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**UNITED NATIONS INDUSTRIAL DEVELOPMENT  
ORGANIZATION (UNIDO)**

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www.unido.org**

**TRAINING WORKSHOP COMPLETION REPORT:**

**TITLE:  
“TRAINING WORKSHOP ON SMALL HYDROPOWER PROJECT  
DEVELOPMENT IN LIBERIA”**

**DATE:  
DECEMBER 9-19, 2013**

**VENUE:  
MAMBA POINT HOTEL CONFERENCE HALL,  
MONROVIA, LIBERIA**



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Liberia: SPWA-CC: Installation of Multi-Purpose  
Mini Hydro Infrastructure (for Energy & Irrigation)  
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**Submitted to:**

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**Date submitted:** January 24, 2014

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## **1.0 GENERAL BACKGROUND:**

The **United Nations Industrial Development Organization (UNIDO)**, as part of its development support to Liberia, has secured a project earmarked for implementation in Suakoko District, Bong County under the project title, **“Liberia: SWPA-CC, Installation of Multi-Purpose Mini Hydro Infrastructure for Energy and Irrigation.**

The Project which constitutes the Installation of a 1 Megawatt hydropower station by harnessing the Mein River, given its huge hydropower potential, is being co-financed by The **Global Environmental Facility (GEF)** with UNIDO as GEF recipient, under its Regional: GEF Strategic Program for West Africa: Energy Component (PROGRAM) along with the **United States Aid for International Development (USAID)**.

The generating capacity of the project when completed is expected to provide clean energy to approximately 30% of household in Suakoko Town and 15% in the rural area of Suakaoko District as well as provide electricity to various institutions including government building, small and medium enterprises, and commercial buildings.

Regarding implementation, UNIDO and USAID are partnering with specific responsibilities while ensuring that the project is fully executed through LESSP/Winrock International, an entity already implementing several energy related projects in Liberia sponsored by USAID.

Specifically, UNIDO’s funding shall be utilized to ensure power transmission and distribution while USAID funding shall go toward the power generation component.

To guarantee the successful implementation of the project, the entire project framework/technical scope of works has been divided sequentially into 4 (Four) major components, with each having a specific objective expected to be accomplished within a specified period, they include:

1. Development of Institutional capacity
2. Installation and commissioning of Mini Hydropower system and local grid distribution
3. Technical capacity building for operation, repair and maintenance of mini hydro power and local mini grid
4. Policy and regulatory framework for mini hydro power development

In order to ensure that component 1 (One) of the project framework is implemented and accomplished, considering the enormous emphasis on development of institutional capacity, UNIDO organised a 10 (Ten) day intensive training workshop which spanned from December 9-19, 2013, under the theme/title, **“Training Workshop on Small Hydropower Project Development in Liberia.”**

With regards to the huge capacity gap, the workshop is expected to strengthened institutional capacity at national and local levels for implementation of mini hydro power (MHP) system and local distribution grid with an expected output as outlined in the project document:

- 1.1: Capacity of national and local energy sector agencies strengthened to promote micro and mini hydropower for improved electricity access
- 1.2: Public-Private partnership model developed for renewable energy projects
- 1.3: Best practices and standard operating practice manual for implementation of micro and mini hydro power projects developed

The overall project objective of the 1 Megawatt hydropower project is to develop the market environment for improving the access to mini-hydro based modern energy services in the rural areas of Liberia.

## 2.0 TRAINING METHODOLOGY:

UNIDO organised the 10 (Ten) days training workshop in collaboration with the **Alternate Hydro Energy Centre of Indian Institute of Technology, Roorkee, (IITR)**, a renowned and internationally accredited institution in the area of renewable energy resources development based in Indian.

As part of the arrangement, IITR agreed to facilitate the exercise in Liberia by ensuring that the following obligations are accomplished:

- Provide trainers/facilitators to conduct the training exercise
- Prepare course outline/materials for the training exercise
- Production of hand-out / training manuals and etc.

To ensuring that these obligations are covered, the institution made available 5 (Five) of its most accredited professors to serve as training facilitators for the established period of the workshop. Below are the names of the professors with their arrival and departure dates specified.

No.	Names of Professors/ Training Consultants	International	Capacity	Date of Arrival	Date of Departure
1.	Dr. Arun Kumar		Team Leader/Facilitator	December 7, 2013	December 16, 2013
2.	Dr. Rajeshwer Prasad Saini		Facilitator	December 7, 2013	December 16, 2013
3.	Dr. Praveen Saxena		Facilitator	December 9, 2013	December 14, 2013
4.	Dr. Girish Chandra Singh Gaur		Facilitator	December 11, 2013	December 20, 2013
5.	Dr. Rahul Dev Garg		Facilitator	December 11, 2013	December 18, 2013

As planned, the trainers/facilitators arrived in the country with all the necessary materials needed to conduct the exercise as indicated above.

Specifically, the course outline was divided into three volumes/manuals due to the extent of the materials to be covered over the period of the 10 days.

Categorically, 6 days of the training exercise was designed purely for theory/classroom exercise in Monrovia, spanning between December 9-15 and 18-19 while December 16 and 17 was designed for hands on / field application or practical site demonstration along the Du River located in Kakata, Margibi County, adjacent the Booker Washington Institute (BWI).

UNIDO being the project principal implementer in Liberia had a wide range of planning and managerial responsibilities to be put in place locally, which included but not limited to the following:

- Recruitment of 40 workshop participants/trainees across selected institutions which included, government ministries and agencies, government and private owned universities as well as the Engineering Society of Liberia
- Provide funding for the procurement of all local materials needed for the workshop, to include stationaries and others
- Rent a suitable venue/hall, adequate to contain both trainees and trainers (as well as invited quest)
- Make available meal enough to cover the 40 (Forty) trainees/participants during the course of the workshop
- Make available transport vehicle to accommodate the 40 (Forty) trainees/participants for the 2 (Two) days field exercise at Kakata, Margibi County
- Ensure the preparation and printing of certificates for the 40 trainees and workshop banners
- Secure/process entry visas for the 5 (Five) trainers/facilitators through the relevant government agency in the country (The visas were processed through the **BIN: Bureau of Immigration & Naturalization**)

UNIDO, through the assistance of Winrock International/LESSP, recruited 42 participants from across 13 (Thirteen) identified institutions in the country (**against the initial 40 targeted due to the high level of interest expressed in the training**), ranging from government ministries and agencies, government and private owned universities, technical institutions etc.

