ANSOLE DAYS 2018
&
ANSOLECAM 2018

2018

Centre Polyvalent de Formation (**CPF**)

Mbouo-Bandjoun, Cameroon, 2-6 Sept 2018



Book of Programme, Abstracts, Biographies & List of Participants

ANSOLE DAYS 2018 & ANSOLECAM 2018

International Conference and Practical Training on Sustainable Energetics

Centre Polyvalent de Formation, Mbouo-Bandjoun, Cameroon

2-6 September 2018

Thanks to

The 17 Sustainable Development Goals (SDGs) to Transform our World

https://www.un.org/sustainabledevelopment/sustainable-development-goals/





About ANSOLE:

The African Network for Solar Energy (ANSOLE) promotes research, education and training in the field of renewable energies among Africans as well as non-Africans with a special focus on - and relationships with - Africa.

As outlined in its by-laws, ANSOLE supports non-profit activities in the field of development aid and cultural exchange with the aim of strengthening the dialogue between the North and African countries (north-south) and among African countries (south-south) on renewable energy.

It endorses the use of solar energy to the benefit of the social and economic development of Africa as well as environmental protection through:

- Education and training of African scientists, experts and students
- Exchange of students and visiting scientists
- Workshops, conferences and meetings in Africa
- Organising and implementing projects and programmes on renewable energy
- Promoting capacity building in the use of renewable energy in Africa for all

As a non-profit and charitable organization registered in Jena Germany (as ANSOLE e.V.), it is locally involved in educational issues related to the 17 Sustainable Development Goals (SDGs) and in arts and culture. In addition, it offers a platform of articulation of students and migrants from Africa with the aim to facilitate their integration and acceptance within the German society using the project designated AMAH (Anlaufstelle für Menschen afrikanischer Herkunkft), which is financed by the City of Jena and the Federal State of Thuringia.

Freistaat Thüringen — Beauftragte für Integration, Migration und Flüchtlinge

JENA LICHTSTADT.

Donations to:

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www.facebook.com/ansole.africa / https://www.linkedin.com/groups/13573724

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Organising Committee

International Organising Committee

Prof. Daniel Ayuk Mbi Egbe, ANSOLE Coordinator
Prof. Samir Romdhane, *ANSOLE Regional Representative in North Africa*
Mr Alexander Sipua Ngnoubamdjum, *ANSOLE Regional Representative in Europe*
Mr. Griffin Ruehl, *CEI, University of Washington, USA*
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Ms Melissa Audrey Gabrielle Oum, *University of Birmingham, Uk*
Prof. Reinhold Lang, *Johannes Kepler University Linz, Austria*
Prof. Dan Nchelatebe Nkwetta, *Northern Alberta Institute of Technology,Canada*

Local Organising Committee

-Mr Daniel Ngwanou, *Director of Centre Polyvalent de Formation (CPF), Mbouo Bandjoun*
-Prof. Cesar Kapseu, *Regional Representative in Central Africa*
-Dr. Claude Vidal Aloyem Kaze, *ANSOLE National Representative in Cameroon and main organizer ANSOLE DAYS 2018 and ANSOLECAM 2018*
-Mr Jean-Pierre Sayouba-Djiéla, *Lecturer, CPF, Mbouo- Bandjoun*
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-Ms Germaine Ashu, *Cameroon Renewable Energy Network (CAMREN)*
-Prof. Martin Kamta, *University of Ngaoundere, Cameroon*
-Ms Ariane Djomo Wandji, *CPF, Mbouo-Bandjoun, Cameroon*

Hostesses from CPF

Ruth Makoutsing, Florence Chemdu, Pascaline Mekengne, Sandrine Ayianyinyi, Fabiola Nangue, Yannick Youbi (Coach)



Centre Polyvalent de Formation (CPF), Mbouo-Bandjoun, Cameroon

Programme

Sunday 02 September 2018

Arrival and checking-in of participants in hotels in Bafoussam and CPF Mbouo-Bandjoun

Welcome dinner at CPF at 19.30pm

MONDAY 03 SEPTEMBER 2018

TIME	ACTIVITY	Participants
7:00-8:00 am	Breakfast	All participants residing at CPF
8:00-9:00 am	Registration	All participants
9:00-11:00 am	**OPENING CEREMONY** ***Moderators:*** **Melissa Oum & Jean-Pierre Sayouba**	
	Welcome of President ANSOLE DAYS 2018	Mr. Daniel A. Ngwanou
	Welcome address on behalf of the CPF-EBZ – partnership	Mr. Alexander Sipua
	Welcome address Central Africa Representative – ANSOLE	Prof. César Kapseu
	Welcome address of the mayor of Pete-Bandjoun	Mme Hélène Fokoua
	Welcome of ANSOLE Coordinator	Prof. Daniel Ayuk Mbi Egbe
	Welcome address of the General President of EEC	Rev. Prof. J. S. Hendje Toya
	Welcome address of the SDO of Pete-Bandjoun	Mme Antoinette Nzongo
	Conference photograph	All
	Cocktail	All
PRACTICAL TRAINING SESSION ***ANALYSIS OF PROJECTS IN RENEWABLE IN CLEAN ENERGY WITH RETSCREEN EXPERT***		
Chair: Ms Breena Sperry		
11:00 am	Introduction and general presentation of RETScreen Expert	Assoc. Prof. Dr. Dan Nchelatebe Nkwetta, *RETSceen Expert, Northern Alberta Institute of Technology (NAIT), Canada*
13:15 pm	Lunch break	All Participants
14:15 pm	Dimensioning and wiring of solar photovoltaic systems	*Prof. Martin Kamta, University of Ngaoundere, Cameroon*
15:30 pm	Case study on the dimensioning	*Mr. Mbakouop and Mr. Ayi*
Chair: Prof. Germaine Djuidje Aloyem		
16:30 pm	**Plenary**: General energy situation and energy	Prof. Daniel Ayuk Mbi EGBE, *Institute of Polymeric Materials*

	research situatíon in Africa	*and Testing, Johannes Kepler University Linz, Austria*
17:00 pm	Phenol and Benzaldehyde Hydrogenation on Metallic Catalysts: Model Compounds for Biomass Conversion	Mr. Griffin Ruehl*, University of Washington*
17:20 pm	Experimental approach for evaluating the reliability of usual MPPT algorithms for stand-alone photovoltaic systems in tropical area	Prof. Martin Kamta*, University of Ngaoundere*
17:40 pm	Biogas: explanation and solutions to the slow popularization in Cameroonian households	Ms. Rhode Ghislaine Nguewo Ngassam*, Université catholique d'Afrique Centrale*
18:00 pm	Return to hotels	*All*
19:30 pm	Dinner	*All participant*

