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## The Africa Electrification (AEI)

# Workshop on “Low cost on-grid electrification technologies”



Novotel Orisha - Cotonou, 19-20 March, 2014

## Workshop Report Summary

## Workshop Summary

The goal of the two days workshop was to empower energy practitioners and decision-makers in Francophone Sub-Saharan Africa with the knowledge needed to successfully implement low-cost grid-based rural electrification technologies.

The first day the various low cost technology options for rural electrification were presented, namely:

- Shield Wire Systems (SWS) on existing transmission lines and its applications in Sub-Saharan Africa, in particular in Ghana, Togo, Burkina Faso and Ethiopia;
- Single Wire Earth Return (SWER) system;
- Single phase medium voltage (MV) network systems linked in particular to the experience from STEG, Tunisia; and
- Low cost transmission extensions and grid substations.

The discussions that followed after the presentations focused on the technical aspects of the different technologies, on the issues related to the power supply of three-phase equipment through single- and two-phase lines and the possibility of evolving from SWER to three-phase.

In the afternoon, the participants split into four groups to work on two cases studies involving a particular MV distribution system. The aim was to evaluate the voltage drop and loss of MV distribution using the different technology options.

During the first session of the second day of the workshop, the Network planning issues were presented and discussed. The second session covered the experiences from the participants' countries regarding their implementation of low cost technologies. The presentations were made by representatives of Benin, ABERME focusing on the cost reduction of equipment; Togo, ARSE on Shield Wire System experience; Burkina Faso, FDE, on the lessons learnt on SWER and Cameroun with two presentations, one from AES covering the wooden poles and the SWER experience and one regarding the experience with a network distribution densification project.

During the two days' workshop, the following options for cost reduction were addressed:

- The connection technologies (MV lines), namely experiences from Tunisia on single-phase; Cameroon and Burkina Faso on SWER; and Togo on Shield Wire Systems.
- The equipment costs reduction and costs depending on exogenous parameters (e.g. time of purchase, volumes purchased, availability), using the example of the Benin and Cameroun.

The main conclusions regarding the low cost technology options are summarized hereafter.

## Conclusions

### SWER and single-phase technology:

- The gradual transition from single-phase to three-phase can be considered where loads of rural communities substantially increase; however, in rural areas the needs can generally be met by SWER and single-phase.
- Before the implementation of a SWER line, it is necessary to ensure that the cost of wire grounding is not higher than the cost of an additional cable (distributed neutral phase). Furthermore the SWER implementation may encounter difficulties due to the high soil resistivity of certain lands (for example desert lands).

### Shield Wire Systems:

- If HV transmission lines are available, the distance between the existing MV network and the targeted village is considerably large while the distance between the HV transmission line and the village is reasonable, the shield wire applications may offer a real solution to connect the villages located by the HV transmission lines.
- Shield Wire Systems are subject to transient faults (i.e. without equipment damage), caused generally by lightning in stormy weather seasons. Their maintenance is similar to the conventional MV lines.
- Shield Wire Systems have sometimes failed due to use of inappropriately designed equipment and non-compliance with specifications.

### The **network planning** should be:

- independent of purely political decisions;
- built over a long-term period (ideally 20 years);
- based on a solid and updated data collection with the support of GIS and possibly involving other relevant ministries (health, energy, water, education, etc.) in order to facilitate the sharing of data and save significant time; and
- elaborated with the help of decision making support tools, i.e. effective planning software, in order to prioritize the electrification of the areas that can have a major socio-economic impact among populations.

However, costs reduction through the implementation of low-cost technology options cannot be fully successful without the following **framework conditions**:

- (i) a sound and coherent planning of rural electrification supported by the different actors concerned (utilities, Rural Electrification Agencies, etc.), and
- (ii) the role of mediator fully assumed by the regulator.

In addition, the actors involved in the planning exercise are multiple and do not necessarily have the same goals. The private operator seeks financial returns while governments and Rural Electrification Agencies have the public responsibility for the provision of the electricity service to rural populations.

- A strong regulator shall balance the equilibrium between the utilities and the rural electrification agencies, pushing the electricity companies to change the often conservative habits in the deployment of the technologies.
- However, this is not only the responsibility of the regulator; it is also up to the utilities and agencies to act as a driver of this change by promoting the use of the new technologies for rural electrification.
- Lessons learned and appropriate tools - such as the handbook currently developed by AEI and EUEI PDF - should be applied to facilitate the advocacy vis-à-vis the decision-makers.

