better assess the energy needs and profitability of the proposed productive uses; this includes access to finance—how easy is it to access and whether it will be paid back profitably.

Knowledge and skills: Rural communities lack skills and knowledge to use and manage new technology (e.g. mini-grids), new enterprises, and improved incomes. There is a need to educate the community on how best to use energy to be more productive, and how to deal with the improved productivity that comes with energy access. The communities need advice or mentoring in sustaining the CEMGs, and this could come from locally organised social organisations, the private sector (for the technology), and government.

Access to markets: After accessing energy and embarking on new activities, enterprises need to access markets for their new or improved products and services. There is a need to train them is how to establish and access these markets.

Discussion

For most projects, impact is mainly measured by increase in revenue; but there are other indicators, such as improved livelihoods in the community because of the access to energy, which may be overlooked. Additionally, while productive use is for stimulating income generation within the community, it is also important for sustaining the mini-grid businesses because it stimulates consumers to buy the electricity being supplied. Part of the equation involves making energy affordable

When considering the strategic importance of productive uses of energy in national gov-

ernment policies, it is important to realise that productive enterprises will not happen on their own; infrastructure projects ought to include ways of supporting productive activities in the communities they serve.

There is a need for research into when and how much energy is used for productive uses, in terms of time of day and seasonality; these factors need to be considered in the planning stage of the projects.

Community engagement and ownership

Florence Agbejule, Foundation for Partnership Initiatives in the Niger Delta (PIND), Nigeria

PIND is an NGO, established in 2006, working on socio-economic development in the Niger Delta. Funded by Chevron, the NGO focuses on four thematic areas: economic development, peace building, capacity building, and analysis and advocacy. Energy supplies are dwindling and PIND aims to address the challenges of distribution and cost of fuel in the Niger Delta. Through their Appropriate Technology Enable Development (ATED) Centre, PIND showcase technologies that may help reduce energy consumption, recycle waste, and provide alternative energy sources—for example, the ATED centre has a biodigester, a water treatment system, reduced energy consumption, and so on.

The Niger Delta is unstable, so security is a key consideration in all PIND activities. For example, the ATED centre was built with full community involvement to ensure buy-in and guarantee security. PIND's market systems approach allows engagement of all market actors, the entry strategy being informed by the exit strategy—in other words, if all actors are engaged then the project has a chance of continuing after the sponsor exits the project. To do this, PIND uses a participatory approach to identify the community needs and wants. This way they gather adequate information for project design, inspire confidence and changed attitudes, and make informed decisions that foster control and ownership of the project by the community.

PIND implemented a 1.5-year project in Beke town in 2013, using their bottom-up approach. The project engaged a local contractor, GV General Electrics (who have installed a number of systems in the area), to install a 60 kW mini-grid system to serve an off-grid community. The community discussed and agreed issues such as availability and price for the power, and the photovoltaic systems were installed in the market square. When it was noticed that households who were not part of the project community (60 households) were tapping into the system, the investor installed smart cards to regulate access. The community identified the problems and the solution. Since the smart card control mechanism that was suggested as the solution involved job creation in the community (e.g. controller, manager for the system), it ensured system community ownership and sustainability.

Discussion

In talking about community involvement it is important to identify the key leaders of opinion (e.g. men, women, families, youth). In the Niger Delta PIND has discovered that it is important to engage the youth because they are often idle and restless. They also realised that relying on local champions has the potential of excluding other community members. Therefore, they start their engagement with the community leaders and then look for representatives from all sectors of the community to take part in the initial discussion. With time, roles are defined and those who have a part to play in the implementation become more involved.

In the end, not that many people have a direct relationship with their power company, so for these community projects it is important to

decide at what point to stop involving the community in the implementation or operational phases, as consultation is expensive and time consuming. This will depend on the operational conditions and vary with each case. There is a need to conduct the consultation process as a businessperson to ensure that the key players in the community are engaged. Community buy-in is necessary but challenges remain—for example, the community may compare themselves with their counterparts or notice the limitations of what the project is providing, and community needs change with time. The provider and the business need to respond to these changes.