Scouting of the trainees was firstly carried out at each institution due to the enormous time constraint, later followed by formal communications requesting participation and nomination of individual (s) with technical background in the area

of either civil, mechanical, electrical or agriculture engineering for the intensive training exercise as was required in the guideline.

In response to the Organization's request, the following individuals as indicated below were nominated by their respective institutions/organizations to participate as trainees in the workshop training exercise:

<b>LIST OF NOMINEES-SHP TRAINING WORKSHOP</b>				
<b>No.</b>	<b>Names of Recruited Trainees</b>	<b>Institutions</b>	<b>Emails</b>	<b>Contacts</b>
1.	Bohmensahn Yuan	LEC	bohmensahn@yahoo.com	0886-590298
2.	Aloysius N. Kleekpo	LEC	loykleepo@yahoo.com	0886-520563
3.	Napoleon Chattah	Engineering Society of Liberia	chattah@engineer.com	0886-515669
4.	N. Pawon Boayue	Engineering Society of Liberia	npboayue@yahoo.com	0886-519691
5.	N. Hun-Bu Tulay	Engineering Society of Liberia	tevonma@yahoo.com	0777-111032
6.	Guah Kennedy	Liberia Hydrological Services	gkennedy@2004yahoo.com	0886-665730
7.	Abednego Koon	Booker Washington Institute		0886-100101
8.	Molley Marvy	Booker Washington Institute		0886-535922
9.	Christiana Konatee	Booker Washington Institute		0880-944519
10.	Joe E. Kanneh	Booker Washington Institute		0886-970352
11.	Archie Kollie	Booker Washington Institute		0880-932250
12.	Jackson Tamba	Tubman University	Jtamba2013@yahoo.com	0886-536627
13.	Abraham Bah	Tubman University	Abraham204@gmail.com	0886-418762
14.	Eric Jones	Stella Maris Polytechnic	ericjones2g8@yahoo.com	0886-549949
15.	Emmanuel Flomo	Stella Maris Polytechnic	emmanuelrashin31@gmail.com	0886-844493
16.	Elijah D. Harris	Stella Maris Polytechnic		0777-132937
17.	Nelson Gargard	Stella Maris Polytechnic	nelsongargard@yahoo.com	0888-562676
18.	Alexander N. Gardour	Stella Maris Polytechnic	alexandergardour@yahoo.com	0777-063828
19.	R. Baiyeszenah W. Brown	Environmental Protection Agency	edwinbah@yahoo.com	0886-536831
20.	Jarsa V. Okai	Environmental Protection Agency	jarsaokai@yahoo.com	0886-466228
21.	Rufus S. Borbor	Ministry of lands, Mines & Energy		0880-447333
22.	Henry F. G. Mulbah	Ministry of lands, Mines & Energy	Henry.mulbah@yahoo.com	0880-883608
23.	Hassan Sankary	Cuttington University	cureseng@gmail.com	0886-516688
24.	J. Alexander Guwoe	Phebe	Jaguwoe17@yahoo.com	0886-326398
25.	Howard F. Kesselly	University of Liberia	kesselly.howard@yahoo.com	0777-030111
26.	Wemogar E. Borweh	University of Liberia	wborweh@gmail.com	0880-958058
27.	Ahmed A. Dukuly	University of Liberia	Ahmeda.dukuly@gmail.com	0886-993415
28.	Mariama S. Bah	University of Liberia	bahmariama@gmail.com	0886-401125
29.	Stanley Sonkarlay	University of Liberia	ssokarlay@yahoo.com	0886-822701
30.	Freeman Woahloe Jr.	Winrock International/LESSP	fwoahloe@winrocklessp.org	0886-911618
31.	Maxine Baiduah	Winrock International/LESSP	mbaiduah@winrocklessp.org	0886-592279
32.	Omar V. Al Sheriff	Winrock International/LESSP	omarshero@yahoo.com	0886-831461
33.	Rhorton Wisseh	Winrock International/LESSP	rwissehlessp@gmail.com	0880-730325

34.	Eunice Y F. Burphy	Winrock International/LESSP	eyfburphy.lessp@gmail.com	0880-676147
35.	Elijah Geetoe	Winrock International/LESSP	egeetoelessp@gmail.com	0886-402836
36.	Aaron Mineen	Winrock International/LESSP	amineenlessp@gmail.com	0886-532462
37.	Momo N. Kaifa Jr.	Winrock International/LESSP	mnkaifa.lessp@gmail.com	0880-940289
38.	Benjamin N. Fah	Winrock International/LESSP	Benfahn060@yahoo.com	0886-599299
39.	Jenkins B. Kullie	Winrock International/LESSP	jbkullielessp@gmail.com	0888-728181
40.	Aloysius W. Kpadeh	St. Clements University College	wkpadeh@yahoo.com	0886-951879
41.	Hilton Payewonmien	St. Clements University College	hiltonpayewonmien@yahoo.com	0886-243751
42.	Ed Blamo	St. Clements University College	edstoic@fastmail.net	0886-566909

Strategically, selection of institutions for the training exercise was decentralized in the country to a maximum level, considering the inclusion of the below institutions:

- Cuttington University, located in Suakoko District, Bong County
- Phebe Medical Hospital, located in Suakoko District, Bong County
- Tubman University, located in Harper, Maryland County, and
- Booker Washington University, located in Kakata, Margibi County

Interestingly, the two institutions, Cuttington University and Phebe Medical Hospital are within bounds of the 1 Megawatt UNIDO hydropower project and are to directly benefit from the power output when commissioned.

Winrock International/LESSP being the project executing partner, recommended 10 (Ten) of its construction inspectors to UNIDO for inclusion in the training workshop, since their responsibility and concentration will include the monitoring, inspection, evaluating, supervision and technical reporting on the 1 Megawatt hydropower project at Suakoko District, Bong county.

In its valuation of the recommendation, UNIDO accepted the proposal considering the success and huge benefit it brings in the management of the project during the course of implementation reliant on the exposure and knowledge gained by the construction inspectors in managing mini hydropower project as is emphasized in the training exercise.

