Sustainable Energetics for Africa (SE4A)
School 2, 31.07.-04.08.2017,
Yaounde & Buea, Cameroon

Venue 1: PKFokam Institute of Excellence, Yaounde, 31.07-02.08.2017
Venue 2: University of Buea, Buea 03-04.08.2017

Book of Programme,
Abstracts and Biographies
Sustainable Energetics for Africa (SE4A)

Book of Programme, Abstracts and Biographies
School 2, 31.07.-04.08.2017, Yaoundé & Buea, Cameroon

Funded by: VolkswagenStiftung

Partners:
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Organising Committee

Prof. Dr. Daniel Ayuk Mbi Egbe, ANSOLE and BALEWARE Coordinator, Institute of Polymeric Materials and Testing (IPMT), Johannes Kepler University Linz, Austria (Initiator and Director of SE4A-Schools)

Prof. Dr. Thomas Njine, Rector of PKFokam Institute of Excellence, Yaoundé, Cameroon (Host and Chairperson of Local Organizing Committee (LOC) at PKFokam in Yaoundé)

Prof. Dr. Emmanuel Tanyi, Dean of Faculty of Engineering and Technology, University of Buea, Cameroon (Host and Chairperson of LOC at the University of Buea)

Prof. Dr. George Elambo Nkeng, Director of National Advanced School of Public Works (ENSTP) Yaoundé, Cameroon (Local Organizer)

Prof. Dr. Michael Düren, Coordinator of SEPA (Solar Energy Partnership with Africa), Justus Liebig University Giessen, Germany (Co-applicant for funding for SE4A-Schools)

Dr. Vidal Aloyem Kazé, HTTTC, University of Bamenda, Cameroon (Local Organizer)

Dr. Nestor Kamdem, PKFokam Institute of Excellence, Yaoundé, Cameroon (Member of LOC)

Prof. Dr. Reinhold Lang, Director of IPMT, Johannes Kepler University Linz, Austria (Public relations)

Dr. Matthias Höher, Managing Director, Center for International Development and Environmental Research, Justus Liebig University Giessen, Germany (Financial Director of SE4A-Schools)

Ms Tina Koch, Justus Liebig University Giessen, Germany (Assistant to the School Directors)

Ms Petra Spamer-Tramp, Justus Liebig University Giessen, Germany (Organization of travels)

Ms Gudrun Haider (MBA), IPMT, Johannes Kepler University Linz, Austria (Support to the Director of SE4A-Schools)

Dr. Ferdinand Ndum, Universitätsklinikum Jena, Germany (Collection and processing of data)

Ms Vivian Ogechi, Pan African University of Water and Energy Sciences (including Climate Change), Tlemcen, Algeria (Collection and processing of data)

Simon P. Amboumbe, Ernest Signe, Jean Paul Tchuente, Eric Njankwa Njabon, Diane Tchuani, Murielle Mefo Simo, Cyrille Gnentedem, Ghislaine L. K. Guiadem, PKFokam Institute of Excellence, Yaoundé, Cameroon (Members of LOC)

Preface: How we got to this point

Dr. Horst Ahlers, a retired scientist from Jena, gave me the hint, in late 2013 or the beginning of 2014, to contact VolkswagenStiftung for a possible funding of Summer Schools in Sub-Saharan Africa. Actually it was through his neighbor Heidi Hornickel that I got in contact with Dr. Ahlers. Heidi had joined ANSOLE e.V. in 2012. After my first meeting with Dr. Horst Ahlers, a series of encounters followed, during which we discussed the possibility of writing book on renewable energies for Africa. Unfortunately the book project never materialized. Nevertheless, Dr. Ahlers was at the very beginning of the chain of actions, which led to the organization of Summer Schools on Renewable Energy (RE) for Africa.

Based on the hint of Dr. Ahlers, I got into contact with Dr. Christoph Kolodziejski (soon his polish surname changed due to his wedding in 2015) who was responsible for the Sub-Saharan Africa region. He gave me the guideline on how to apply for a Summer School. I contacted our ANSOLE e.V. member, Dr. Bettina Schmidt, who had written a successful proposal to VolkswagenStiftung in the past. The first proposal was drafted with inputs from her and colleagues from Jena University of Applied Sciences, Germany, Prof. Dr. Andreas Schleicher and Prof. Dr. Matthias Schirmer.

With regard to the first school, which was planned to be held from 25th to the 29th of August 2015, Kwame Nkrumah University of Science and Technology (KNUST) in Kumasi, Ghana, was selected as the venue. After having personally visited the institution during the first ANSOLE Regional Meeting for West Africa in April 2014, I experienced KNUST as a well-equipped institution for practical training in renewable energy. Out of time factor KNUST was dropped.