From Ecobank's experience in Nigeria, the consultation is not simply a round of discussions with local people but an exercise meant to establish buy-in from the community so that they will not vandalise the project. The consultation establishes whether the community accepts the proposed mini-grid, whether they want access to power, and discusses how the power will be supplied. If consulted properly, the community will police and protect the project, and fight off detractors and potential sabotage. For example, when PIND was constructing buildings for one of their projects some community elders said there was no permit for the work, but the youth took ownership and fought for the project.

In a case from Sierra Leone, community consultation was necessary and carried out before permits were given to the developers to establish two mini-grids. It emerged during the consultation that the proposed tariff was not acceptable to the community, and the developers factored in their input in their project planning. In the end, the market ought to drive the mini-grid investment and opportunities. In Nigeria, for example, consumers are willing to pay 127 Naira for power from the mini-grid that from the national grid costs 27 Naira because of other issues such as power availability, reliability, and quality of service.

Health/education centres as anchor loads

Louis Seck, Energy4Impact, Senegal

Energy4Impact works with a range of partners to support provision of appropriate energy access in rural Senegal and other sub-Saharan African countries. Senegal's Plan Senegal Emergent (PSE), a national master plan for the future of Senegal, encompasses a number of projects for social-economic development for an emerging Senegal. There is a need for energy to support some of the goals outlined in PSE, such as for education and health. The state is now putting in place reforms to ensure that there are human resources and policies to support the attainment of the plan.

Considering health and education in rural Senegal (50% of the Senegalese population is rural), there is better penetration of schools and health centres than electricity so there is a need to have energy supplied to these facilities. This will also help in recruiting the right human resources to work in these facilities; this is the work that Energy4Impact is involved in. There are an increasing number of technologies that allow the decentralisation of energy supply to cater for local needs without relying on national grid extension and there is a move to deploy these in Senegalese communities. As a result, there has been an increase in the roll-out of solar energy systems for health, education, and communication in rural Senegal, with installations for household, community, and telecommunication requirements.

When providing energy services to schools and health centres, the energy is paid for through tariffs or external donor support, depending on the project. In some cases, the beneficiaries have come up with ways of partly paying for the system, e.g. some school parents or clinic patients pay for the maintenance of solar systems.

Launch of technical assistance facility for the improvement of the policy and regulatory framework Moderator: Mahama Kappiah

Mahama Kappiah of ECREEE moderated the final session of the workshop: the launch of the technical assistance facility for the improvement of the policy and regulatory framework for mini-grids in West Africa. The facility is available to public sector practitioners: they make requests through their ministers, and the partnership (including ECREEE, Power Africa, AfDB, IRENA, and EUEI PDF) decides how to assist them. Representatives of the various organisations involved in the technical assistance facility gave presentations on the contribution of their organisation to the scheme.

AfDB Green Mini-Grids Market Development Programme
Jeff Felten, SE4ALL Africa Hub, African Development Bank

Jeff Felten, Coordinator of the SE4ALL Africa Hub at the African Development Bank (AfDB), spoke first about the Green Mini-Grids Market Development Programme. He reminded participants that the first objective of SE4ALL is to achieve universal access to modern electricity by 2030. AfDB's 'New Deal on Energy for Africa' moves that forward to 2025. Out of the 1.1 billion Africans, 645 million or nearly 60% do not have access to electricity, and half of those come from only six countries: Nigeria, Ethiopia, DRC, Niger, Uganda, and Ghana. For the 645 million Africans without power, to achieve universal access to electricity Africa will need 800 new power plants with a capacity of 200 MW each, transmission and distribution for 130 million new connections, 350,000 mini-grids with 150 connections each, and 22.5 million newly installed solar home systems.