### 3.0 WORKSHOP OPENING & CLOSING CEREMONY:

#### 3.1 Opening Ceremony:

In response to UNIDO's invitation, the below personalities from the government and partner organization (s) attended the workshop opening ceremony on December 9, 2013 and made the following remarks:

INVITEES AT THE OPENING SECTION OF THE TRAINING WORKSHOP			
No.	Name of Personalities	Institution/Agency	Remarks made:
1.	Madam Anyaa Vohiri-Executive Director & Global Environmental Facility (GEF) Focal Person	Environmental Protection Agency (EPA)/GEF	<ul style="list-style-type: none"> <li>• Welcomed the training workshop on hydro power development in Liberia and stressed that it has come at a time government is emphasizing, prioritizing electricity in the rural areas of Liberia to in able every inhabitant have access</li> <li>• Stressed that as Head of EPA and GEF Focal Person in Liberia she seriously support electricity in the rural areas of the country, because no electricity means, the forest sector is threaten, environment is threaten as they go hand in hand</li> <li>• Extended her appreciation also to UNIDO for having her staff participant in the</li> </ul>

			<p>training as EPA currently lacks the technical capacity as the training will help them to know what to look for when they go out in the field and to know what they are monitoring</p>
2.	Mr Augustus Goanue-Executive Director	Rural & Renewable Energy Agency (RREA)	<ul style="list-style-type: none"> <li>• Expressed his happiness to see that the Mein River Project has come to fruition today, demonstrated in the training exercise being organized by UNIDO. He recounted back in 2007 when UNIDO contacted RREA on how to interface with LESSP</li> <li>• That RREA is highly interested in the project and training considering its mandate to facilitate and accelerate the economic transformation of rural Liberia by promoting the commercial development and supply of modern energy services with emphasis in locally available renewable energy resources</li> <li>• He encouraged the trainees/participants to take advantage of the UNIDO training because the future of Liberia lies in hydro</li> </ul>
3.	Honorable Jewel Howard Taylor-Senior Senator	Bong County	<ul style="list-style-type: none"> <li>• Expressed her thanks and appreciation to UNIDO for undertaking the 1 Megawatt hydropower project in Bong County, specifically Suakoko considering similar undertaking by LESSP in Lofa County which is currently providing 24 hour electricity to three-four communities</li> <li>• That development is going beyond Monrovia, as Monrovia is not Liberia</li> <li>• That everything ties into electricity as it relates to development because people will not want to go outside Monrovia as cost of electricity, cost of opening businesses and the cost of innovation becomes more expensive the further you are from the national/electricity grid</li> <li>• Lastly, she stressed that electricity means access to job opportunities for young people</li> </ul>
4.	Honorable Edward Kafia-Representative, District # 5	Bong County	<ul style="list-style-type: none"> <li>• That the 1 Megawatt Mein River hydropower Project to be implemented in Suakoko by UNIDO is unbelievable for a country where even in the capitol city (Monrovia) light is something scarce and luxury, to see it coming to your community it is indeed something to welcome and appreciate</li> <li>• Overwhelmed by the presence of both the Paramount and Clan Chiefs from Suakoko District at the opening of the training workshop, demonstrating that the project have finally come to fruition, reflecting on the eagerness of the people of Suakoko District for the project commencement</li> <li>• That giving light to the people of Suakoko means giving life to someone in a deprived</li> </ul>



			community, which means Cuttington will have sustainable power which will cut cost in students fees, which also means saving lives at Phebe medical Hospital considering its huge energy challenge
5.	Mr. C. Gyude Bedell Senior Financial Analyst at Ministry of States without Profolio proxy for Honorable Mounir W. Sraplay-Economic Advisor to the President, republic of Liberia (away for official visit)	Ministry of Sate & Presidential Affairs, Republic of Liberia	<ul style="list-style-type: none"> <li>Extended his gratitude to UNIDO and all the partners involved in the process and pointed out that Liberia constraints analysis identified that energy is one of the critical issues to sustainable economic development</li> <li>Stressed that for an economy to have a vibrant private sector energy must be a priority</li> <li>That the 1 Megawatt hydropower project is very strategic to key institutions like Phebe Medical Hospital, Cuttington University, CARI etc,</li> </ul>
6.	Mr. Michael McGovern- Chief of Party	Winrock International/LESSP	<ul style="list-style-type: none"> <li>That the project represents the future as people spent a lot of time focusing on national grid electricity instead of off grid which has the potential to provide electricity to people living in the rural parts of Liberia</li> <li>Assured UNIDO and USAID that Winrock International will ensure that the project is fully implemented as per the required scope of works</li> </ul>
7.	Honorable Arthur Wennah- Paramount Chief	Suakoko District, Bong County	<ul style="list-style-type: none"> <li>Extended his thanks and appreciation to UNIDO for undertaking the hydro project in Suakoko District, which he sees will bring pride to the district and its people</li> <li>That most patience lost their lives at Phebe Medical Hospital when there is critical work to be done like surgery due to power shut down or shortage</li> </ul>
8.	Honorable Moses Momo- Acting Clan Chief	Suakoko District, Kpatawee Clan, Bong County	<ul style="list-style-type: none"> <li>Expressed his happiness that his district will be electrified by the UNIDO 1 Megawatt Hydropower project</li> </ul>

**Note:**

The below institutional heads were given Letter of Invitations but did not attend:

- Honorable Patrick Sandolo  
Minister of Lands, Mines and Energy
- Mr. John Mark Winfield  
Chief of Mission  
USAID Liberia
- Honorable Antoinette Weeks  
Minister of Public Works
- Honorable Axel M. Addy  
Minister of Commerce and Industry
- Dr. Emmett Dennis  
President  
University of Liberia

Also attending the opening ceremony was UNIDO's Regional Representative for Liberia, Guinea and Sierra Leone, with duty station in Guinea, **Mr. Bafotiqui Sako** who arrived in country for the opening section of training workshop. He delivered the keynote speech marking the official opening while stressing the following significant points:

- Assured the Government of Liberia and other counterparts that UNIDO remains committed to meeting the national development agenda of Liberia which accords high priority to development of renewable energy in the country
- That UNIDO, having identified the huge capacity gap in the renewable energy sector of the country, organized the 10 day workshop to strengthen the human resource capacity of Liberia and Liberians as we work closely with national stakeholders, local and international partners with the aim of strengthening the technical and managerial knowledge within the country as pertaining to Small Hydropower Project (SHP) design and technology, to provide a critical mass of competent professionals in Liberia in the SHP area.
- That Liberia is endowed with renewable energy resource potentials most especially hydropower, given the enormous rainfall the country receives annually and strategic rivers
- That the 1 Megawatt power project to be implemented in Suakoko by UNIDO is a demonstrative pilot project expected to lay the foundation for a market environment for mini hydro-based renewable energy in Liberia, and that GEF support towards the pilot mini hydro project, capacity development mini hydro sector and developing and regulatory framework, will enable the Government to scale up and replicate the project's achievements across the country.
- That the project when completed will also build on national priorities, taking into account recommendations made in the Poverty Reduction Strategy (PRS), as well as in the power sector master plan which mentions that GOL will begin to develop new hydropower generation capacity and assess other energy sources.
- Lastly he challenged the trainees to make maximum use of the training opportunity provided by UNIDO as it covers a wide range of topics for the benefit of the institutions they represent and also for their own human resource development.

Dr. Arun Kumar, Facilitator, Team Leader, and also CSO/Head Professor of the Alternate Energy Sector of the Indian Institute of Technology (IITR) presented an overview of the SHP Training Workshop emphasizing the following points:

- That he and his Team from IITR feel honoured by UNIDO and the Liberia Government and its people to be accorded such an opportunity to conduct such significant training as it relates to hydropower development in the country
- That the workshop will cover a wide range of topics in hydropower development starting from planning, investigations, design, report preparations, equipment evaluation and selection and etc.
- And that 2 days of the training will be dedicated to hands on field exercise with focus on the water, the head, the geology and those issues that necessarily require the use of instruments

The workshop opening began with the registration of the trainees/participants followed by welcome and introductory remarks to the trainees/participants and invited guest by the National Project Coordinator, A. Brahim Sackie.

### 3.2 Workshop Closing:

The Workshop closing was also attended by the below personalities at which they made closing remarks:

INVITED GUEST AT THE CLOSING SECTION OF THE TRAINING WORKSHOP			
No.	Name of Personalities	Institution/Agency	Comments made:

1.	Madam Laura William, Technical Advisor proxy for Madam Anyaa Vohiri-Executive Director & GEF Focal Person	Environmental Protection Agency (EPA)	<ul style="list-style-type: none"> <li>Extended her thanks to UNIDO on behalf of the Executive Director and also thank the trainees for their participation in the training as they have learned by the art of doing</li> <li>Encouraged them to make maximum use of the knowledge gained in order to be better citizens</li> </ul>
2.	Mr Augustus Goanue-Executive Director	Rural & Renewable Energy Agency (RREA)	<ul style="list-style-type: none"> <li>Thanks UNIDO and USAID for the partnership</li> <li>That through RREA the issue of renewable energy has come to focus in Liberia</li> <li>That the training is perfect because RREA has been raising and mobilizing funding for renewable energy in Liberia with number one priority for the government being hydro as far as the Ministry of Lands, Mines and Energy and the entire energy sector is concerned</li> <li>That in future the government will be able to build on the success of the UNIDO/USAID 1 Megawatt Mein River Project and the training conducted to scale up renewable energy in Liberia</li> </ul>
3.	Mr. Michael McGovern-Chief of Party	Winrock International/ LESSP	<ul style="list-style-type: none"> <li>Extended thanks and appreciation to the professors for conducting the training exercise successfully</li> <li>And that the trainees should considered themselves lucky to have been trained by the Professors from IITR as they are some of the authorities in the world today as it relates to hydro power development</li> <li>Also extended thanks and appreciation for the cordial working relationship between him and Mr. Rana P. Singh, the Project Manager and Allotment Holder at UNIDO for his many support over the years</li> </ul>

The **Project Manager and Allotment Holder**, based at Headquarters, Vienna, Austria, **Mr. Rana Pratap Singh** arrived in Liberia on December 16, 2013 for the workshop. He delivered the closing statement during the close of the workshop with the following remarks:

- Expressed his appreciation for the successful closing of the workshop, demonstrating UNIDO's intervention and assistance in the development of the human resource potential of Liberia and Liberians most especially in the hydropower sector of the country, and that the knowledge gained by the trainees will remain useful throughout their career
- He recalled back in 2007 that he was able to let the Liberia Government be aware of the hydro energy potential of Liberia when it was believed that it was impossible, and that the result of his declaration has led to new interest in the country, considering the Mein River Hydropower Project to be undertaken by UNIDO and as well as other energy project to be implemented by other organizations

Mr. Hu-Bu Tulay, president of the Engineering Society of Liberia (ESOL) and trainee of the workshop, was nominated by his colleagues to serve as trainees' representative. He made the following remarks on behalf of his colleagues:

- Firstly extending his gratitude to UNIDO for providing them such a meaningful training opportunity that has helped to build their human resource capacity in the implementation of mini Hydro-based project as it relates to the energy sector. And that the training is one of few experiences in a country that lacked the necessary manpower.

- Also extended his thanks and appreciation to the training professors and the Alternate Energy Centre of the Indian Institute of technology, Roorkee (IITR) for taking the time to come to Liberia to contribute meaningfully in building the capacity of Liberian in the hydropower sector
- Assured UNIDO, RREA, LESSP/Winrock International that he and his colleagues are confident that with the exposure and knowledge gained from the exercise, they can assist in hydropower project assessment and investigation because they know what to look for in order to have a functional hydro station, considering the head, discharge, selection of hydro site, generator house location and so more.