As things evolved. Prof. Kerstin Wydra, Chair of Plant Production and Climate Change at Erfurt University of Applied Sciences, Germany who had joined ANSOLE e.V. after meeting me during an event in Berlin in June 2014, came into play.

After having handed the proposal draft to her, everything went fast. This time, we decided to have the venue at Nelson Mandela African Institution of Science and Technology (NM-AIST) in Arusha Tanzania. Why? Because I had signed a MoU with the institution in August 2014.
and Prof. Wydra had met Prof. Burton Mwamila, the then Vice-Chancellor of NM-AIST during an executive meeting of the Universities Council of East Africa in the second half of 2014. An application for funding an international Summer School on “Renewable Energies for Africa: Solar Energy and its Applications” was submitted to VolkswagenStiftung at the beginning of January 2015. This first school was then held between the 13\textsuperscript{th} and the 18\textsuperscript{th} of July 2015 during the Nelson Mandela Week at NM-AIST.

Full of ambition, after this first school, I got into contact with Prof. Michael Düren (Michael means “Who is like our God?”) from Justus-Liebig University Giessen, Germany. Furthermore, Prof. Dieter Meissner was of great support during this phase as well, since he was the one who suggested the topic “Sustainable Energetics for Africa”. Prof. Düren brought in Dr. Matthias Hoeher, with whom I enjoyed working together ever since, after having gotten to know him closely. Dr. Hoeher has past experience in organizing Summer Schools with funding from VolkswagenStiftung.

With the new input, I contacted KNUST to be the venue of the second school. Unfortunately, it was not possible holding the second school with KNUST as the venue. As an alternative venue, Dr. Daniel Yamegueu made it possible to organize the second school at 2iE in Ouagadougou, Burkina Faso. After the successful organization of a venue in Burkina Faso, I contacted Dr. Nestor Kamdem who is in charge of events at PKFokam Institute of Excellence in Yaoundé, Cameroon. He linked me to Prof. Thomas Njine, who accepted to host the third school. The following colleagues supported the proposals of the aforementioned Summer Schools, namely: Prof. Angeles Lopez Agüera, University of Santiago de Compostela, Spain; Prof. Elisabeth von Hauff, Free University of Amsterdam, Netherlands; Prof. George Elambo Nkeng, National Advanced School of Public Works, Yaoundé, Cameroon; Dr. Vidal Aloyem Kaze of HTTTC, University of Bamenda, Cameroon as well as Jennifer Rush, International Solar Energy Society (ISES), Freiburg, Germany.

After handing in the proposals, we were finally granted funding for the two remaining schools on the 7\textsuperscript{th} of September 2016. In the meantime, the responsibility for Sub-Saharan Africa had changed hands. Dr. Hannah Wielandt had taken over and was extremely supportive ever since.

The Second School was attended by 65 participants from 18 nations. It was officially inaugurated by the Burkinabe Minister of Energy, Prof. Alfa Oumar Dissa, who is an active ANSOLE member. It consisted of 4 days of lectures and poster presentations, 1 day tour of the RE experimental facilities of 2iE, rehearsal of a piece on Theater for Development (TFD) during the first 4 evenings under the supervision of Dr Emelda Ngufor Samba, discussions on energy scenario in 2050 under the leadership of Prof. Dieter Meissner (also during the first 4 evenings), and finally the conference dinner, which saw the performance of the TFD piece, presentation of the energy scenario in 2050, award of 3 poster prizes (all won by 3 ladies: Ms Vivian Nwadiaru Ogechi of PAUWES, Tlemcen, Algeria, Ms Fatou Ndiaye of Gaston Berger University, Saint-Louis, Senegal and Ms Sibiath Osséni of the University of Abomey-Calavi, Benin) and award of gifts and certificates of participation by the ANSOLE coordinator.

On the 26\textsuperscript{th} of February, prior to the beginning of the School, the ANSOLE coordinator was invited to a reception banquet at the residence of the German Ambassador in Ouagadougou in honor of the German Minister of Cooperation, Mr Gerd Müller, who was paying an official visit to Burkina Faso. The ANSOLE coordinator took the opportunity to inform the visiting Minister about the School and other research funding activities of VolkswagenStiftung in Sub-Saharan Africa. The same information was passed on to a visiting delegation of
Bundestag parliamentarians of the Green Party, who later came to the ambassador’s residence just after the Minister and his wife had left.

Group picture of School in Ouagadougou (27.02-03.03.2017) together with the Burkinabe Minister of Energy, Prof. Alfa Oumar Dissa.