TUESDAY, 04 SEPTEMBER 2016

PRACTICAL TRAINING SESSION ***ANALYSIS OF PROJECTS IN RENEWABLE IN CLEAN ENERGY WITH RETSCREEN EXPERT***		
7:00-8:00 am	Breakfast	All participants residing at CPF
8 :00	Analysis of projects in Renewable Energy with RETScreen Expert: Case study 1	Assoc. Prof. Dr. Dan Nchelatebe NKWETTA, *RETSceen Expert, Northern Alberta Institute of Technology (NAIT), Canada*
11:00 am	Practical (Workshop)	Mr. Mbakoup and Mr. Ayi*, CPF, Bandjoun*
13:15 pm	Lunch break	*All participants*
TECHNICAL TRAINING SESSION **Chair: Prof. Daniel A. M. Egbe**		
14:15 pm	**Plenary:** Nanostructured organic solar cells	Prof**.** Samir Romdhane*, Invited lecturer, University of Carthago, Tunisia*
14:45 pm	Brief presentations of projects in Renewable Energy (moderated by Prof. Germaine Aloyem)	All women Researchers
15:05 pm	Importance of vocational training in Renewable Energies in Africa: Case study partnership CPF(Cameroon)- EBZ (Germany)	Mr. Alexander Sipua*, Project coordinator*
16:00 pm	**Poster Presentations**	*Students: DIPET I, DIPET II, MASTER, NGOs*
18:00 pm	Return to hotels	All participants

19:30 pm	Dinner	All participants

WEDNESDAY 05 SEPTEMBER 2018

PRACTICAL TRAIING SESSION ***ANALYSIS OF PROJECTS IN RENEWABLE IN CLEAN ENERGY WITH RETSCREEN EXPERT***		
7:00-8:00 am	Breakfast	Particpants residing at CPF
8:00 am	Analysis of projects in Renewable Energy with RETScreen Expert: Case Study 2	Assoc. Prof. Dr. Dan Nchelatebe Nkwetta, *RETSceen Expert, Northern Alberta Institute of Technology (NAIT), Canada*
10:30 am	Practical training on the field (Workshop)	Mr. Mbakoup, Mr. Ayi, *CPF Bandjoun, Cameroon*
13:00 pm	Lunch	
TECHNICAL SESSION		
Chair:Prof. Samir Romdhane		
14:00 pm	**Plenary**: Energy for all: a mobile generator of solar energy "Solargene group" on wheels for the resolution of the energy deficit	Prof. César Kapseu, *University of Ngaoundere, Cameroon*
14:30 pm	Modelling microstructural and chemical degradation of ferritic stainless steels for SOFC Interconnects	Ms Melissa Oum, *University of Birmimgham, United Kingdom*
14:50 pm	Sustainable hybrid energy system design: Potential optimal solution to meeting Cameroon future energy supply	Assoc. Prof. Dr. Dan Nchelatebe Nkwetta, *Northern Alberta Institute of Technology (NAIT), Canada*
15:20 pm	Renewable Energy in developing countries: From research to exploitation	Mr. Djoussi Sosthene, *ENSTP Yaounde, Cameroon*
15:20 pm	Visit of the Palace in Bafoussam	*All participants*
18:30 pm	Return to hotels	*All participants*
20:00-23:00 pm	Conference Dinner + Awards+ Gifts	*All participants*

THURSDAY 06 SEPTEMBER 2018

PRACTICAL TRAINING SESSION ***ANALYSIS OF PROJECTS IN RENEWABLE IN CLEAN ENERGY WITH RETSCREEN EXPERT***		
7:00-8:00 am	Breakfast	Participants residing at CPF
8:00 am	Presentation RETScreen: Case Study 3 in Energy efficiency	Assoc. Prof. Dr. Dan Nchelatebe Nkwetta, *RETSceen Expert, Northern Alberta Institute of Technology (NAIT), Canada*

10:00 am	Practical training on the field (workshop)	Mr. Mbakoup, Mr. Ayi, *CPF Bandjoun*
13:00 pm	Lunch	
TECHNICAL SESSION		
Chair: Prof. Cesar Kapseu		
14:00 pm	**Plenary :** Design, feasibility, performance assessment and optimization of the technical and financial viability of potential renewable energy and energy efficiency projects	Assoc. Prof. Dr. Dan Nchelatebe Nkwetta, *Northern Alberta Institute of Technology (NAIT), Canada*
14:45 pm	How ligand selection for capped-nanocrystals impacts film formation during annealing	Ms Breena Sperry, *Material Science and Engineering, University of Washington, Seattle, Washington*
15:05 pm	*Business incubator: driving the development of renewable energies*	Prof. César Kapseu, *University of Ngaoundere, Cameroon*
15:25 pm	Power control of a Brushless Doubly Fed Induction Generator based on Model Predictive Control	Mr. Dountio Tchioffo, *University of Ngaoundere*
15:40 pm	Effect of molecular-weight distributions on photovoltaic performance of an anthracene-based arylene-ethylene/arylene-vinylene polymer	Daniel Ayuk Mbi Egbe, *Institute of Polymeric Materials and Testing, Johannes Kepler University Linz, Austria*
16:10 pm	Application of Artificial Neural Networks for predicting monthly wind energy potential in Bamenda, Cameroon	Mr. Fogno Fotso Hervice, *University of Yaounde I, Cameroon*
16:30 pm	Awards (**by Prof. Djuidje k. Germaine, 2018 OWSD-Elsevier Foundation Awards,** and **EBZ)**	*All participants*
17:00 pm	Attestations of Participation and Closing Ceremony	*All participants*
19.30 pm	Dinner	Participants residing at CPF