Dr. RP Saini, on behalf of the Facilitators and Alternate Energy Centre of the Indian Institute of Technology, Roorkee (IITR), made the following remarks during the closing exercise:

- That the batch they have trained are found to be one of the most excellent batches that they have ever handled in their career, considering the eagerness of the trainees to gain knowledge and the level of interaction, as they remained committed throughout the 10 (ten) day of intensive training exercise
- He also extended thanks and appreciation to UNIDO for the opportunity to have them come to Liberia to help build resource capacity in the hydro power sector of the country

#### **4.0 TRAINING MODULES / PRESENTATION & WORKSHOP PHOTOGRAPHS:**

The training workshop covered a wide range of significant topics on hydropower development divided into modules. Presentations were made by the 5 (Five) Facilitators as per the required topic (course outline), with date and time indicated below:

<b>TRAINING MODULES / PRESENTATIONS</b>	
<b>TIME</b>	<b>TOPICS</b>
<b>Day One: Monday, Dec. 09, 2013</b>	
11:30-13:00	• Overview of SHP Development and studies done in the past- <i>Dr. Arun Kumar</i>
13:00-14:00	Lunch Break
14:00-15:15	• Approach for identification of potential site- <i>Dr. Arun Kumar</i>
15:15-15:45	• Tea/Coffee Break
15:45-17:00	• Hands on catchment area delineation and project layout- <i>Dr. Arun Kumar</i>
<b>Day Two: Tuesday, Dec. 10, 2013</b>	
9:00-10:30	• Different types of investigations- <i>Dr. Arun Kumar</i> • Hydrology of un-gauged catchments- <i>Dr. Arun Kumar</i>
10:30-11:00	Tea/Coffee Break
11:00-13:00	• Hydrological observations-Methods, Limitations- <i>Dr. Arun Kumar</i> • Flood estimations- <i>Dr. Arun Kumar</i>
13:00-14:00	Lunch Break
14:00-15:15	• Existing practice for meeting energy demand- <i>Dr. P. Saxena</i>
15:15-15:45	Tea/Coffee Break
15:45-17:00	• Flow duration and installation capacity estimation- <i>Dr. Arun Kumar</i>
<b>Day Three: Wednesday, Dec. 11, 2013</b>	
9:00-10:30	• Planning and preliminary design of diversion weir and intake works- <i>Dr. Arun Kumar</i>
10:30-11:00	Tea/Coffee Break
11:00-13:00	• Planning and preliminary design of desilting tank and forebay tank- <i>Dr. Arun Kumar</i> • Power purchase agreements and feed in tariff- <i>Dr. P. Saxena</i>
13:00-14:00	Lunch Break
14:00-15:15	• Planning and preliminary design of channel, tunnel and pipes- <i>Dr. Arun Kumar</i>
15:15-15:45	Tea/Coffee Break
15:45-17:00	• Strategy formulation, policy and regulatory instruments to bring IPPs on board- <i>Dr. P. Saxena</i>
<b>Day Four: Thursday, Dec. 12, 2013</b>	
9:00-10:30	• Topographical surveys- <i>Dr. RD Garg</i> • Different scales for topographical surveys- <i>Dr. RD Garg</i>
10:30-11:00	Tea/Coffee Break

11:00-13:00	<ul style="list-style-type: none"> <li>• Planning and preliminary design of channel, tunnel and pipes-<i>Dr. Arun Kumar</i></li> <li>• Specification for turnkey execution-<i>Dr. Arun Kumar</i></li> </ul>
13:00-14:00	Lunch Break
14:00-15:15	<ul style="list-style-type: none"> <li>• Decentralization and grid connected hydro power-<i>Dr. P. Saxena</i></li> </ul>
15:15-15:45	Tea/Coffee Break
15:45-17:00	<ul style="list-style-type: none"> <li>• Planning and preliminary design of access road and temporary housing-<i>Dr. Arun Kumar</i></li> </ul>
<b>Day Five: Friday, Dec. 13, 2013</b>	
9:00-10:30	<ul style="list-style-type: none"> <li>• Structure for pre-feasibility report and feasibility report-<i>Dr. Arun Kumar</i></li> </ul>
10:30-11:00	Tea/Coffee Break
11:00-13:00	<ul style="list-style-type: none"> <li>• Instruments used for surveys-<i>Dr. RD Garg</i></li> <li>• Modern equipment for topographical surveys-<i>Dr. RD Garg</i></li> </ul>
13:00-14:00	Lunch Break
14:00-15:15	<ul style="list-style-type: none"> <li>• Survey of load demand-<i>Dr. GCS Gaur</i></li> </ul>
15:15-15:45	Tea/Coffee Break
15:45-17:00	<ul style="list-style-type: none"> <li>• Landslides and slope stability-<i>Dr. GCS Gaur</i></li> </ul>
<b>Day Six: Saturday, Dec. 14, 2013</b>	
9:00-10:30	<ul style="list-style-type: none"> <li>• Geological investigations-<i>Dr. GCS Gaur</i></li> </ul>
10:30-11:00	Tea/Coffee Break
11:00-13:00	<ul style="list-style-type: none"> <li>• Planning and preliminary design of power house building-<i>Dr. Arun Kumar</i></li> </ul>
13:00-14:00	Lunch Break
14:00-15:15	<ul style="list-style-type: none"> <li>• Environment Impact Assessment-<i>Dr. GCS Gaur</i></li> </ul>
15:15-15:45	Tea/Coffee Break
15:45-17:00	<ul style="list-style-type: none"> <li>• Environmental impact assessment related investigations (Air, water, soil, flora, fauna, wild life)-<i>Dr. GCS Gaur</i></li> </ul>
<b>Day Seven: Monday, Dec. 16, 2013</b>	
9:00-17:00	<ul style="list-style-type: none"> <li>• Traveled to Kakata, Margibi County for field application or hands on training on discharge measurement, use of GPS, survey equipment, load demand survey, selection of sampling locations, method of survey and investigations-<i>Dr. GCS Gaur &amp; Dr. RD Garg</i></li> </ul>
<b>Day Eight: Thursday, Dec. 17, 2013</b>	
9:00-17:00	<ul style="list-style-type: none"> <li>• Traveled to Kakata, Margibi County for field application or hands on training on discharge measurement, use of GPS, survey equipment, load demand survey, selection of sampling locations, method of survey and investigations-<i>Dr. GCS Gaur &amp; Dr. RD Garg</i></li> </ul>
<b>Day Nine: Wednesday, Dec. 18, 2013</b>	
9:00-10:30	<ul style="list-style-type: none"> <li>• Selection and specifications of hydraulic turbines- <i>Dr. RP Saini</i></li> </ul>
10:30-11:00	Tea/Coffee Break
11:00-13:00	<ul style="list-style-type: none"> <li>• Public participation and response-<i>Dr. GCS Gaur</i></li> </ul>
13:00-14:00	Lunch Break
14:00-15:15	<ul style="list-style-type: none"> <li>• Selection and specifications of hydraulic turbines-<i>Dr. RP Saini</i></li> </ul>
15:15-15:45	Tea/Coffee Break
15:45-17:00	<ul style="list-style-type: none"> <li>• Survey for muck disposal-<i>Dr. GCS Gaur</i></li> </ul>
<b>Day Ten: Thursday, Dec. 19, 2013</b>	
9:00-10:30	<ul style="list-style-type: none"> <li>• Survey of power evacuation and distribution lines-<i>Dr. GCS Gaur</i></li> <li>• Cost estimates-<i>Dr. GCS Gaur</i></li> </ul>
10:30-11:00	Tea/Coffee Break
11:00-13:00	<ul style="list-style-type: none"> <li>• Preparation of feasibility report-<i>Dr. GCS Gaur</i></li> </ul>
13:00-14:00	Lunch Break
14:00-15:15	<ul style="list-style-type: none"> <li>• Selection and specifications of power evaluation-<i>Dr. RP Saini</i></li> </ul>