Some impressions of school 2 in Ouagadougou

During 3rd ANSOLE National Conference in Cameroon I met Prof. Emmanuel Tanyi for the first time. Based on this meeting, I invited him to lecture at the Second School in Ouagadougou, Burkina Faso, during which he decided to be actively involved in the whole endeavor by spontaneously offering to co-host the third school in Cameroon by offering a practical training session. His institution contributed financially (more than 5000 Euro) and otherwise (i.e. putting at our disposal 3 of their buses) to the organization of the last school. I thank Professor Tanyi, his dynamic local organizing team and the University of Buea for this special support. I also thank Professor George Elambo Nkeng for putting at our disposal 2 buses of the Ecole Nationale Supérieure des Travaux Publics during our stay in Yaounde.

Summer School 3 at PKFokam Institute of Excellence in Yaounde, Cameroon: Left) some participants waiting for the start of the lectures in the morning the 31st of July 2017, while Prof. Dieter Meissner who gave the first scientific lecture on “Overview on Sustainable Energetics” is uploading his presentation on the computer of Tina Koch for the preparation of the filming of the lecture for broader outreach through online dissemination. Right) Prof Lang lecturing on “Global Change and Challenge: The Transformation of the Energy System and the Key Role of Plastics”

The 3rd School witnessed the attendance of participants from 26 nations, it was mediatically covered by 3 TV stations (Vox-Africa, Canal 2 and CRTV) and many local newspapers, 7
lecturing participants and a female student participated at the production of two long TV broadcasts in French (https://www.youtube.com/watch?v=34e-gE6Qq68&t=3542s) and English on “Sustainable Energetics”. The School consisted of 2.5 days of lectures and poster presentations at PKFokam Institute of Excellence in Yaounde, 1.5 days practical sessions (9 groups of students rotated through 9 experimental platforms namely, outdoor wind station, indoor wind station, hydroelectric station, outdoor solar energy station, indoor solar energy station, a PLC control system for load and battery, labview simulation of a hybrid solar-mini hydro system, solar thermal station, and indoor hydrogen station) at the Faculty of Engineering and Technology of the University of Buea (UB) (after spending 6 hours travelling from Yaounde to Buea and checking- in at the Buea Mountain Hotel, which recently “went solar” during its renovation), an excursion to Limbe and a conference dinner, which was held similar to that of Ouagadougou, in addition to the performance of a live music band sponsored by UB. All 3 poster awards were also won by ladies: Ms Nothando Ndlovu from Zimbabwe, Ms Asma Saaidia from the Faculty of Science Tunis, Tunisia and the Kenyan Ms Jacinta Akoth Okwako from PAUWES, Tlemcen, Algeria. Reports on the female dominance during the poster awards in both schools can read either in Catalan, written by Prof. Angeles Lopez (http://xornal.usc.es/xornal/acontece/2017_08/noticia_0018.html) on website of the University of Santiago de Compostella, or in German, written by Prof Veronika Wittmann (http://www.iku.at/content/e213/e63/e43?apath=/e32681/e320780/e336833/e337759) on the website of the Johannes Kepler University Linz, Austria. The University of Buea also did an online report on the second part of the 3rd School (http://fetubuea.com/2017/09/12/3471/).

The first part of the 3rd school was inaugurated by the Rector of PKFokam Institute of Excellence, while the second part was inaugurated by the Vice-Chancellor of UB, Prof. Ngome Horace Manga, in the presence of his deputies and a representative of the Mayor of the city of Buea. The ceremony was highlighted by song performances of the UB choir. The lectures of Schools 2 and 3 were filmed to be placed online for a broader outreach.
I want to thank all those mentioned above who willingly contributed to the realization of the three schools. I thank Ms Jana Bauer who was my wonderful assistant during the school in Ouagadougou, Burkina Faso, Ms Tina Koch, for her time devoted to School 3 in Cameroon, Dr. Ferdinand Ndum and Ms Vivian Ogechi for collecting and processing the submitted data of candidates, Ms Petra Spamer-Tramp and Ms Gudrun Haider for assisting in purchasing of air-tickets and preparing event documents, respectively. I thank Prof. Reinhold Lang, the Director of the Institute of Polymeric Materials and Testing (IPMT) for according me his full support during the realization of the two last schools.

I am also grateful to all the lecturers who accepted our invitation to travel to the various venues and to lecture the students, and colleagues who enabled on the spot smooth running of the schools. I thank all the selected participants who actually attended the schools.