The programme is part of the Green Mini-Grids Africa Programme of the UK Department for International Development (DfID). It is a multi-phase programme: the first phase started in 2015 and will end in 2017, and the second phase is about to begin. It will include activities on market intelligence, business development services, policy and regulatory support, quality assurance, and access to finance. A key aim is to trigger within African Ministries of Energy and their partners a commitment to put into place the policies, regulations and support needed to create an enabling environment for private investment into green mini-grids across the continent. It also aims to arrive at mutual agreement on the five essential elements that comprise a favourable environment for green mini-grids, to detail the steps required in each country to put these key elements in place, and to guide countries in the creation of action plans.

The five essential elements to enable green mini-grids are considered to be:

1. To enact clear regulations and provide simple licensing procedures.
2. Communicate plans for expanding the main grid.
3. Enact laws that allow for cost-reflective tariffs.
4. Undertake integrated energy planning.
5. Increase the capability of government officials and service providers to implement green mini-grids.

Introduction to the Clean Energy Mini-Grid (CEMG) intervention of EUEI PDF
Daniel Werner, EUEI PDF

Daniel Werner described the activities of the EUEI PDF on capacity building and technical assistance on policy and regulation for clean energy mini-grids in the ECOWAS region. The EUEI PDF fosters the coherence of energy development cooperation, facilitates strategic political dialogue,

provides demand-driven policy advice and capacity building, mobilises and supports private investment in renewable energy, and strengthens renewable energy research, innovation, and skill development.

The clean energy mini-grids sector in West Africa has not grown at the rate expected. The lack of clear policy and regulatory instruments is still a barrier to their large-scale deployment. Responding to a request from ECREEE, the EUEI PDF is therefore providing support to ministries, regulators and utilities on appropriate approaches and methodologies for improving the policy and regulatory framework for clean energy mini-grids. A first phase (March to June 2017) will focus on regional capacity building; phase 2 (July to November 2017) will provide tailored technical assistance to improve the policy and regulatory frameworks in two ECOWAS member states.

Introduction to the NREL Clean Energy Solutions Centre and the Ask an Expert services

Jessica McDonald, Department of Energy of USA

Jessica McDonald of the US Department of Energy described the activities of the Clean Energy Solutions Centre launched by the Clean Energy Ministerial in April 2011. Its goals are: to deliver dynamic services that enable expert assistance, learning, and peer-to-peer sharing of experiences; to serve as a first stop clearinghouse of clean energy policy and finance resources; to share policy and finance best practices, data and analysis tools across countries; and to foster dialogue on emerging policy and finance issues and innovation across the globe. Its main target audiences are government policymakers and advisors.

Its 'Ask an Expert' facility connects policymakers to a global network of over 100 energy experts for personalised and responsive technical assistance and strategies, market frameworks, standards, financial incentives, and deployment programmes for a broad range of clean energy sectors and technologies. In West Africa the Clean Energy Solutions Centre, in partnership with ECREEE, EUEI PDF and Power Africa, will provide in-depth advisory support on policy and market frameworks for mini-grids.

Introduction to the Power Africa initiative

Katrina Pielli, Power Africa

Katrina Pielli introduced Power Africa's off-grid energy access activities. Power Africa's goals are to support the installation of 30 GW of new, cleaner power generation capacity and the establishment of 60 million new household and business connections. Power Africa's model focuses on practical solutions based on its deep knowledge of the power sector, a private sector-led engagement approach, and its experience of working with governments, development partners, and civil society to improve policies and governance.

A key component of its activities is the 'Beyond the Grid' initiative launched in June 2014. This involves over 60 investor and practitioner partners who have committed to invest over $1 billion into off-grid and small-scale solutions. The initiative's focus is to unlock investment and growth for off-grid and small-scale energy solutions on the African continent. It has two strategic off-grid priorities: the first is to address recurring market constraints in the household energy market by increasing access to finance and by providing technical assistance; the second is to strive to achieve scalable, cleaner, community-level solutions that offer electricity access greater than the first tier of lighting.