Abstracts and Biographies of Lecturers

General energy situation and energy research situation in Africa

Daniel A. M. Egbe
International Coordinator of ANSOLE, Institute of Polymeric Materials and Testing, Johannes Kepler University Linz, Altenbergerstr. 69, A-4040 Linz, Austria
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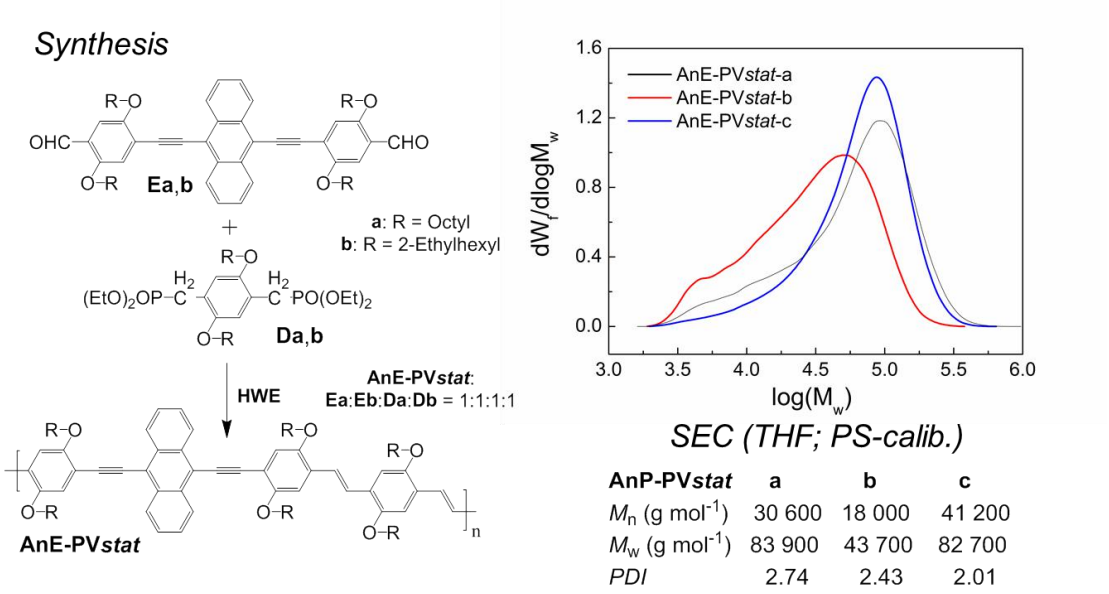
Abstract
Despite huge energy potentials in Africa, the energy production costs are high and the consumption is low as compared to other World regions. Less than 40 % of Sub-Saharan Africans have access to electrical energy. Lack of electrical energy hampers the rapid development of the continent. The present yearly economic growth of~ 5-6% will be higher if sufficient electrical energy and infrastructure are present. However, Africa cannot embark on the same path as Europe, USA and China for its development by relying only or strongly on non environment-friendly energy sources. This is imperative in order to achieve the Sustainable Development Goals (SDGs) (2016-2030) and the resolution of COP 21 of maintaining the world temperature rise not above 1.5 °C. The appropriate use of the abundant solar energy and other renewable energy sources can be regarded as a solution to the African energy problem. This requires highly qualified human resources at all levels. The presence of local qualified skills lead to acceptance by the population of the renewable energy technologies and reduction of energy end-price.
This lecture will present the energy situation of Africa followed by an overview of capacity building activities (training, education and research) going on, especially actions taken to address the low experimental research budget in most African institutions of higher learning.

The Effect of Molecular-Weight Distributions on Photovoltaic Performance of an Anthracene-Based Arylene-Ethynylene/Arylene-Vinylene Polymer

Christoph Ulbricht,[a,] Francesca Tinti,[b] Vera Cimrova,[d] Nadia Camaioni[c] and **Daniel A. M. Egbe***[,a,]

[b]*Institute of Polymeric Materials and Testing, Johannes Kepler University, Altenbergerstr. 69, 4040 Linz, Austria.* daniel_ayuk_mbi.egbe@jku.at
[b]*Instituto per la Sintesi Organica e la Fotoreattività, Consiglio Nazionale delle Ricerche, via P. Gobetti 101, I-40129 Bologna, Italy.*
[c]*Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, Heyrovsky Sq. 2, 16206 Prague 6, Czech Republic*

Abstract
Conjugated polymers can be pepared with various molecular mass distributions, which can have a distinct impact at the solid state properties and the performance in organic electronic applications such as bulk-heterojunction solar cells. Herein we present the investigation of three poly(p-phenylene-ethynylene)-*alt*-poly(p-phenylene-vinylene) batches, which were formed from identical building blocks but exhibit variations regarding their molar mass characteristics (Scheme 1).[1]



*Scheme 1: Synthesis, molecular-weight distributions and polymer characteristics of the polymer batches **AnE-PVstat-a,b,c**.*

Analysis in solid state, e.g. XRD measurements, indicate, that the presence of small molecular mass species lead to a better ordering in the **AnE-PV*stat*** films, which seems to facilitate a better performance in bulk-heterojunction solar cell assemblies (Figure 1).

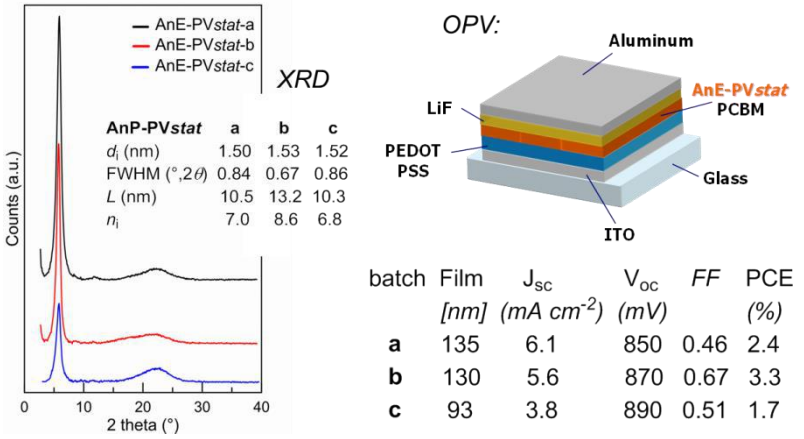


*Figure 1: XRD results of annealed films (*left*) and solar cell characteristics (*right*) of the polymer batches **AnE-PVstat-a,b,c**.*

Acknowledgement: C. Ulbricht and D. A. M. Egbe acknowledge the financial support by FWF through project No: I 1703-N20.

Reference:

[1] Tinti, F.; Fedlu, K. S.; Gazzano, M.; Righi, S.; Ulbricht, C.; Usluer, Ö.; Pokorna, V.; Cimrova, V.; Yohannes, T.; Egbe, D. A. M; Camaioni, N.; *RSC Adv.* **2013**, *3*, 6972.



Daniel Ayuk Mbi EGBE received his BSc in Physics and Chemistry in 1991 from the then University of Yaoundé (now University of Yaoundé 1), Cameroon. In 1992, he moved to Germany where he obtained a MSc and PhD in Chemistry in 1995 and 1999, respectively, from the Friedrich-Schiller University of Jena. He

completed his habilitation in Organic Chemistry at the same institution in 2006.

From 2006 to 2008, he spent postdoctoral stays at the Max Planck Institute for Polymer Research in Mainz, Germany, the Technical University of Eindhoven in Holland, and at the Technical University of Chemnitz, Germany. Since 2009, he researches and lectures at the Johannes Kepler University Linz, where he is presently member of the Institute of Polymeric Materials and Testing (IPMT). Egbe's main research interest is the design of semiconducting materials for optoelectronic applications.

He is a member of Organic Electronics Association (OE-A), and a board member of the World University Service (WUS) in Germany. He is the initiator of the German-Cameroonian Coordination Office, initiator and International Coordinator of the African Network for Solar Energy (ANSOLE), initiator and chairperson of ANSOLE e.V., an institution legally representing ANSOLE, and initiator of the Cameroon Renewable Energy Network (CAMREN). He also initiated and coordinates the research platform BALEWARE (Bridging Africa, Latin America and Europe on Water and Renewable Energies Applications),In 2015 he was an independent evaluator for the World Bank Group in higher education issues and was appointed member of the scientific council of the newly created "Ecole Supérieure des Métiers des Energies Renouvelables (ESMER), in Benin. He was part of the team engaged in developing research programs at the Pan African University Institute of Water and Energy Sciences (including Climate Change) (PAUWES) in Tlemcen, Algeria. In 2016 he was appointed the first Distinguished Brian O´Connell Visiting Fellow of the University of the Western Cape, South Africa. He is the director of the VolkswagenStiftung-sponsored Summer Schools on sustainable energetics and on water. He is presently PhD supervisor and visiting lecturer at the African Centre of Excellence in Energy for Sustainable Development (ACE-ESD) of the University of Rwanda in Kigali.