I am extremely thankful to VolkswagenStiftung for making these schools possible! I am convinced you will enjoy reading the scientific contributions and/or biographies of all participants of School 3, while praying for us to obtain funding for additional schools in the near future

Stay blessed

Daniel A. M. Egbe (Director of SE4A Schools)
### Programme

**-Travel to Yaounde and check-in in Yaahot Hotel: 27-31 July 2017**

#### Monday, 31st July 2017

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<tbody>
<tr>
<td>08:30 – 09:00</td>
<td>Registration and Networking</td>
</tr>
<tr>
<td>09:30 – 10:00</td>
<td>Welcome by organizers &amp; organizational issues, Thomas Njiné, Emmanuel Tanyi &amp; Daniel A. M. Egbe</td>
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<tr>
<td>10:00 – 11:00</td>
<td>Presentation of organizing institutions moderated by Daniel A. M. Egbe</td>
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<tr>
<td>10:00-10:10</td>
<td>Short Presentation of the PkFokam Institute of Excellence, Yaoundé, Thomas Njiné</td>
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<tr>
<td>10:10-10:20</td>
<td>The PKFokam Conference &amp; PKFokam platform on Science, Research and Technology, Nestor Kamdem</td>
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<tr>
<td>10:20-10:30</td>
<td>Renewable Energy Study Programme at ENSTP, Yaoundé, George Elambo Nkeng</td>
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<tr>
<td>10:30-10:40</td>
<td>Renewable Energy Training and Research at the University of Buea, Emmanuel Tanyi</td>
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<tr>
<td>10:40-10:50</td>
<td>Links to Africa, Rainer Waldhardt, Justus-Liebig University of Giessen, Germany:</td>
</tr>
<tr>
<td>10:50-11:00</td>
<td>Anchoring Sustainability in Teaching and Research, Reinhold Lang &amp; Veronika Wittmann, Johannes-Kepler University Linz, Austria</td>
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<tr>
<td>11:00-11:30</td>
<td>Coffee Break and Networking+ Group Photo</td>
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**SECTION 1, CHAIRPERSON: VIDAL ALOYEM**

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>11:30-12:25</td>
<td>Overview on Sustainable Energetics, Dieter Meissner, University of Tallinn, Estonia</td>
</tr>
<tr>
<td>12:30-13:30</td>
<td>Speed up access to a sustainable energy in remote areas through innovative renewable energy systems and business approach, Yao Azoumah, CEO KYA-Energy Group, Ouagadougou, Burkina Faso</td>
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<tr>
<td>13:30-14:30</td>
<td>Lunch Break and Networking</td>
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**SECTION 2, CHAIRPERSON: REINHOLD LANG**

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>14:30-15:25</td>
<td>Hybrid power system for decentralized rural electrification in Africa, Daniel Yamegueu, 2iE Ouagadougou, Burkina Faso</td>
</tr>
<tr>
<td>15:30-16:25</td>
<td>Energy in nexus context-analysis (energy-water-food security-climate change mitigation), Driss Zejli, SMADER, Morocco</td>
</tr>
<tr>
<td>16:30-17:25</td>
<td>Design, Simulation and Control of a Hybrid Solar/Mini-Hydro Renewable Energy System, Emmanuel Tanyi, Ndeta Bueama’a and Chu Donatus, University of Buea, Cameroon</td>
</tr>
<tr>
<td>17:30 – 18:00</td>
<td>Coffee break and Networking</td>
</tr>
<tr>
<td>18:00– 18:45</td>
<td>Theater for development/ Science Slam, Maryam Abdi &amp; Emelda Samba,, University of Evansville &amp; USA University of Yaoundé I, Cameroon</td>
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<tr>
<td>18:45-19:45</td>
<td>Back to Yaahot Hotel or direct to a restaurant</td>
</tr>
<tr>
<td>20:00-21:00</td>
<td>Dinner</td>
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**Tuesday, 1st August 2017**