Power Africa combines the resources and global know-how of its partners to provide resources and mechanisms that drive deals between the private sector and African governments. Its toolbox comprises five categories: transaction assistance, finance, enabling environment, capacity building, and legal assistance.

Introduction to IRENA's activities

Safiatou Alzouma, International Renewable Energy Agency (IRENA), UAE

Safiatou Alzouma indicated that the ECREEE collaboration is very important for IRENA: many of IRENA's activities have been piloted in West Africa, and ECREEE was the first institution to enter into a formal partnership with IRENA (in 2011). A report on capacity needs assessment for the deployment of clean energy mini-grids in ECOWAS will be completed in the coming weeks. Recommendations from the report will be taken forward in partnership with ECREEE and other institutions or partners.

The key contributions of IRENA will be: to provide support for establishing enabling environments; to facilitate cross-regional exchanges of best practices; to increase engagement and matchmaking with the private sector; to build capacity along the value chain; and to strengthen the messaging for off-grid energy.

Access to energy will become a key component of IRENA's next work programme (2018 – 2019). IRENA will leverage its analytical work, convening power, established networks, and country-level activities to support the scaling-up of standalone systems and mini-grids deployment. The following ongoing programmatic activities will be undertaken:

- Support development of enabling frameworks: assisting countries to get the right policy and regulatory frameworks, suitable institutional structures, financing and business models, customised technology solutions, and capacity development. This will be done in close cooperation with ECREEE and other institutions.

- Facilitate cross-regional exchange of best practices and lessons learnt: The International Off-Grid Energy Conference (IOREC) is now the global platform to convene key stakeholders and facilitate cross-regional, cross-sectoral discussions. The first edition of IOREC was held in Accra in 2012 in close cooperation with ECREEE, the second edition in Manila in 2014 in partnership with the Asian Development Bank, and the third edition in Nairobi in 2016.

- Increase engagement with private sector and other stakeholders: IRENA will work closely with stakeholders to identify and share innovation in financing and business model design that can unlock new markets for off-grid renewable energy solutions. It will also continue to work closely with stakeholders on increasing awareness about platforms and tools, such as Sustainable Energy Marketplace and Project Navigator, to support the development of a pipeline of bankable projects and facilitate financing.

- Build capacities along the value chain: IRENA will strengthen its work on capacity building (e.g., ECOWAS Entrepreneurship Support Facility) and tailor the scope of its activities to specific audiences and thematic areas.

- Strengthen the messaging on off-grid renewable energy: providing up-to-date and sound information to decision makers, leveraging ongoing work on costing and statistics, as well as resource assessment.

In conclusion, Mahama Kappiah encouraged all those present to engage with the technical assistance facility, whatever their request may be, as requests will be shared with all the partners and directed to those best suited to address them. The facility is an opportunity open to all and should lead to significant achievements within the region.

Concluding remarks

John Holmes thanked the workshop participants, the Ivory Coast hosts, and the organising partners for their input and gave some concluding remarks on behalf of SVI. In terms of next steps,

SVI will prepare a workshop report and a policy brief based on the two-day event (aimed at policymakers, development workers and other key stakeholders), which will summarise the key findings and recommendations from the meeting. SVI will engage with the workshop participants to ensure that the policy brief is distributed as widely as possible and delivered to the appropriate individuals within the region.

In June 2017 SVI will hold a workshop in Brussels, Belgium, involving EU member state representatives, policymakers, development agencies, etc. in an interactive dialogue based on the key findings and messages from West Africa and other regions where SVI has been working. The aim of this workshop will be to contribute to better-informed future policies and interventions in the energy for development sector.