He has published more than 120 peer-reviewed articles. He speaks 5 languages and is father of 4 children. Contact: Daniel.egbe@ansole.org, daniel_ayuk_mbi.egbe@jku.at

Business incubator: driving the development of renewable energies

KAPSEU Cesar[1], NSO Jong Emmanuel[2], Atoukam Tchefenjem Liliane Dalis[3]

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Abstract
A business incubator or a startup accelerator is a support structure for business creation projects. The incubator can provide support in terms of accommodation, advice and financing during the early stages of the company's life. According to the financial lexicon, an incubator is an investment fund specialized in accompanying star-ups. The incubator can provide a local, services paid by a few percent of the capital. Financial support: these are grants, repayable advances, sureties and guarantees, access to risk capital. Advice and training: Awareness and training in business creation, the different types of specialized or general advice given to entrepreneurs have multiplied. Logistical support: The aim was to provide young companies with accommodation in adapted and flexible premises for a temporary period and administrative, time-sharing se ncubators belong to the following categories: job creation, the development of economic activity through business creation, profit, the transfer and exploitation of technologies, the revitalization of areas in difficulty or reconversion, the

diversification of the fabric the promotion of certain sectors of activity such as renewable energies, the promotion of certain categories of populations, for example young people. Revenues can come from a wide range of means: rents and business services in incubation, external services, grants in cash or in kind, sponsorship, deferred income (royalties and shares). The determination to support renewable energy incubators is a priority given the issues at stake.



KAPSEU César is the focal point of the business incubator at the University of Ngaoundere located at National Advanced School of Agro-industrial Sciences (ENSAI). He is Member of the Steering Committee of the International Drying Symposium Series (IDS') and Regional representative of the African Network for Solar Energy (ANSOLE)in Central Africa. He is the Ambassador of Science (TWAS) since 2013 for Central Africa; he represents the African Committee for the Future of the Earth (AFEC) in Central Africa. He is also an Expert at the National Committee for Technology Development and at the Research Support Program under the Deleveraging and Development Contract(C2D). He is the author of 253 scientific publications including 10 books. His latest books deal with renewable energies in sub-Saharan Africa in 2012, Cane sugar cane in sub-Saharan Africa: processes and professions in 2014 and Biodiversity and global changes: valorisation of effluents from industry, agro-pastoral residues and forestry in 2016.
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Design, feasibility, performance assessment and optimization of the technical and financial viability of potential renewable energy and energy efficiency projects

Dan Nchelatebe Nkwetta*, [a], Jim Sandercocka
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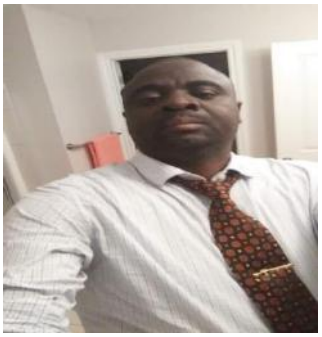
Abstract
Until recently, renewable energy technologies (RETs) have been confronted with a huge upfront cost and technologies in development but massive and global deployment of renewable energy systems has led to significant cost reductions and performance improvements and the hope is to see increasing uptake of RETs by African countries. Cameroon a Central African country is heavily reliant on hydropower, which contributes an estimated 60% to the country's total installed 1,400MW capacity in 2015. In addition, there is constants power failure due to the non-reliability of the electric grid and load shedding to meet increasing demand and or to relieve stress on a primary energy source when demand for electricity is greater than the primary power source can supply. However, climate change poses additional huge risk (large reservoirs and dams drying up) and to meet the increasing demand, Cameroon is being forced to seek alternative power sources. In January 2014, Cameroon welcomed its first 72MW solar photovoltaic plant as well as the construction of a 500MW solar photovoltaic park in Q3 of 2015 in the northern region of Cameroon. It is common practice that energy efficiency + energy conservation lead to environmental sustainability. "Energy security starts with energy efficiency and the most sustainable energy option or system is energy conservation". While it is common practice that energy efficiency + energy conservation lead to environmental sustainability, the building envelope also plays a key role in energy usage, energy conservation and thermal comfort for the building occupants. The rate of infiltration/leakage rate detect the rate of energy usage and cost of using energy. Having a tide and well-constructed building envelope is a key factor and helps reduce/reconcile buildings gas and electricity consumption. RETScreen Expert is the most

current version of the RETScreen software and was released to the public on September 19, 2016. The software allows for the comprehensive identification, assessment and optimization of the technical and financial viability of potential renewable energy and energy efficiency projects; as well as the measurement and verification of the actual performance of facilities and the identification of energy savings/production opportunities [1]. The author who is an expert and certified RETScreen Expert (CRE) will demonstrate how the software can be use in the design, feasibility, performance assessment and optimization of the technical and financial viability of potential renewable energy and energy efficiency projects related to photovoltaic, solar thermal, building envelope and the replacement of non/less-efficient electrical equipment with more efficient and cost effective lamps like LEDs and the installation of smart power bars with automatic shut off function for TV screens, to take care of phantom power in large scale hotels. This approach will further reduce electricity usage and help diversified the sources of energy for a country like Cameroon, which is often subjected to constant power failure and load shedding to either relieve the stress on a primary energy source when demand for electricity is greater than the primary power source can supply or to meet power supply during the critical seasons.

Keywords- Sustainable energy systems, RETSCreen Expert, design, feasibility, performance assessment, optimization, renewable energy and energy efficiency

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[1] IEA (International Energy Agency), 2014a. Africa Energy Outlook, Paris: OECD/IEA.
[2] IEA Solar Heating and Cooling Programme, 2015. Solar Heat Worldwide – Markets and Contribution to the Energy Supply 2013, Gleisdorf: AEE – Institute for Susatainble Technologies.
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[9] D.N. Nkwetta and J. Sandercock. A State-of-the-art Review of Solar Air-conditioning Systems, Renewable and Sustainable Energy Review, 60 (2016), pp. 1351-1366.