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>8:30-8:55</td>
<td><em>SECTION 3, CHAIRPERSON: YAO AZOUMAH</em> A Multi Hybrid Energy Lab for model based training and applied research: Fuel Cell - PV - Wind Technologies, Nadja Thomas, Heliocentris, Berlin, Germany</td>
</tr>
<tr>
<td>09:00 – 09:55</td>
<td>The Challenges of Hybrid Renewable Energy for Rural electrification: Design, Sustainability, Control and Cost, Emmanuel Tanyi, Tounsi Willy and Musong Louis, University of Buea, Cameroon</td>
</tr>
<tr>
<td>10:00 - 11:20</td>
<td>Global Change &amp; Challenges: The Transformation of the Energy System and the Key Role of Plastics, Reinhold Lang, Johannes Kepler University Linz, Austria</td>
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<td>11:20-11:40</td>
<td>Coffee Break and Networking</td>
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<tbody>
<tr>
<td>12:40 – 13:35</td>
<td>Energy saving in air-conditioned buildings in tropical regions, Yezouma Coulibaly, 2iE Ouagadougou, Burkina Faso</td>
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<tr>
<td>13:40 – 15:00</td>
<td>Lunch Break + Networking</td>
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<tbody>
<tr>
<td>15:00-16:00</td>
<td><em>SECTION 5, CHAIRPERSON: DANIEL YAMEGUEU</em> Challenges of renewable energy supply from a landscape ecological perspective, Rainer Waldhardt, Justus-Liebig University Giessen, Germany</td>
</tr>
<tr>
<td>16:00-17:00</td>
<td>Poster presentations by students and a jury of 4 lecturers selects the 3 best posters + coffee break</td>
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<tr>
<td>17:00 – 17:55</td>
<td><em>SECTION 6, CHAIRPERSON: VERONIKA WITTMANN</em> A short introduction to the terminology and technology of photovoltaics, Elif Arici-Bogner, Istanbul Technical University, Turkey</td>
</tr>
<tr>
<td>18:00 - 18:45</td>
<td>Overview on Renewable Energies Sources in Central Africa, Vidal Aloyem Kazé, HTTTC, University of Bamenda, Cameroon</td>
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<tr>
<td>19:00-20:00</td>
<td>Departure to Yaahot Hotel or to a restaurant</td>
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<tr>
<td>20:00-21:30</td>
<td>Dinner</td>
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**Wednesday, 2nd August 2017**

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<th>Time</th>
<th>Session</th>
</tr>
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<tbody>
<tr>
<td>08:00-08:45</td>
<td><em>SECTION 7, CHAIRPERSON: YEZOUMA COULIBALY</em> Check out from Yaahot Hotel</td>
</tr>
<tr>
<td>09:00 – 09:50</td>
<td>Integrated Sustainable Development Pilot Project Proposal (ISD-3P), In Mayo-Darle Old Tin Mine Banyo, Adamawa Region Cameroon, Emmanuel Ojong, GMIE-Consult Sarl B.P 646 Limbe, Cameroon</td>
</tr>
<tr>
<td>09:50- 10:00</td>
<td>Short Coffee Break</td>
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<tr>
<td>10:05 - 11:00</td>
<td>Sizing, Design and Appropriate Technology Selection of PV powering at Isolated Communities, Angeles Lopez Agüera, University of Santiago de Compostela, Spain</td>
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## Sustainable Energetics for Africa (SE4A)

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<th>Time</th>
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<tbody>
<tr>
<td>11:05 – 12:00</td>
<td>Solar Thermal Energy: Case Study in Tunisia, Amel Ben Fredj Romdhane, University</td>
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<tr>
<td></td>
<td>Tunis El Manar, Tunis, Tunisia</td>
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<tr>
<td>12:00 – 13:30</td>
<td>Lunch Break + Networking</td>
</tr>
</tbody>
</table>

### SECTION 8, CHAIRPERSON: ELIF ARICI-BOGNER

<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>13:30- 14:25</td>
<td>Global Understanding for Sustainability, Benno Werlen, Friedrich-Schiller University Jena, Germany (presented by Veronika Wittmann/Daniel A.M.Egbe)</td>
</tr>
<tr>
<td>15:30-16:30</td>
<td>Material Design for Organic Solar Cells, Daniel A. M. Egbe, Johannes Kepler University Linz, Austria</td>
</tr>
<tr>
<td>16:30-17:30</td>
<td>Coffee break and preparations for departure to Buea</td>
</tr>
<tr>
<td>18:30-00:30</td>
<td>Journey to Buea and check-in at Buea Mountain Hotel</td>
</tr>
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**Thursday, 3rd August 2017**

<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>08:00 – 09:00</td>
<td>Breakfast at Buea Mountain Hotel</td>
</tr>
<tr>
<td>09:00 – 09:20</td>
<td>Departure to the University</td>
</tr>
<tr>
<td>09:20– 10:00</td>
<td>Registration and Installation of Posters</td>
</tr>
<tr>
<td>09:45 – 10:00</td>
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### OPENING CEREMONY