## Annex 1: Agenda

DAY 1 – Wednesday, 19 March 2014			
08:15	Registration		
09:00	<b>Welcome session</b> <ul style="list-style-type: none"> <li>Opening remarks</li> <li>Welcome by Organizers</li> <li>Definition of the problem, presentation of the CLUB-ER, and presentation of the agenda</li> </ul>	<b>Christophe Kaki</b> , Directeur du Cabinet du Ministre, <i>Ministère de l'Energie, des Recherches Pétrolières et Minières, de l'Eau et du Développement des Energies Renouvelables</i> , Benin <b>Franklin Gbedey</b> , <i>World Bank</i> <b>Niklas Hayek</b> , <i>EUEI PDF</i> <b>Silvia Cabriolu Puddu</b> , <i>CLUB-ER</i>	
10:00	Tea break		
10:15	<b>Presentations - low cost technology options:</b> <ul style="list-style-type: none"> <li>Shield Wire Systems and Low Cost HT Grid Extensions</li> <li>Single Phase/Two Phase Reticulation</li> <li>Single Wire Earth Return (SWER)</li> </ul>	<b>Prof. Francesco Iliceto</b> , <i>University of Rome 'La Sapienza'</i> , Italy <b>Moncef Aissa</b> , <i>Consultant Power Engineer</i> , Tunisia <b>Eugène Ngueha</b> , <i>AES, Sous-Directeur des Etudes et de la Régulation</i> , Cameroon (presented by Mr Gervais Ouoba, FDE, Burkina Faso)	
12:00	Lunch		
13:15	Plenary discussion on technology options	Moderation: Romain Frandji, Project Manager, IED/CLUB-ER	
14:15	<b>Breakout sessions:</b> <i>Analysis of Selected Case Studies</i>		
	<b>Group 1 : Plenary</b> Moderation: Moncef Aissa, Consultant Power Engineer, Tunisia	<b>Group 2 : Plenary</b> Moderation: Gervais Ouoba, Technical Director, FDE, Burkina Faso	<b>Group 3 : Sala Gani</b> Moderation: Prof. Francesco Iliceto, University of Rome 'La Sapienza', Italy
16:15	<b>Wrap-up Day 1</b>	Romain Frandji, Project Manager, IED/CLUB-ER	
16:30	End of day 1 sessions		

DAY 2 – Thursday, 20 March, 2014				
09:00	<b>Presentation – Electrification planning</b>		Franklin Gbedey, World Bank	
09:45	<b>Country experiences</b> <ul style="list-style-type: none"> <li>Country presentations on low cost technologies</li> </ul>		<b>Melvine Ahuouissoussi</b> , Chef de Services des Etudes des Projets d’Electrification Rurale, <i>ABERME</i> , Benin <b>Abdoulaye Abbas</b> , <i>ARSE</i> , Togo	
10 :30	<i>Tea break</i>			
	<b>Country experiences - cont.</b>		<b>Gervais Ouoba</b> , Technical Director, <i>FDE</i> , Burkina Faso <b>Eugene Ngueha</b> , Sous-Directeur Etudes et Régulation, <i>AES</i> , Cameroon <b>Guy Oswald Demtare</b> , Engineer, Chef de Projet Energie, Cameroon	
12:00	<i>Lunch</i>			
13:00	<b>General discussion:</b> <ul style="list-style-type: none"> <li>Network Planning Issues and countries’ experience</li> </ul>		Moderation: Romain Frandji, Project Manager, IED/Club-ER	
14:30	<b>Finalisation of Case Study Analyses and preparation of the presentations</b>			
	<b>Group 1 : Plenary</b>	<b>Group 2 : Plenary</b>	<b>Group 3 : Sala Gani</b>	<b>Group 4 : Sala Gani</b>
15:15	<i>Tea break</i>			
15:15	<b>Presentation of results of case studies</b>		Rapporteur of each Breakout Group	
16:00	<b>Closing Session</b> <ul style="list-style-type: none"> <li>Conclusion</li> <li>Closing Remarks</li> </ul>		<b>Romain Frandji</b> , Project Manager, IED/CLUB-ER <b>Hamoud Souleiman Cheik</b> , Président du CLUB-ER et Chef de service des Energies conventionnelles, Ministère de l’Energie en charge des Ressources Naturelles (MERN), Djibouti <b>Bertin Codjo Djaito</b> , Ministère de l’Energie, des Recherches Pétrolières et Minières de l’Eau et du Développement des Energies Renouvelables	
16:30	<i>End of day 2 sessions</i>			