Professor **Dan N Nkwetta** is a Canadian of Cameroonian origin experience and recognized international leader in renewable energy technologies and system design, system evaluation and optimization. He is an expert in different aspects of energy performance training including RETScreen Expert, energy auditing/management, performance measurement & verification and Homer-Pro for the design of integrated/hybridized energy systems. National and international reviewer of many energy journals including Renewable and sustainable energy review, Applied energy, Solar energy, Energy and buildings etc and funds/grant applications/proposals. Over 35 publications (in high-energy impact journeys)

related to solar thermal energy systems, energy storage, concentrated augmented solar absorption cooling systems, electrical grids, grid disturbances and power quality. He received a Post-doctoral in engineering from Concordia University, Montreal, Canada in 2012, a PhD from the University of Ulster, Northern Ireland in 2010 and Pre-doctoral engineering degree from KULeuven, Belgium in 2007. He is a certify energy manager (CEM), professional/chartered energy engineer (PEng, CE.Eng) and certified RETScreen expert (CRE). Worked as a Researcher & application engineer for the Sustainable Building Envelope Centre, Tata Steel, UK and the Low Carbon Research Institute (LCRI), Cardiff University. Was a part time Professor at the Centre for Engineering in Society, Concordia University, Montreal Canada and a core faculty and researcher of energy system technology, NBCC, Centre of Excellence for Energy & Construction. Presently a core faculty member and researcher of alternative energy technologies at NAIT"s school of applied sciences and technology and consultant with NRCAN (RETScreen Expert Division) and Sustainable Development Technology Canada (SDTC). Email: dann@nait.ca

Phenol and benzaldehyde hydrogenation on metallic catalysts: model compounds for biomass conversion

Griffin Ruehl[1,2], Nirala Singh[1,2,3], Udishnu Sanyal[2], Oliver Gutierrez Tinoco[2], Don Camaioni[2], Johannes Lercher[2], Charles T. Campbell[1]

[1] University of Washington (Department of Chemistry, Seattle, WA, USA)

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Abstract

Converting biomass into fuels provides a pathway for carbon-neutral chemical production and a means of energy storage for intermittent renewable energy technologies. Thermal (TCH) and electrocatalytic (ECH) hydrogenation are two routes to saturate organic intermediates and increase the energy density of the final products, a crucial step in converting biomass to fuels. Obstructing this process is the complexity of bio-oil; its wide variety of organic molecules complicates catalyst and reactor design. Phenol and benzaldehyde are representative molecules for several of the organics in ligno-cellulosic biomass, and their activity on nanoparticle Pt and Pd catalysts supported on carbon can provide insight into the mechanisms, energetics, and kinetics of biomass hydrogenation. Benzaldehyde shows lower activation energies and higher rates on Pd than Pt, with extremely high activity for ECH on Pd. Pd also has a significantly higher Faradaic efficiency for benzaldehyde ECH (99%) than Pt (~50%). In contrast, phenol demonstrates higher activation energies for both routes, with lower ECH and equivalent TCH rates to benzaldehyde on Pt, while being extremely inactive on Pd. Here we show using cyclic voltammetry, X-ray Absorption Near Edge Spectroscopy, and reaction order analysis that Pd has a higher coverage of benzaldehyde and lower steady state coverage of hydrogen than Pt. As both routes proceed through a surface hydrogenation mechanism, the difference in coverages explains the lower Faradaic efficiency of benzaldehyde ECH on Pt. We also show that phenol poisons Pd at higher concentrations (>200 mM), even inhibiting benzaldehyde rates, which explains why Pd is much less active for phenol than benzaldehyde hydrogenation. The higher equivalent hydrogen chemical potential during ECH explains the higher hydrogenation activity for ECH than TCH. Better understanding of the competitive adsorption between hydrogen and organic species related to differing binding energies on varying materials can provide insight into catalyst design for biomass hydrogenation.

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program at Pacific Northwest National Laboratory. This research was conducted at the University of Washington, Pacific Northwest National Laboratory, and Argonne National Laboratory.



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Biogas: explanation and solutions to the slow popularization in Cameroonian households

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Abstract

The increase in the pollution rate and the scarcity of standard energy sources are increasingly pushing states to question renewable energies, which, in addition to being inexhaustible sources, are solutions that respect the environment. In Cameroon, the quantity of domestic waste and the high level of livestock farming raise the question of a solution that would make it possible to take advantage of it. This thinking has led to the production of biogas, which is a useful source not only for the supply of domestic gas but also for the supply of electricity. This article examines the inventory of the integration of this new technology in Cameroon and makes a comparison with what is done in other places, before proposing areas and perspectives for improvement so that the popularization of this biotechnology is more effective and more efficient in our environment. Starting from the biogas production mechanism in Cameroon, we show that the inaccessibility and non-awareness of households regarding this technology is one of the main causes of the slow evolution in the complete integration of biogas within households.



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Application of Artificial Neural Networks for predicting montly wind energy potential in Bamenda, Cameroon

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Abstract
Due to its socio-economic and environmental advantages, the use of wind energy as a renewable energy source for the power generation is growing quickly in all parts of the world. The output power of the wind turbine varies significantly with wind speed. Indeed, wind power planning, assessment, management and installation in a location required the wind speed prediction of this location. This work presents the long-term wind speed prediction using Artificial Neural Networks (ANNs) in the North-West region of Cameroon. The Feed Forward Neural Network (FFNN) architecture is used to develop the models of ANN by using the Levemberg-Marquardz back-propagation algorithm. The meteorological data used as variables of prediction tool is provided by the NASA for the period from 1999 to 2003. Spearman rank correlation method is applied to select the appropriate variables used as input of ANN to get predicted wind speed in the output. A new model of ANN based for wind speed prediction was proposed. The results of monthly wind speed achieved from ANNs models are presented comparing it with the measured values which prove that the proposed model works very well and has better accuracy.

Keywords: Artificial Neural Networks, wind speeds prediction, spearman rank correlation, back-propagation algorithm, wind potential

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Sustainable hybrid energy system design: Potential optimal solution to meeting Cameroon future energy supply

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Abstract
Energy supply worldwide until recently has been mostly provided using conventional energy sources including hydro, coal, nuclear and thermal. These energy sources have resulted in climate change with huge greenhouse gas emission and related energy crises. While the develop world who are among the huge users of energy often have reliable electric grids to provide electricity access to most of their population, developing countries still face huge challenges in providing electricity to millions of user. These millions of users often live far off the electric grid (rural areas) which seems not very cost effective extending the national grid to these rural areas as per respective governments. Africa's total energy supply which has been more or less constant for the last 30 years is provided mostly from mix conventional resources including biomass (50%), oil (22%), coal and natural gas (14% each) and hydro (1%) [1, IEA, 2015]. However, the total primary energy supply has seen an increasing annual rate of about 3%, seeming to be the highest among all other continents. The African continent as a whole is endowed with large renewable energy potential, varying in type across diverse geographic locations. These resources, and the settings in which they exist, can point to country or regional specific renewable energy solutions to fit each nation's strengths and needs. In Sub-Saharan and the rest of the world, reliable access to electric power must be consider a basic precondition to improve people's lives as it further promote education, health care and economic growth via the creation of sustainable and clean energy jobs.
Until recently, renewable energy technologies (RETs) have been confronted with a huge upfront cost and technologies in development but massive and global deployment of renewable energy systems has led to significant cost reductions and performance improvements and the hope is to see increasing uptake of RETs by African countries. Cameroon a Central African country is heavily reliant on hydropower, which contributes an estimated 60% to the country's total installed 1,400MW capacity in 2015. In addition, there is constants power failure due to the non-reliability of the electric grid and load shedding to meet increasing demand. However, climate change poses additional huge risk (large reservoirs and dams drying up) and to meet the increasing demand, Cameroon is being forced to seek alternative power sources. In January 2014, Cameroon welcomed its first 72MW solar photovoltaic plant as well as the construction of a 500MW solar photovoltaic park in Q3 of 2015 in the northern region of Cameroon. This paper proposes the need for a sustainable hybrid energy system design and the development of an effective design, simulation and analysis approach of stand-alone hybrid renewable energy systems for mostly off-grid areas and grid connected (solar cooling) in Cameroon as an potential optimal solution to meeting Cameroon future energy supply. The solution propose involves the importance of using optimized hybrid renewable energy systems to obtain reliable autonomous systems for both electricity and air conditioning needs.