The current phase of SVI will end in September. Plans are underway for the next phase, which will include prototype 'smart villages' in different regions, hopefully including West Africa. The objective would be to work with under-served, under-developed villages to put in place interventions (including improved access to energy, healthcare, productive enterprises, education, etc.) and systematically tracking their progress over a number of years. The general lessons on what works, what does not, and why, would be shared widely to improve policy and interventions that seek to improve energy access in off-grid villages.

On behalf of ECREEE and EUEI PDF, Mahama Kappiah thanked all the workshop participants and organisers for their input. He encouraged everyone to continue to build on the conversations and relationships started during the workshop.

Annex 1: Agenda

The inceptive High-level workshop on energy access in West Africa

27–28 March 2017 - Azalaï Hotel, Abidjan, Ivory Coast

PROGRAMME

Day 1 - Monday, 27 March 2017

08:15	**Registration**
08:30	**Welcome address** *John Holmes, Smart Villages Initiative (SVI)* *Crispen Zana, EUEI PDF* *Mahama Kappiah, ECREEE*
09:15	**Group photo**
09:30	**Introduction to workshop agenda,** *Nicola Bugatti (ECREEE)*
09:45	**Introduction to the Smart Villages Initiative,** *John Holmes (SVI)*
10:00	**Summary of findings:** Smart Villages Initiative's West Africa engagement, *John Holmes (SVI)*
10:30	**Keynote 1 and Q&A:** Promoting private enterprises' interest in PPP mini-grid development *Jannik Moller, GIZ Nigerian Energy Support Programme*
11:00	**Tea break**
11:30	**Breakout session:** Discussion around SVI's key findings from West Africa engagement programmes
12:35	**Feedback on breakout discussion session**
13:00	**Lunch break**
14:15	**Plenary session 1 and Q&A:** Clean Energy Mini-Grid (CEMG) targets, goals and situation in ECOWAS countries. Preliminary findings of the CNA. Regional initiative for the promotion of an enabling environment for investment in CEMG. *Nicola Bugatti (ECREEE*)

14:45 **Interactive discussion session 1:** Policy and regulatory framework for CMEGs, including successes and challenges of ECOWAS national experiences

Moderator: Peggy Mischke, RECP Policy Advisory

Energy and Electricity Policy

A1. National Electricity or Electrification Policy

A2. Rural Electrification Strategy and Master Plan

A3. Energy and Electricity Law (including Implementing Institutions)

- *Dele Shobayo, Ministry of Lands, Mines and Energy (MLME), Liberia*
- *Ghislain Tanoh, CI-ENERGIE, Ivory Coast*

A4. Tariff Policy and Regulation (including Connection Fee)

- *Karine Monteiro, Economic Regulatory Agency (ARE), Cape Verde*
- *Benjamin Kamara, Ministry of Energy, Sierra Leone*

15:45 **Tea break**

16:15 **Interactive discussion session 2:** Policy and regulatory framework for CEMGs, including reference to successes and challenges of ECOWAS national experiences

Moderator: Peggy Mischke, RECP Policy Advisory team

Economic Policy and Regulation

B1. Fiscal Policy and Regulation (Taxation, Import Duty, etc.)

- *Ampadu Otu-Danquah, Energy Commission, Ghana*

Customer Protection and Environmental Policy and Regulation

C1. Technical Regulation (including Grid Connection)

C2. Quality of Service Regulation

C3. Environmental Policy and Regulation

- *Quality Assurance Framework for Mini-Grids: Ian Baring-Gould, US National Renewable Energy Laboratory*
- *Alfred Dieng, Rural Electrification Agency of Senegal (ASER)*

17:15 **Closing remarks**

Day 2 - Tuesday, 28 March 2017

09:00 **Introduction**

ECOWAS Centre for Renewable Energy & Energy Efficiency (ECREEE)

09:15 **Interactive discussion session 3:** Policy and regulatory framework for CMEGs, including reference to successes and challenges of ECOWAS national experiences