<table>
<thead>
<tr>
<th>Time</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>10:00 – 10:05</td>
<td>Welcome address of the Dean of the Faculty of Engineering and Technology</td>
</tr>
<tr>
<td>10:05 – 10:15</td>
<td>Solar Energy as a driver of Rural Electrification: An appraisal by the South West Regional Delegate of Water and Energy</td>
</tr>
<tr>
<td>10:15 – 10:20</td>
<td>Welcome address by the Mayor of Buea</td>
</tr>
<tr>
<td>10:45- 10:55</td>
<td>Opening address by the Vice-Chancellor of the University of Buea</td>
</tr>
<tr>
<td>10:55- 11:00</td>
<td>Signature of MoU between ANSOLE and the University of Buea</td>
</tr>
<tr>
<td>11:00 – 11:10</td>
<td>Photo Session</td>
</tr>
<tr>
<td>11:10 – 11:30</td>
<td>Coffee Break</td>
</tr>
<tr>
<td>11:30 – 12:00</td>
<td>VolkswagenStiftung: Funding Possibilities for Sub-Saharan Africa, Daniel A. M. Egbe</td>
</tr>
<tr>
<td>12:00 -12:30</td>
<td>Overview of the laboratory sessions, organization of work groups and scheduling of groups on the various laboratory platforms Emmanuel Tanyi</td>
</tr>
<tr>
<td>12:30 - 13:30</td>
<td>Lunch Break +Networking</td>
</tr>
<tr>
<td>13:30 – 16:00</td>
<td>Laboratory Sessions at the indoor and outdoor Renewable Energy Laboratories of the Faculty of Engineering and Technology</td>
</tr>
<tr>
<td>16:00 – 16:20</td>
<td>Coffee Break</td>
</tr>
<tr>
<td>16:20 – 18:30</td>
<td>Laboratory Sessions continue</td>
</tr>
<tr>
<td>18:30 – 19:00</td>
<td>Return to Buea Mountain Hotel</td>
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### Abstract and Biography of Lecturers

**Short Presentation of the PKFokam Institute of Excellence**

Prof. Thomas Njine  
PKFokam Institute of Excellence, Yaoundé, Cameroon

**Abstract**

PKFokam Institute of Excellence was created on February 2007 by the NGO named Appropriate Development for Africa Foundation (ADAF) under the denomination of PKFOKAM Higher Institute, a non-denominational private Institute of higher learning. A few years later, the Institute took its current name. Its motto is the three following words: Dignity, Faith, and Responsibility.

Located in Emana, Yaoundé, Cameroon, in the Central African sub-region, the Institute seeks to be an African incubator for world-class leaders: «building tomorrow’s leaders today».

English is the language of instruction, and partner universities are in the United States of America, namely: Kennesaw State University, Kennesaw, Georgia; State University of New York at Canton, and in China: North China University of Technology, Beijing.

Undergraduate and postgraduate training offers are available in two faculties divided into departments: the Faculty of Science and Technology for engineering programs, and the Faculty of Economics and Management Sciences.

The student population is made up of 300 students. Admission into the first year of studies is by competitive examination.

Our interests lie in renewable energy research/applications.

In the near future we plan to introduce a special short-term training program for young Cameroonians who wish to invest their time in renewable energies. Also a Bachelor degree programme on Alternative and Renewable Energy Systems is envisioned to be part of our offering from 2018 on.

Thus, the international summer school on sustainable energetics for Africa will be of great support.
Biography: Prof. Thomas Njiné

Thomas Njiné is the incumbent Rector of the PKFokam Institute of Excellence after having been Dean of the Faculty of Science and Technology in the institute for several years. Prior to that, the Professor of environmental microbiology has held several positions at the Faculty of Science of the University of Yaoundé: He has been Head of the Department of Animal Biology and Physiology, Chair, Advisory Scientific Committee of the Faculty, Dean, and he was the founder of the Hydrobiology and Environment research unit. He has also worked at the Cameroon ministry in charge of research as Director of scientific and technical research. He was co-applicant of the proposal submitted at VolkswagenStiftung seeking for funding of SE4A schools. Contact: njinet@yahoo.fr

The PKFokam Conference & PKFokam platform on Science, Research and Technology

Nestor Kamdem
PKFokam Institute of Excellence, Yaoundé, Cameroon

Abstract

Scientific conferences are important platforms for researchers and PhD students that generally help to seek out collaborations and new horizons. Participants have the opportunity to learn from others, improve their knowledge about their own field, and get new ideas about their own works through exchanges. Unfortunately, these kinds of platforms are lacking in our scientific environment. Initiated in 2014, the PKFokam conference on science and technology is attempting to fill the vacuum. This conference is unique. It brings together scientists, engineers, industrialists, and people who have special knowledge to be transmitted or inventions that are to be promoted. Beside the PKFokam conference on Science & Technology, the PKFokam platform to support the activities of African Scientists and Engineers in Africa has been created in June 2016. They are tools and incentives to attract the best brains inside the continent.