## 4.1.1 PHOTOS OF WORKSHOP OPENING SECTION AND REGULAR TRAINING



Fig. 1: Opening section of workshop Dec 9, 2013: Sitting left-right; LESSP/Winrock International Chief Of Party, Mr. Michael McGovern, UNIDO Regional Representative, Mr. Bafotiqui Sako, Paramount Chief of Suakoko District, Bong County, Honorable Arthur Wennah, EPA Executive Director & Focal Person for GEF in Liberia, Madam Anyaa Vohiri, RREA Executive Director, Mr. Augustus Goanue, Bong County Senior Senator, Honorable Jewel Howard Taylor with some of the trainees standing in the rear for group photo



Fig. 2: Opening section of workshop Dec 9, 2013: Sitting left-right; LESSP/Winrock International Chief Of Party, Mr. Michael McGovern, UNIDO Regional Representative, Mr. Bafotiqui Sako, Paramount Chief of Suakoko District, Bong County, Honorable Arthur Wennah, EPA Executive Director & Focal Person for GEF in Liberia, Madam Anyaa Vohiri, RREA Executive Director, Mr. Augustus Goanue, Bong County Senior Senator, Honorable Jewel Howard Taylor with some of the trainees standing in the rear for group photo



Fig. 3: Dr. Arun Kumar making presentation on the first day of workshop section while Dr. SP Saxena looks on



Fig. 4: Dr. Arun Kumar making presentation on the first day of workshop section while Dr. SP Saxena looks on



Fig. 5: Dr. Praveen Saxena making presentation while Dr. Kumar looks on



Fig. 6: Dr. Praveen Saxena making presentation during workshop section



Fig. 7: Dr. Rahul Dev Garg making presentation while Dr. Kumar looks on



Fig. 8: Dr. Girish Chandra Singh Gaur making presentation



Fig. 9: Dr. Rahul Dev Garg giving assistance to one of the trainees during break section



Fig. 10: Dr. Girish Chandra Singh Gaur in interactive discussion with one of the trainees during break section



Fig. 11: Dr. Praveen Saxena in interactive discussion with one of the trainees during break section while the others look on



Fig. 12: Dr. Arun Kumar giving assistance to one of the trainees

**4.1.2 HANDS ON SITE APPLICATION AT KAKATA, MARGIBI COUNTY (DEC 16-17, 2013)**



Fig. 13: Dr. Rahul Dev Garg training some of the trainees divided into section on the use of hydrological instruments at the Du River located at Kakata



Fig. 14: Dr. Rahul Dev Garg training some of the trainees divided into section on the use of hydrological instruments at the Du River located at Kakata





Fig. 15: Dr. Girish Chandra Singh Gaur on field exercise at Kakata with trainees on map reading and investigation, how to identify suitable location for proposed hydro project



Fig. 16: Dr. Girish Chandra Singh Gaur on field exercise at Kakata with trainees on map reading and investigation, how to identify suitable location for proposed hydro project

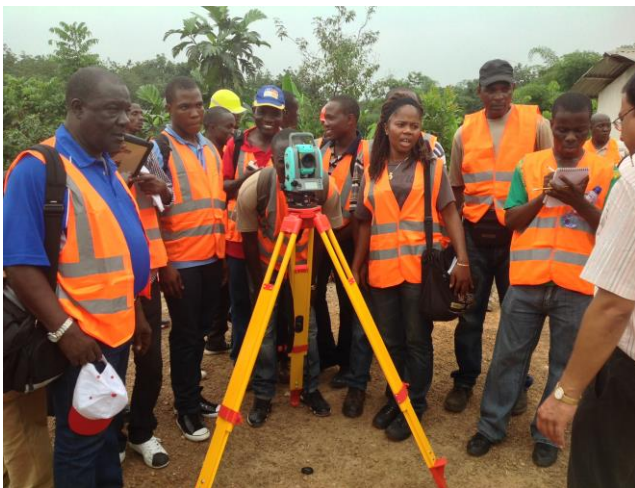


Fig. 17: Trainees learning how to use Total Station with targets in hydrological survey



Fig. 18: Trainees learning how to use Total Station with targets in hydrological survey



Fig. 19: UNIDO Project Manager, Mr. Rana Pratap Singh in discussion with Dr. Gaur and Dr. Saini On Dec. 17, 2013 at Kakata during the field demonstration



Fig. 20: Some of the trainees post for group photo at Kakata, Margibi County near the Du River during the filed exercise

#### 4.1.3 WORKSHOP CLOSING CEREMONY (DEC. 19, 2013, MAMBA POINT HOTEL)



Fig. 21: Dr. Rajeshwer Prasad Saini Making presentation on Dec. 19, 2013 before the workshop closing ceremony



Fig. 21: Dr. Rajeshwer Prasad Saini making a practical demonstration to trainees during the exercise on Dec. 19, 2013 before the workshop closing ceremony



Fig. 22: Dr. Rajeshwer Prasad Saini making a practical demonstration to trainees during the exercise on Dec. 19, 2013 before the workshop closing ceremony



Fig. 23: Dr. Rajeshwer Prasad Saini reaching out to one of the trainees to answer his question