Moderator: Peggy Mischke, RECP Policy Advisory team

Licences and Contract Regulations

D1. Generation and Distribution Permits and Licences

D2. Concession Contracts and Schemes

D3. Power Purchase Agreements (PPA)

- *Thienta Sabbah Fatoumata Thiero, Malian agency for the Development of Household Energy and Rural Electrification (AMADER), Mali*
- *Abayomi Adebisi, Federal Ministry of Power, Works and Housing, Nigeria*

Financial Support Schemes

E1. Grants and Subsidies (including CAPEX, OPEX and performance based)

E2. Loan Support and Risk Mitigation Instruments

- *Burama Jammeh, Public Utilities Regulatory Authority (PURA), The Gambia*
- *Nouhou Zakaouanou, Ministry of Energy and Petroleum, Niger*

Technical Assistance

F1. Technical Assistance

10:00 **Panel session 1:** The project developer's perspective on CEMGs

Moderator: Thera Aminata Fofana, Ministry of Energy and Water, Mali

- *Abdoulaye Ba, COOSER, Senegal*
- *Asanvo Alfred Atta, Fondation Akwaba, Ivory Coast*
- *Yacouba Camara, Rural Electrification Development Fund (FDE), Burkina Faso*
- *Fousseyni Diarra, Mali National Electricity Utility, Mali*

Discussion and Q&A

11:00 **Tea break**

11:30 **Panel session 2:** Is public investment key to scaling-up business models for CE-MGs?

Moderator: Safiatou Alzouma, IRENA

- *Olowo Olasunkanmi, Ecobank, Nigeria*
- *Dean Cooper, Parallax – Sustainable Development Solutions*
- *El Hadji Diakhate, Commission de Régulation du Secteur de l'Electricité (CRSE), Senegal*
- *Wisdom Ahiataku-Togobo, Ministry of Power, Ghana*

Discussion and Q&A

12:30 **Harmonisation of the regional market**

Keynote: different approaches to technical standards for CEMG, *Ian Baring-Gould, US National Renewable Energy Laboratory*

Discussion

Moderators: Nicola Bugatti (ECREEE), Ian Baring-Gould (NREL)

13:15 **Lunch break**

14:45 **Plenary session 2 and Q&A:** Going beyond energy access, how to ensure the long-term sustainability of CEMG

- Supporting productive enterprise: *Billy Yarro, Practical Action Consulting West Africa*
- Community engagement and ownership: *Florence Agbejule, Foundation for Partnership Initiatives in the Niger Delta (PIND)*
- Health and education centres as anchor loads: *Louis Seck, Energy4Impact*

16:00 **Tea break**

16:30 **Green Mini-Grid Market Development Program,** *Jeff Felten, African Development Bank*

17:00 **Launch of technical assistance facility for the improvement of the policy and regulatory framework,** *Mahama Kappiah, ECREEE*

- **Introduction to the Clean Energy Mini-Grid (CEMG) intervention of EUEI PDF**

  Daniel Werner, EUEI PDF

- **Introduction to the NREL Clean Energy Solutions Centre and the Ask an Expert services**

  Jessica McDonald, Clean Energy Solutions Center, International Energy Transition

- **Introduction to the Power Africa initiative**

  Katrina Pielli, Power Africa

- **Introduction to IRENA and their regional engagements**

  Safiatou Alzouma, International Renewable Energy Agency (IRENA), UAE

17:45 **Next steps (SVI)**

John Holmes (SVI)

18:00 **Closing remarks**

John Holmes, Smart Villages Initiative (SVI)