Biography: Dr. Nestor Kamdem

Dr. Nestor Kamdem holds a PhD in Chemistry from the Free University of Berlin, in Germany. His research interests are in the areas of Drug Design & Development. He conducted his research activities and his postdoctoral at the Leibniz-Institute for Molecular Pharmacology in Berlin, Germany. Nestor Kamdem is member of several projects of the African Union including: African Diaspora Technical Committee of Experts for the implementation of the African Diaspora roadmap, The African Institute for Remittances (AIR) and African Union Agenda 2063. He is the Founder and chairman of RUAD-EURD (Research University Aid and Development: www.ruad-eurd.org). He is the responsible of the PKFOKAM conference on Science & Technology, and the PKFOKAM AWARDS for Science & Technology (www.pkfokam-cap.org).

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Renewable Study Programme at the Advanced School of Public Works (ENSTP) Yaoundé Cameroon

George Elambo Nkeng
Ecole Nationale Supérieure des Travaux Publics, Yaoundé, Cameroon

Abstract

The Advanced School of Public Works (ENTSP), which recently gained the status of a University, launched a Renewable Energy Masters Programme 5 years ago. This programme is a joint effort with the University of Padova in Italy, which allows students to obtain a Master degree from both
institutions. This short lecture will present the content of the programme, its achievements and its future.

Biography: Prof. George Elambo Nkeng

Prof George Elambo Nkeng is a Professor of Chemical Engineering of the University of Buea and Director of the National Advanced School of Public Works (ENSTP) Yaoundé, Cameroon. He holds a PhD in Chemical Engineering of Imperial College, University of London. He is one of the founding members of African Network for Solar Energy (Ansole) in Cameroon. Prof Nkeng's research covers environmental pollution, materials, energy and water resources and has several publications in these areas.

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Overview on Sustainable Energetics

Dieter Meissner

Tallinn University of Technology, Department of Materials and Environmental Technology, Tallinn, Estonia

Abstract

Sustainability and sustainable are certainly among the most misused terms in discussions of our development and possible development goals. In general, most people agree that an appropriate definition was given by the 1987 Brundtland Commission of the United Nations as “sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” The organizing principle for sustainability is sustainable development, which includes the four interconnected domains: ecology, economics, politics and culture. All four need to be analyzed for every pathway taken.[1]

A specific technology, e.g. a specific energy technology can never be sustainable, its specific use in a specific context may be. So what is needed is sustainable energetics, from the use of energy through transport up to its “production”, i.e. the first conversion of “primary energy”, more precisely exergy, into a useful form. So renewable forms of primary energy such as solar radiation, wind, waves or tidal energy have to replace fossil energy carriers like coal, oil and natural gas as well as uranium 235 etc., the energy carriers of atomic energy. However, even renewables may be used in a non-sustainable way if they are not in accordance with economic, political and cultural criteria.

The lecture will start with a concise explanation of important terms such as energy, exergy, anergy, and power, and will then analyze the future need for non-fossil power: 30 TW as soon as possible, certainly before 2050. The only primary energy source capable of delivering this amount of power is solar radiation, which today can be converted to the most useful form of power, electricity, for costs already lower in parts of our world than fossil or atomic energy and potential for even much lower costs: photovoltaics.

However, in order to replace fossil fuels PV technologies need to keep up a growth rate of at least 30% per year for the next 30 years. And finally a production rate of around 3 km² per hour will be needed to replace the then installed more than 140 TW every 30 years. Such a rate of production requires completely different module fabrication, replacing today's robot-manufacturing by printing technologies.

the different PV technologies available today (wafer-based, thin-film, organic and powder-based) will be discussed and the latter will be identified as the most promising[2]. Thereby it will be demonstrated that the key scientific problems to save our climate have been solved, so that today it remains mainly a political problem to do it.

Acknowledgement:

This work was supported by the European Union through the European Regional Development Fund, Project TK141 “Advanced materials and high-technology devices for energy recuperation systems”.

References

Wikipedia: “Sustainability”, online: https://en.wikipedia.org/wiki/Sustainability. 7.7.2017; in Wikipedia also most of other specific terms used in this abstract are explained in detail.
Biography: Prof. Dieter Meissner

Prof. Dieter Meissner studied Chemistry, Biology, Philosophy and pedagogics in Hamburg and Southampton. He obtained his PhD in Physical Chemistry at the University of Hamburg in Germany. He is a Professor of Sustainable Energetics at Tallinn University of Technology (TTU), Estonia. He is also Chief Scientist at Crystalsol GmbH, Austria and Crystalsol OÜ, Estonia, spin-out companies of TTU he founded in 2008. Meissner’s main research interests are photoelectrochemistry, photovoltaics, and materials research and development.

Meissner published more than 170 papers in refereed scientific journals, and 150 papers in proceedings volumes. He has more than 150 patents. He edited and co-edited two books.