Power control of a brushless doubly fed induction generator based on model predictive control

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Abstract
The Brushless Doubly Fed Induction Machine (BDFIM) appears to be relevant in the class of brushless machines especially for wind power generation. In this paper, a model power predictive control of a Brushless Doubly Fed Induction Generator (BDFIG) is presented. A suitable model of the machine is given to lighten as much as possible the power winding apparent power derivative. Through discretization, prediction of the apparent power is achieved and a cost function on which lays the control scheme is defined in terms of active and reactive powers. Digital simulations are carried out on Matlab-Simulink to show the effectiveness of the control scheme.



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Modelling microstructural and chemical degradation of ferritic stainless steels for sofc interconnects

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Abstract
Ferritic (FeCrX) alloys forming a protective chromium oxide layer (Cr_2O_3) are the preferred materials for the interconnect component in solid oxide fuel cells (SOFC). Due to their oxidation rate in moist air, these alloys undergo degradation causing an increase in interconnect electrical contact resistance and formation of (poisonous) volatile chromium species. Developing coating agents and techniques that protect these alloys and lower their degradation rates is the current approach to extending SOFC lifetime. In this paper we examine the oxidation behaviour of an uncoated ferritic stainless steel interconnect for a supposed SOFC system operating at 850^{o}C. A precursor numerical model with respect to the oxidation and evaporation kinetics of the steel has been developed. The model is able to predict the weight gain of the samples upon oxidation, the oxide film thickness, the volatilisation of chromium, and the useable lifetime of interconnects based on chromium depletion calculations.

Mélissa Oum, Doctoral Researcher



Mélissa Oum is a doctoral researcher at the Centre for Hydrogen and Fuel Cells Research at the University of Birmingham. Her current research is the investigation of degradation mechanisms of steels components used within intermediate temperature solid oxide fuel cells. Mélissa graduated from the University of Leeds in July 2014 with a master's degree inChemical Engineering. Following her degree, she

spent several months working as a sourcing engineer for Schlumberger. Mélissa's motivation for sustainable development and the widespread deployment of renewable energy technology comes from a desire to see increasing world's energy demands met without environment attrition. Email address: mxo469@bham.ac.uk

Experimental approach for evaluating the reliability of usual MPPT algorithms for stand alone photovoltaic systems in tropical area

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Abstract
It is well known that the crystalline silicon photovoltaic modules are more sensitive to direct radiation than diffuse radiation. Therefore, it is widely used as power supply sources in the tropical areas where sunny days are preponderant over a year. However, for these weather conditions, the irradiance changes abruptly and the question of the performance of the MPPT algorithms is worrying. In this paper, a near to real model of crystalline silicon photovoltaic module has been simulated using the intrinsic photovoltaic parameters (i.e.: Rs, Is,), extracted first of all by fitting the I(V) characteristic to experimental points. So, the reliability of usual MPPT algorithms has been evaluated in the near to real weather conditions. The simulation results allowed to classifying the usual MPPT algorithms by their reliability, respectively.



Prof. Martin Kamta obtained the Postgraduate Doctorate and the Doctorate in physics of semiconducting materials in 1989 and 1998 respectively. These thèses was carried out from the Louis Pasteur University of Strasbourg, France. He is currently an Associate Professor at the University of Ngaoundere, Cameroon. His current research interests are physics of solar cells and the photovoltaic systems. He is author of several scientific papers related to solar cells and photovoltaic systems. He teaches courses on electronics, sensors, solar energy and photovoltaic systems. He is the Head of the thematic section of "Solar Energy" of the Cameroon Physical Society located in the University of Yaounde 1, Cameroon. He is also the focal point of ANSOLE at the University of Ngaoundere, Cameroon. He designed several photovoltaic installations and rehabilitated several small and medium enterprises in Cameroon.

Renewable energy in developing countries: from research to exploitation

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Abstract

In an international context of fight against climate changes, research for green energy is one of the major challenges facing developing countries. Research is carried out, often supported by international programs to develop new techniques and innovative technologies to diversify renewable energy (RE) forms and improve the performance of existing ones. Since the ultimate objective is to meet people's energy needs in an environmentally sound manner, considerations other than technological must be taken into account, particularly social ones. However, despite all that has been done so far by scientific research, there is still a mismatch between research/innovation and the population's access/exploitation on RE. Our work consisted in identifying the different RE access equipment available, according to the energy needs of the different social strata, analyzing them on the basis of the available data, highlighting some elements that hinder the access and the usage of RE and proposing solutions to overcome the impasse. This data should thus be useful for decision-making by users, procurers, public authorities and researchers, in order to develop a new paradigm of research and development, with the goal of strengthening the access and the usage of RE in the future.

Keywords: Renewable Energy, Social Aspects, Access, Exploitation

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Energy proportion estimation of a hybrid pv-biomass system: application in Batoufam village.

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Abstract

Growing concern the environment after the Kyoto Protocol has encouraged the exploitation of clean and inexhaustible renewable resources. However, for hybrid systems, it is always none that their installation requires a design study of the organs representing the system for an ideal operation. Thus, the main objective of this work is to set up hybrid PV-Biomass (biogas) system models equivalent to the ideal 40Wp BP Solar 340 photovoltaic module, for an estimation of the energy proportions of each subsystem in Batoufam village. The maximum power determination delivered by module (P_{mi}) was done using the indirect method by M. Belhadj et al.(2010), which are Borowy and Salameh model (P_{m1}), Benchmark model (P_{m2}), Jones model and Underwood (P_{m3}), input / output power model (P_{m4}), Cristofri peak power model (P_{m5}) . By using the PVgis-Africa online software to have météorological data of batoufam and the Microsoft Excel software to set up the empirical mathématical equations, the results obtain shown that, the energy proportions depend greatly on the model of hybrid system (P_{SHi}) studied. So the P_{SH3} model is unsuitable for Batoufam because it gives rise to negative photovoltaic powers in low sunlight Karatepe et al. (2006). The P_{SH1} model gives

rise to more energy proportion in photovoltaics with 94.3% against 5.7% for that of biomass (biogas) while the models P_{SH2}, P_{SH4} and P_{SH5} allocate the least energy proportion to the photovoltaic subsystem with respectively 43.4%, 33.6%, 29% against 56.6%, 66.4%, 71% for the Biomass Subsystem (Biogas).