Fig. 24: Dr. Rajeshwer Prasad Saini assisting trainees



Fig. 25: UNIDO Project Manager, Mr. Rana Pratap Singh encouraging trainees to make use of the training opportunity before the official closing ceremony



Fig. 26: UNIDO Project Manager, Mr. Rana Pratap Singh encouraging trainees to make maximum use of the training opportunity before the official closing ceremony



Fig. 27: UNIDO Project Manager, Mr. Rana Pratap Singh encouraging trainees how to manufacture simple turbines with least cost before the closing ceremony



Fig. 28: Closing ceremony photo-Dec 19, 2013: Sitting from left-right: Executive Director of RREA, Mr. Augustus Goanue, EPA Proxy, Madam Laura Williams, Facilitator, Dr. G.C.S. Gaur, Facilitator, Dr. R.P. Saini, UNIDO Project Manager/Allotment Holder, Mr. Rana Pratap Singh, LESSP/Winrock International Construction Manager, Mr. Ram Gobinda Yadav and LESSP/Winrock International Chief of Party, Mr. Michael McGovern with trainees posing for group photo



Fig. 29: Closing ceremony photograph



Fig. 30: Closing ceremony photograph



Fig. 31: Madam Laura William presents certificate to one of the trainees on behalf of Madam Anyaa Vohiri, Executive Director of EPA and GEF Focal Person In Liberia

Fig. 32: RREA Executive Director, Mr. Augustus Goanue present certicicate to one of the trainees at the end of the traing



Fig. 33: UNIDO Project Manager/Allotment Holder based in Vienna, Austria making closing remarks during the end of the 10 days intensive training exercise

Fig. 34: LESSP/Winrock Chief of Party, Mr. Michael McGovern making remars at the workshop closing exercise



Fig. 35: RREA Executive Director, Mr. Augustus Goanue making remarks during the closing exercise

Fig. 36: Dr. Rajeshwer Prasad Saini, Professor & Training Facilitator making remarks at the closing



Fig. 37: Madam Laura William, Technical Advisor making remarks on behalf of Madam Anyaa Vohiri, Executive Director of EPA and GEF Focal Person



Fig. 38: Mr. Hu-Bu Tulay, Trainees' Representative and also President of the Engineering Society of Liberia making remarks during the closing on behalf of his colleagues



Fig. 39: Typical Tea/Coffee break



Fig. 40: Typical lunch break



Fig. 41: Dr. Arun Kumar trekking through the bush along the Du River on December 8, 2013 identifying suitable location for the proposed hands on exercise of the trainees at Kakata, Margibi County scheduled for December 16 and 17



Fig. 42: Dr. Arun Kumar along the Du River on December 8, 2013 identifying suitable location for the proposed hands on exercise of the trainees at Kakata, Margibi County scheduled for December 16 and 17



Fig. 43: Dr. Arun Kumar along the Du River on December 8, 2013 identifying suitable location for the proposed hands on exercise of the trainees at Kakata, Margibi County scheduled for December 16 and 17

## 5.0 PROCUREMENT & EXPENDITURE:

For the successful implementation of the training workshop, several measures were put in place by the Project Manager/Allotment Holder with regards to expenditure as per the following:

- Procuring all required workshop materials
- Ensuring media coverage of the workshop for publication
- Hall rental and meal
- DSA for trainees, contingency budget and etc.

Below is the full financial breakdown of money expended on the workshop:

5.1 Materials Procured				
Description of items	Qty.	Unit Price	Total(USD)	Comments
A4 Papers	2 pks	23.50	47.00	
Sten pad	50 pcs	.75	37.00	
Stapler	2 pcs	5.00	10.00	
Pen	1pk	2.00	2.00	
Marker	2 pks	5.00	10.00	
Higher Lighter	2 pks	3.00	6.00	
badges	2 bxs	10.00	20.00	
ledger	2 pcs	5.00	10.00	
Scissor	2 pcs	2.00	4.00	
Scratch Tape	2 pcs	1.00	2.00	
Manila Folder	1 bx	10.00	10.00	
A4 Brown Envelop	1 pk	6.00	6.00	
Stick on pad	1 bx	9.00	9.00	
Flip chart pad	5 pcs	6.00	30.00	
White Board	1 pc	65.00	65.00	
Projector	1 pc	950	950.00	
4 Cabinet Drawers	1pc	150.00	150.00	

4 GB Memory Stick	40 pcs	15.00	600.00	Submitted request for purchasing to HQ based on Facilitators' instruction but 40 memory sticks was brought in the country by the Trainers/Facilitators with stored information which was given to trainees
Pencil	10 pks	1.00	10.00	
Eraser	2 pks	5.00	10.00	
Calculator	40 pcs	5.00	200.00	
<b>SUB TOTAL</b>			<b>2,188.00</b>	
<b>5.2 Other Services</b>				
Designing and printing of workshop banners and certificates (certificates for 42 Trainees)			310.00	
Hall reservation for workshop and meal preparation for trainees & trainers			14,620	
Bus rental for two days trip to Kakata, Margibi County			920.00	NTA refusal to complete UNDP's vendors' requirements left HQ with no alternative but to authorized UNDP to make payment of the amount in the name of the National Project Coordinator due to time constraint to make arrangement for bus rental which was implemented
Media Coverage-Liberia Broadcasting System			1,375.00	
Media Coverage-Liberia Observer Corporation			350.00	
Media Coverage-New Era Publications Ltd.			400.00	
Processing of Entry Visas for the 5 training professor from IITR, India			250.00	
Procurement of computer, printer, external hard drive, mouse and ink for project for the office use of the National Project Coordinator			1,390.00	
<b>SUB TOTAL</b>			<b>19,615.00</b>	
<b>5.3 DSA and Contingency</b>				
This amount issued in the name of the National Project Coordinator for transport allowance of the trainees, Chiefs, DSA for Sackie and Isaac travel to Kakata, and others (see below for detailed expenditure)			<b>9,840.00</b>	

<b>GRANDTOTAL</b> <b>(2,188+19,615+9,840)=</b>			<b>31,643.00</b>	Total amount submitted by HQ for workshop activities and others
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**Notes:**