Daniel Werner, EUEI PDF

Mahama Kappiah, ECREEE

19:00 Formal dinner – Azalaï Hotel

Annex 2: List of participants

Name	Designation	Organisation	Country of operation
Gbedonougbo Claude Gbaguidi	Chairman	ARE	Benin
Guy Clarence Semassou	Director for Energy	ANADER	Benin
Alassane Tiemtore	Directeur des services techniques et de la régulation	ARSE	Burkina Faso
Yacouba Camara	Director General	FDE	Burkina Faso
Gervais Ouoba	Directeur Technique	FDE	Burkina Faso
Mário João Marques De Oliveira	Director for Energy, Industry and Commerce	Ministério a Economia e Emprego	Cape Verde
Karine Brandão PIRES Monteiro	Administradora	ARE	Cape Verde
Addy Arsene	President	ONG ADDY	Cote D'Ivoire
Atta Assanyo Alfred	Coordinateur	Foundation Akwaba	Cote D'Ivoire
Janoh Ghislain	Ingenieur Statisticien-eco	CI-Energies	Cote D'Ivoire
Ebo Felix	PDG	GRPI ASEMI	Canada
David Jacobs	Expert	Clean Energy Solution Center	Germany
Wisdom Kwasi Ahiataku-Togobo	Director for Renewable Energy	Ministry of Energy and Petroleum	Ghana
Kwabena Ampadu Otu-Danquah	AG. Director, Renewable Energy	Energy Commission	Ghana
Cheick N'Fall Cissoko	Director of Energy	Ministère de l'énergie et de l'hydraulique	Guinea
Acheick Mouctar Youla	Directeur Général	ARSEPEE	Guinea

Name	Designation	Organisation	Country of operation
William Ferreira De Pina Araujo		Ministério da Energia e Industria	Guinea Bissau
Dele SHOBAYO	Technical Advisor on Energy/ Energy Advisor; Office of the Minister	Ministry of Lands, Mines and Energy	Liberia
Mme Aminata FOFANA ép. Thera	Ministry in charge of energy	Ministry of Energy and Water	Mali
Mamadou Goundiam	Ingenieur Electricien	CREE	Mali
Fousseyni Diarra	Chef Département EnR	EDM	Mali
Sabbah Fatoumata Thiero	Chef Service Pour l' Appui au Montage des Projets d'Électrification Rurale	AMADER	Mali
Abdoulkarim Saidou	Directeur General	ARSE	Niger
Amadou Halilou KANE	Directeur Général	ANPER	Niger
Nouhou Zakaouanou		Ministère de l'Énergie et du Petrole	Niger
Florence Agbejule	Field Operations Manager/ATED Centre Manager	PIND	Nigeria
Theresa Nkechi Obiekezie	Lecturer	Nnamdi Azikiwe University	Nigeria
Olasunkanmi Israel Olowo	Head SME	Ecobank	Nigeria
Adebisi Abayomi	Federal Ministry of Power	Director for Energy	Nigeria
Yusuf Abdulsallam			Nigeria
Elhadji Diakhate	Expert Economiste Sénior	CRSE	Senegal
Alfred Dieng	Directeur de Service	ASER	Senegal
Abdoulaye Ba	Directeur General	COOSER	Senegal
Baba Diallo	Directeur Général	ASER	Senegal
Benjamin Kamara	Director for Energy	Ministry of Energy	Sierra Leone
Tamba Kellie	DIRECTOR GENERAL	EWRC	Sierra Leone
Burama Jammeh	Director of Economic Regulation	PURA	The Gambia
Musa Njie	Water Manager	PURE	The Gambia
Kemo Kending Ceesay	Directeur General	Ministry of Energy	The Gambia
Abbas Aboulaye	Directeur Technique	ARSE	Togo
Aaron Leopold	Global Energy Representative	Practical Action	UK