Keywords: Hybrid system; Energy proportion; Indirect method; Biomass, photovoltaic

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Energy for all: a mobile generator of solar energy "Solargene group" on wheels for the resolution of the energy deficit

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Abstract
The energy deficit causes Cameroon to lose half a point of growth every year, according to the estimates of the Ministry of Economy, Planning and Development of the territory. Similarly, a study places the energy deficit at the top of the list of factors that limit the optimum development of companies. This deficit in the production of electricity in Cameroon reaches peaks of 100 MW daily, especially at the beginning of each year, which coincides with the dry season during which the water level drops considerably in the dams. In order to reduce this deficit, several solutions are envisaged; the return to service of thermal power stations, the substantial reduction in evening consumption of the largest consumers, period when household demand explodes and finally the exploitation of renewable energies such as solar energy. Our team has developed a mobile generator of solar energy called "Solargene group" on wheels to help solve the energy deficit. It is a complex consisting of a platform on wheel, either motorized or in tow and a kid - photovoltaic plates, regulator, battery, converter, circuit breaker, anti-return diode and wiring. The investment cost has been calculated at 4,000,000 FCFA depreciable in 7 years. This is a 'solution to meet the energy demand a la carte. The kit can be carried as a trailer behind a car or by a tri-cycle to satisfy all requests and to enter the most isolated corners. As soon as the light cut occurs, the call calls our green number and the mobilization is triggered either over the sun if it is the day or with the batteries if it is night.

Keywords: solar energy, generator, kid, door to door sales, energy availability, power outage

How ligand selection for capped-nanocrystals impacts film formation during annealing

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There has been an increase in demand for sustainable substitutions for fossil fuels [1]. In particular, solar photovoltaics (PVs) have begun to compete with traditional energy sources

as grid-parity is reached [2]. This includes thin-film chalcogenide solar cells which have also gained attention due high efficiencies beyond 20% [2]. One chalcogenide material, $Cu_2ZnSn(S,Se)_4$ (CZTSSe), is of interest due its earth-abundant and low-cost components, ideal optoelectronic properties, tunable bandgap between 0.9-1.5 eV, and capability to be solution processed [1].

In our work [3], we investigated the solution processing of CZTS metal-chalcogenide nanocrystals (NCs) through the use of coordinating ligand chemistries. Upon annealing the NCs in a selenium rich environment to form CZTSSe, NCs capped with ligands comprised of only single bonds produce a carbon rich film, whereas, ligands that have a carbon-carbon double bond (C=C) produces a distinct carbon layer in addition to a carbon-free CZTSSe film. Here, we observe how the bonding and structure of the ligand can alter the growth of the carbon film and affect device performance. Two aliphatic ligands, dodeclamine (DDA) and oleylamine (OLA), were previously studied to determine their effect on CZTSSe devices [3]. Relative to DDA, OLA features more carbon atoms and a double bond, resulting in films with a defined carbon layer, larger CZTSSe grains, and higher device performance. We aim to continue investigating how the molecular weight and presence of double bonds affect these parameters using compounds such as linoleylamine (LOA) which has the same number of carbon atoms as OLA, and has two sets of C=C bonds.

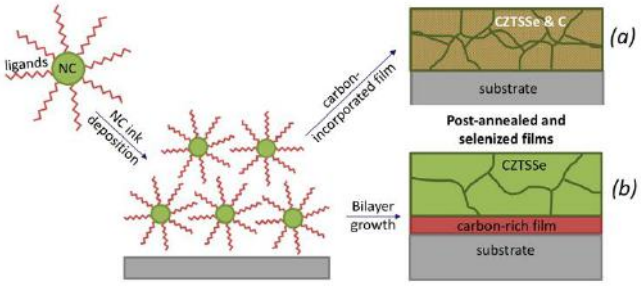


Fig. 1. Schematic displaying the deposition of NCs with either (a) the carbon from the ligand incorporated into the active material, or (b) the carbon being expelled to form a bilayer post-selenization.

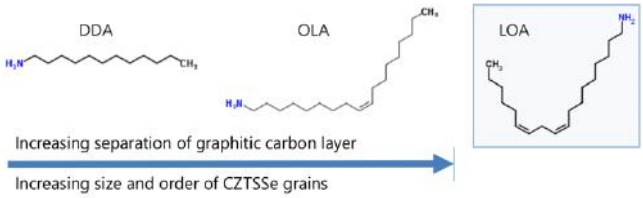


Fig. 2. Outline of current trend observed with ligand selection. LOA has yet to be tested.

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of Washington (WA, USA). Here, her research focus is on the solution processing of thin film solar cells using environmentally friendly and earth abundant materials. At this conference, you will hear Breena discuss her current fundamental work on CZTSSe, where she is studying how the bonding and molecular weight of ligands that cap CZTS nanocrystals can alter properties of the final selenized films. Her work in in partnership with the Clean Energy Institute (CEI) at the University of Washington.Contact: bmsperry@uw.edu

Abstracts and Biographies of Poster Presenters

Improved thermal performance of the thermosyphon solar water heater

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Abstract
Solar energy is free, environmentally clean, and therefore it is accepted as one of the most promising alternative energy sources. The effective use of solar energy is hindered by the intermittent nature of its availability, Conversion of solar energy into thermal energy is the easiest and most used method. Passive techniques have been used to improve the convective heat transfer. A thermosyphon solar water heater is designed, constructed and tested in Bamenda-Bambili, North West, Cameroon (Latitude 6.005º N and Longitude 10.257º E. A flat plate collector at 43 ^{0}C angle of tilt to the horizontal is employed. Readings were taken for a period of five days. With an ambient temperature at 26 ℃, a maximum hot water temperature of 85 ºC is recorded and during the experiment, the TRNSYS "**TRaNsient SYstem Simulation program''** model method is used to improve it. The suggestion in this study is to add two new components in order to account theoretically for this situation as well as to change the characteristic performance of the collector, pipe and tank loss coefficients from being parameters to instead being inputs to the current version of Type 45. The study has shown that linking these two components with the modified thermosyphon-collector component Type 245 (referred to as 'Modified TRNSYS Model') gives results that agree to within an error of less than 7% with the traditional way of evaluating system performance (solar fraction) by using Type 45 (referred to as 'Original TRNSYS Model'). Furthermore, the modified TRNSYS model eliminates restrictions on design parameter optimization to improve thermal performances and gives a wider choice for conducting parametric studies.
Keywords: Solar water heating systems; Heat transfer; Thermosyphon; Radiation.

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Recycling of Standard Old Phone Chargers into Solar-Powered Rechargeable Led Bulb

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Abstract
One of the major global problems in waste management is how to recycle them into reusable objects or controls it using an environmentally friendly method. This article presents a method of converting standard mobile phone chargers into rechargeable solar-powered LED bulbs. To accomplish this task, we designed a model through an electronic simulator named PROTEUS. For the practical implementation of the solar-powered rechargeable LED bulb, we use a NOKIA brand standard phone charger to connect 10 white LEDs of 2v, easily found on any electronic light bulb waste, for the lighting part; a 1200mAH phone lithium battery TECHNO brand for the storage part and finally for the charging circuit, we use another phone charger receiving 3 solar panels of 1w each. After putting all this together, we finally get a solar-powered rechargeable LED bulb that recharges for about 6 hours in the full sun when the battery is low and has a lighting time of 3 hours when battery is full. This wonderful design is easily used in any critical situation, power outage, outdoor, hanging lantern or portable flashlight or table lamp. The lamp is designed to light by hand or in suspension on an E27 socket.
Keywords: Lithium battery, LED bulbs; Solar cell phone chargers; Waste management.