- Procured 40 Memory Sticks as requested by Trainers/Facilitators for storage of hydropower resources to be given to each trainee. However, the Trainer/Facilitators brought 40 memory Sticks which already had the materials stored and given to each trainee at the end of the workshop closing ceremony

<b>Detailed Expenditure of DSA (in The Name of the National Project Coordinator, A. Brahima Sackie)</b>			
<b>Description</b>	<b>Qty.</b>	<b>Amount (USD)</b>	<b>Comments/Remarks</b>
<b>PER DIEM/TRANSPORT ALLOWANCE</b> -for 9 (Nine) Trainees out of Monrovia as per official listing submitted to HQ		4,500.00	Expended as required
<b>PER DIEM/TRANSPORT ALLOWANCE</b> -for 31 (Thirty One) Trainees from around Monrovia as per official listing submitted to HQ		3,100.00	Expended as required
<b>PER DIEM/TRANSPORT ALLOWANCE</b> -for 2 local chiefs from the Suakoko, Bong County		300.00	Expended as required
<b>DSA for 1 night Sackie &amp; Isaac</b> -Travel to Kakata for pre-site visitation		140.00	
Procurement of 50 pcs of reflective safety jackets		250.00	
Procurement of Flip Chart Stand		130.00	
Procurement of 5 gallons of gasoline for travel to Kakata		50.00	Purchased gasoline in order to take Dr. Arun Kumar to the Kakata demonstration site for inspection on December 15, 2013. Repair of the project vehicle was completed late by Toyota Garage on December 14, 2013 and by then the UNMIL fuel station had closed to take fuel for the next day
Procurement of Ink/Cartridge for general office printer		150.00	
Processing of Mr. Rana P. Singh Entry Visa at Bureau of Immigration & naturalization (BIN)		80.00	Actual fees for visa processing is 50 USD but additional 30 USD was spent to expedite processing due to short notice received from Mr. Rana Partrap Singh
Service fee for Camera man for workshop coverage-video recording and photographs		350.00	
Brushing of field demonstration site at Kakata around the Du river		150.00	



1 day vehicle rental for transport of trainees food from Monrovia to Kakata, Margibi County	150.00	
Communication expense-Scratch cards	150.00	
Purchased of additional food, water and soft drinks for trainees during the filed exercise at Kakata, December 16, 2013	250.00	
Purchased of additional water and soft drinks for trainees during the filed exercise at Kakata, December 17, 2013	90.00	
<b>TOTAL AMOUNT EXPENDED (DEDUCTED FROM THE TOTAL DSA OF 9,840.00 USD):</b>	<b>9,840.00</b>	

## **6.0 ACCOMPLISHMENTS / RESULTS:**

The 10 (Ten) day training workshop accomplished the following:

- 42 Liberians from across 13 identified institutions capacity strengthened; (As per **Project Component 1**, which lay emphasis on the development of institutional capacity at national and local levels for implementation of mini hydro power (MHP) system and local distribution grid in Liberia)
- Trainees gain hands on exposure to basic instruments and equipment used in hydrological investigations and surveys
- Trainees received certificates of training in Small Hydropower project (SHP) development
- Trainees received three volumes each of training manuals/materials in hard copies with 4 GB Memory Stick containing stored training materials
- RREA to incorporate few trainees to work along with International Consultants coming from Sri Lanka to conduct hydrological survey in rural Liberia based on the knowledge gained by the trainees as RREA is currently understaff

## **7.0 CONSTRAINTS:**

During the planning and implementation of the workshop the following below constraints were experienced:

- Delay of some of the institutions to submit the names of nominees for the workshop as requested by UNIDO
- Delay by UNDP Finance Section to release payments request as per Headquarters instruction
- Arrangement for bus rental for transportation of 40-48 participants including journalists and others to Kakata for the field exercise (**Note: Initially we made arrangement with National Transport Authority (NTA) for a 48 seated bus for the exercise at Kakata scheduled for December 16 and 17 but later declined due to their failure to complete the UNDP vendors' requirements, a situation that seriously embarrassed us and left us with no option but to quick arrangement with other transport services.**)

## **8.0 LESSON LEARNED:**

- Exposure gain of Liberia’s renewable energy potential especially the hydropower sector if properly exploited and managed
- How to make use of available renewable energy resources especially hydropower to provide clean electricity to people living in urban and rural communities without tapping on the national grid
- The huge economic benefits electricity brings to a nation and its people, especially through mini hydropower project

## **9.0 RECOMMENDATIONS:**

Considering the huge capacity gap in the renewable energy sector of the country (Liberia), especially Hydro power, the following are recommended below:

- That another training be conducted in hydropower development to scale up the human resource capacity of Liberians in hydropower sector of the country, with specific focus on mini hydropower projects
- In future, assist technical institutions (technical universities) in the country to develop a curriculum that focus specifically on **Renewable Energy** program at a degree granting level, as there is no specific attention given this sector and has created a serious vacuum in terms of manpower.

## **10. ACKNOWLEDGEMENT:**

We acknowledged the following UNIDO staff for their unflinching support/assistance during the planning, organizing and implementation of the training workshop, as well as external support received from our project partner (s) as below indicated:

1. Mrs. Jovita Culaton Viray  
Chief Technical Advisor  
Project: **‘Reintegration for Liberian Returnees through Skill Training and Job Creation Project’**  
UNIDO
  2. Mr. Stavros Papatravoros  
Chief Technical Advisor  
Project: **‘Project for Promoting Youth Employment in the Mining, Construction and Agriculture Sector’**  
UNIDO
  3. Ms. Leila Salehiravesh  
Officer –In-Charge  
Project: **(Reintegration for Liberian Returnees through Skill Training and Job Creation Project)**  
UNIDO
  4. Ms. Maryaan Sajery  
Administrative Assistant  
UNIDO
  5. Mr. Michael McGovern  
Chief of Party,  
LESSP/Winrock International
- LESSP/Winrock International provided the following instruments/equipment used in the field exercise at Kakata, Margibi County at no charge to UNIDO. They included the following:

<b>Instruments/Equipment Used in Field Exercise at Kakata, Margibi County</b>		
<b>No.</b>	<b>Description</b>	<b>Quantity</b>
1.	Total Station with Targets	1
2.	Hand-held Global Positioning System (GPS)	1
3.	Flow Meter (Salt based conductivity type)	2
4.	Propeller current meter	1