## Annex 1: Participants list

Name	Surname	Organisation	Country
Toussaint	AHOUANGBENANGNON	ABERME	Bénin
Alzouma Ibrahim	CISSÉ	NIGELEC	Niger
Adjid	MAHAMAT	Direction de l'Energie (DE)	Tchad
Nomenjanahary Heritiana	RAZAFINDRAKOTO	Agence de Développement de l'Electrification Rurale (ADER)	Madagascar
Abbas	ABOULAYE	Autorité de Réglementation du Secteur de l'Electricité (ARSE)	Togo
Kandine	ADAM ABORAK	Ministère de l'énergie et du pétrole	Niger
Melvine	AHOUISSOUSSI	ABERME	Bénin
Yves-Serge	AHOUSSOU	CI-ENERGIES	Côte d'Ivoire
Moncef	AISSA		Tunisie
Todéman	ASSAN	ABERME	Bénin
Blaise	BANGUITOUMBA	ENERCA	République Centrafricaine
Gildas	BANKOLE	SBEE	Bénin
Thierry	BEFIO NAMDENGANANA	Agence Centrafricaine d'ER (ACER)	République Centrafricaine
Baptiste	BOBILLIER	Délégation de l'Union Européenne au Bénin	Bénin
Silvia	CABRIOLU PUDDU	INNOVATION ENERGIE DEVELOPPEMENT – IED	France
Bertin	CODJO DJAITO	Ministère de l'Energie, des Recherches Pétrolières et Minières de l'Eau et du Développement des Energies Renouvelables	Bénin
Lamine	COULIBALY	AMADER	Mali

Name	Surname	Organisation	Country
Guy Oswald	DEMTARE	"Etudes Engineering Développement - EED	Cameroun
Mamadou Saïdou	DIALLO	Bureau d'Electrification Rurale Décentralisée (BERD)	Guinée
Yvon Polycarpe	DOSSA	GIZ - Energising Development	Bénin
Peter	FÖRSTER	GIZ - Energising Development	Bénin
Romain	FRANDJI	INNOVATION ENERGIE DEVELOPPEMENT – IED	France
Franklin	GBEDEY	World Bank	
Jenny	HASSELSTEN	World Bank	
Niklas	HAYEK	EUEI PDF	
Francesco	ILICETO	Rome Université « La Sapienza »	Italie
Yaovi Charles	KOUMAPLE	ABERME	Bénin
Ahmedou	M.M. AHMED ALEM	ADER	Mauritanie
Mlle Jocelyne Odette	MBOUMBA VOUNGBO	ENERCA	République Centrafricaine
Leonard	NTIRWONZA	Agence Burundaise de l'Electrification Rurale (ABER)	Burundi
Mário	OLIVEIRA	Direction Générale de l'Énergie (DGE), Ministère du Tourisme, de l'Industrie et de l'Énergie (MTIE)	Cap Vert
Moussa	OMBOTIMBE	Direction Nationale de l'Énergie	Mali
Gervais	OUOBA	Fond de Développement de l'Electrification (FDE)	Burkina Faso
Olivier Bruno	RABEMANANTSOA	Jiro Sy Rano Malagasy (JIRAMA)	Madagascar
Victor Dieudonné	SALA MENGUE	ELECTRICITY DEVELOPMENT CORPORATION (EDC)	Cameroun



Name	Surname	Organisation	Country
Hamoud	SOULEIMAN CHEIK	Ministère de l'Énergie en charge des Ressources Naturelles (MERN)	Djibouti
Claude Michel	TAMO	"Etudes Engineering Développement - EED	Cameroun
Bamba	THIAM	Agence Sénégalaise d'Electrification Rurale (ASER)	Sénégal
Claude	ZIMBO	SBEE	Bénin
Mamidou	TCHOUTCHA	DGE / MERDMEDER	Bénin
Jean Francois	MODONDO	SBEE	Bénin
Malick	MAMA	SBEE	Bénin
Badarou	M. RAOFON	Consulat / VE	Bénin
Nestor	NOUHOUAYI	Délégation de l'Union Européenne	Bénin
Sabin	LOUMEAJINON	Presse / La Nation	Bénin
Serge	BOYA	Presse / La Nation	Bénin
Samuel	FAVI	Journaliste /Communal info	Bénin
Felix	EBO	Miert international	Bénin
Cyrille	DJEBOU O	Journaliste / L'autre Vision	Bénin
Herman W	ADIMOU	Journaliste / Aube Nouvelle	Bénin
Yaoui	NYAMADOR		Togo
Sodji	ALAIN	Agence Bénin Presse	Bénin
Biomama	BOUBACAR	Direction Générale de L'Énergie	Bénin
Odjo	CYRIAQUE	ABERME / Ministère Énergie	Bénin