Name	Designation	Organisation	Country of operation
Louis Seck	Mr Louis Seck	Energy for Impact	Senegal
Billy Yarro	Practical Action Consulting	PA West Africa	Senegal
Burama Jammeh	Director of Economic Regulation	PURA	The Gambia
Hary Andr: Aintavy	Executive Secretary / Secrétaire Exécutif	African Association for Rural Electrification / CLUB-ER	Cote d'Ivoire
Jessica McDonald		NREL	USA
Ian Baring-Gould		NREL	USA
Samuel Booth		NREL	USA
Dean Cooper	Director	Parallax – Sustainable Development Solutions	France
Jannik Moeller	Head of Unit Rural Electrification	GIZ (Nigeria)	Nigeria
Jeff Felten	Consultant	AfdB	Cote D'Ivoire
Susan Emiko-Coulibaly	Training officer	AfdB	Nigeria
Safiatou Alzouma	Director of Renewable Energies at the Ministry of Mines and Energy (Niger)	IRENA	United Arab Emirates
Salieu M Barrie	Head of Finance	Electricity and Water Regulatory Commission	Sierra Leone
Mireille Affoudji		EnDev	Senegal
Jakob Schmidt-Reindahl	Renewable Energy and Mini-Grid Expert	UNOPS	Sierra Leone
Katrina Pielli	Senior Energy Advisor and Lead, Beyond the Grid	USAID/ Power Africa	South Africa
Krou Henri-Pépin	Conseiller Technique du Directeur Général	Anaré	Cote d'Ivoire
Laurent Kossivi Domegni	Energy Technical Expert	Econoler	Togo
John Holmes	Co-leader	SVI	UK
Stephanie Hirmer	Research Associate	SVI	UK
Molly Hurley-Dépret	Storyteller	SVI	UK
Tinashe Chiurugwi	Research Associate	SVI	UK
Nicola Bugatti		ECREEE	Cape Verde
Nathalie Weisman	SEforALL coordinator	ECREEE	Cape Verde
Mahama Kappiah	Executive Director	ECREEE	Cape Verde

Name	Designation	Organisation	Country of operation
Peggy Mischke	Moderator (RECP Policy Advisory)	EUEI PDF	Germany
Michael Herb		EUEI PDF	Germany
Alice Whaltman	Energy MRC	EUEI PDF	Germany
Daniel Werner	Programme Manager	EUEI PDF	Germany
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SMART VILLAGES

New thinking for off-grid communities worldwide

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energy for development

EUEI PDF

The European Union Energy Initiative Partnership Dialogue Facility (EUEI PDF) is a multi-donor facility that contributes to the achievement of the Sustainable Development Goals, and in particular, on energy. It is a flexible instrument of the European Union since 2004 to promote sustainable energy for equitable development in Africa, Latin America and Asia. The EUEI PDF offers a range of services from coordination and strategic political dialogue to implementation in partner countries and focusing on:

Strengthening the coordination of European donors and the common European contributions;
Supporting high-level political dialogue and processes;
Providing policy advice, institution and capacity building services;
Working towards accelerating the development of sustainable energy markets;
Conducting research and facilitating knowledge sharing in collaboration with academia and energy research institutions.

The EUEI PDF together with the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) are currently implementing a regional capacity building and technical assistance project on Clean Energy Mini-grids in the ECOWAS region and training on a toolbox for Renewable Energy tariff setting.

ECREEE
TOWARDS SUSTAINABLE ENERGY

ECREEE

The Economic Community of West African States (ECOWAS) is a regional organisation of fifteen countries in West Africa. ECOWAS was established in May 1975 with the main goal of promoting economic integration among the member states. ECREEE is a specialised agency of ECOWAS which acts as an independent body, within the legal, administrative and financial framework of ECOWAS rules and regulations. The overall objective of ECREEE is to contribute to the sustainable economic, social and environmental development of West Africa by improving access to modern, reliable and affordable energy services, energy security and reduction of energy-related green house gas (GHG) emissions and climate change impacts on the energy system. ECREEE aims for the workshop were to promote the exchange of experiences on policy and regulatory framework for clean energy mini-grids among and with the ECOWAS member states and launch a multi-stakeholder partners for the provision of technical assistance and capacity building on this topic.