NZENDJANG MBAKOUOP Arnaud



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Study and realization of a bi-axial solar tracker system in the tropical context

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Abstract
Today, Cameroon's energy situation suffers from a structural and technical problem, yet the existing solar potential from North to South, East to West is evaluated averagely on 5kwh/m^2/day which could be exploited in order to provide a lasting solution to this problem and equally boost the development of solar energy. However, the device that could help in collecting maximum solar energy is not always easy to acquire. In this work, we present the construction or realization of an automatic tracker destined for photovoltaic solar modules. The objective here is to improve the gain in power of photovoltaic generator. Our instrument device is attached to a mechanical structure made up of two continuous current motors with their control circuit. The formed system is then able to accurately track the position of the sun and ensure at every moment an adaptation between the source and the charge at the operating point of maximum power. To obtain the results presented here, several hardware

and software resources like solar generator, RETScreen, PVgis, and Arduino were used. The resulting device will be used to provide permanent electrical power to the population and at the same time serve as educational tools for students.
Keywords: Solar Energy; Solar Tracker; RETScreen; Arduino; Solar Generator.

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Mobile multi-functional smart hybrid PV solar kit system for households in cameroon

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Abstract
According to a report of ARSEL in 2014, of more than 14000 localities identified in Cameroon, more than 3000 are not electrified. This is to say more than 22% on the national territory and this descends to 3.5% in remote areas. To adapt to this sad situation, several solar kit models are made available in the markets with some limitations. It remains operational only in the context of the family and cannot be useful for a community. Our objective in this work is to propose a mobile and intelligent hybrid multi-functional solar kit, made up of team system bulbs with type LED anti shedding, a phone charging station and finally a desk with a best communication device for the masses in church. This system is powered by a solar generator of 80Wp, of a battery of 40Ah, a microcontroller of the card Arduino, and finally a presence detector in order to ensure efficient energy consumption. Based on the economic analysis, the LCOE is also proposed. This new solar kit realized is very important in that it will help lift people out of poverty
Keywords: Solar Kit, Remote area, Microcontroller, Energy efficiency

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Feasibility studies and optimization of photovoltaic installation for Deuk town electrification in the Mbam-and-Inoublu

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Abstract
The isolated zone Deuk depends only on generators for electricity production.This work carries out feasibility studies to provide optimized electricity solution.
Matlab is used to simulate the results of the multi-criterion optimization according to C. Yann and al.[1]. Excel is exploited to simulate the statistical curves, the variations of solar irradiation of Deuk. PVGIS is used to simulate the monthly global solar irradiation and daily average data, respectively. The Net Present Value(NPV) method gives the results of financial profitability criterion, which has been confirmed by the CER method of B.Chabot[2]

Keywords: feasibility, design, optimization, CER, dimensioning

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Fight against post-harvest losses in the rural area.

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ABSTRACT
The mechanization of agriculture has led to a significant increase in production, leaving behind post-harvest losses of more than 70%. This is due to poor conservation techniques and conservation tools, especially in developing countries. The alternation of seasons creates overabundance and shortages of foodstuffs. The drying of tropical agricultural products often appears as the easiest principle of conservation and marketing of these products. Among the drying processes available, the mixed indirect airflow dryer with decentralized production of heat sources like solar collector, combustion from biogas, biomass and a heating resistor provides. The diversity of many source of heat requires manufacturers to adopt each dryer to a type of food. In a great food crusade, it will be wise and economical to make a multifunctional dryer able to joint need and a typology of products. In this vein, it will be question of federalize all sources of heat produced and regulate the temperature ranges following each product.

To carry out this work we have for objectives, the setting up of an experimental device allowing a computerized follow-up of the drying process, the simulation of different tropical products compared to the sources, the determination of the equations of drying taking into account of the variation of the drying parameters.
These objectives refer in advance to assumptions such as:
H1: The federation of energy sources influences the product;
H2: The speed of the coolant and its temperature varies with the heat source;
H3: each heat source can empower the dryer
For this purpose, as a methodology, we will:

- Realize a central data acquisition,
- Writing of a code and realization of a theoretical simulation application of the drying of peppers
- Determination of the influence of fluid flow according to various sources
- Determination of the influence of the temperature and the attack drying speed and the drying time with respect to the different sources.

So we will put together a prototype.

Keywords: post-harvest losses, mixed indirect dryer, decentralized heat production, temperature control, flat collector, biogas combustion, heating resistance, biomass.

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energy deficit and the questions of climate change led him to seek a Master's degree in Food Engineering Energy Option and Processes ENSAI N'Gaoundéré. He is currently studying airflow and temperature regulation in an incubator in an isolated area. He is the ANSOLE manager of the students at N'Gaoundéré and energy manager of a company doing construction / public works (CHODROLEC Sarl.). He is currently working with United Nations Youth as a supervisor of parliamentary groups. (See Project, page 66). Contact : mbouendeufils@gmail.com

Energy management in building in Cameroon: application to a building industrial use

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Abstract
The building sector is very dynamic because of the strong demographic growth that the world is currently facing. In a context where there is a decrease in production capacity coupled with the development of environmental protection laws, criticizing the way we consume is a necessity. However, recent studies with Njomo et al show that the building sector alone accounted for 73% of final energy consumption in 2006. For this reason, the latter is considered as a huge potential energy savings field. Hence the existence of numerous research project on the control of energy demand. In this study, we perform the energy audit of a building to improve its energy demand. If the literature, reveals the existence of several methods for this work, we have chosen the one developed by energy briefing management. It is structured around three fundamental phases, namely the planning and design phase, followed by the implementation phase and the evaluation phase. The application of this method to a building in the Yaoundé city allowed us the reduce its energy bill by 21%. However, it is important to note that although this purely static method makes is possible to evaluate the consumption, it is not possible to make a prediction of it in medium or long term because it does not take into account the meteorological data and other than the socio economic parameters of the structure.
Keywords: Building, management, energy

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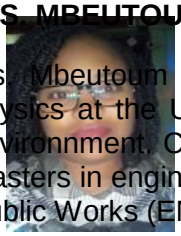
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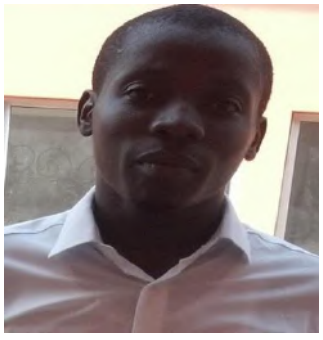
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Safe the dates!!!

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