During his academic career, Meissner developed two universities curricula: the Eco-Energy Engineering curricula at the University of Applied Sciences, Austria, and the Sustainable Energetics curricula for an international master course of both Estonian universities, Tartu University, and Tallinn University of Technology.

He taught at many universities, including the University of Hamburg, Germany, Osaka University, Japan, University Buenos Aires, Argentina, Technion Haifa, Israel, Johannes Kepler University Linz, Austria, and Tallinn University of Technology, Estonia.

Meissner is the initiator, founder and co-founder of five university spin-out companies, namely AQR consulting, Wels, Austria, ALPPS Fuel Cell Systems GmbH (fuel cells), Graz, Austria, Solar Surface (Selective Absorbers), Linz, Austria, crystalsol OÜ (PV solar cell powders), Tallinn, Estonia, crystalsol GmbH (PV modules), Vienna, Austria.

Contact: profdieter@gmail.com

Speed up access to a sustainable energy in remote areas through innovative renewable energy systems and by business approach

Yao Azoumah
KYA-Energy Group, Ouagadougou, Burkina Faso

Abstract:

Access to energy could be rapidly widened by developing a large bench of technologies that will allow the companies to make substantial economies of scale. It is really questionable the way things are being done today. In fact, when investing $100 into a grid-connected energy solution, almost $20 will finally be used for the energy supply directly to the beneficiaries. This difference is due to many intermediate costs (socio-economic studies, environmental impact studies, low voltage grids construction, and power losses by LV grids etc.).

Innovative renewable energy units are proposed today to tackle the issue of sustainable access to energy for all. These new products are « solar gensets » named KYA-Energy Solar Packs.

Inspired by the success story of the mobile telephony in Africa, KYA-Energy Solar Packs® are composed of KYA-Energy Boxes powered by optimized number of PV panels.

A KYA-Energy Box is composed of a hybrid inverter (all-in-one inverter, could accept different type of power sources), solar batteries, electrical protection devices, multi-source and multi-load management unit (in option), and a remote control unit (in option).

The KYA Energy Solar Pack® allows customers to make substantial savings of electricity consumption. It is an affordable standalone unit. They are available currently in four categories, depending on the power of the inverter: 1; 3; 5 and 10 kVA.
In fact, many classical energy systems are offered today, such as solar PV kits, mini off-grid solar PV systems, Diesel gensets and many other back-up technologies. Compared to the solar gensets developed by KYA-Energy Group, many comparative advantages arise:

- Solar kits are usually used for lighting purposes and in the best case for mobile phone charging. The power of solar kits is very weak (from 5W to 300W) and could hardly power some basic household electrical appliances such as refrigerators, TV etc. Unlike to solar PV kits, KYA-Energy Solar Packs offer a larger power supply to the customers (0.8kW up to 8kW, and more if needed). Their powers are scalable upon demand of the clients. It could therefore power many basic household electrical appliances (fans, lights, TV, refrigerators, Air Conditioner etc.)

- Mini or micro-grids solar based systems are also used nowadays to address access to energy in many countries. Such systems could supply more power to the costumers (from 10kW up to 500kW, or even more). The main issue linked to this system is their non-affordability by the local beneficiaries. Most of the time their investments are made by the local governments or international institutions such as UNO, Word Bank, African Union Commission, European Union commission, etc. This model is not sustainable and not bankable. Furthermore, many intermediate costs make the implementation of micro/minis grids very expensive. These intermediate costs are mainly due the socio-economic studies, environmental impact studies, construction of low voltage transmission and distribution lines etc.

- Diesel generators are usually used as back-up technologies. As they run with diesel oil, running costs are extremely high whereas the investment costs are in the same range as KYA-Energy Solar Packs. In addition to their advantages of less operational costs and CO₂ savings, solar gensets don’t make any noise when operating.
Biography: Prof. Yao Azoumah

Prof. Yao Azoumah is specialist of solar energy and energy efficiency. He is currently CEO of KYA-Energy Group (www.kya-energy.com) which is a solar company with headquarter in Lome (Togo). He also serves as the chairman of the scientific and academic council of ESMER which is an engineering renewable energy school located in Cotonou (Benin). Prior to his current activities, Prof Yao Azoumah served as energy engineering professor at 2iE (located in Ouagadougou, Burkina Faso) where he established and led, for many years, the Laboratory of Solar Energy and Energy Efficiency. He is author of several scientific papers related to renewable energy fields.

Contact: yao.azoumah@gmail.com

Hybrid power system for decentralized rural electrification in Africa
Daniel Yamegueu
International Institute for Water and Environmental Engineering (2iE), Ouagadougou, Burkina Faso

Abstract
Most rural areas and in particular those of sub-Saharan African (SSA) region do not have access to electricity. Indeed, in most of the cases, less than 5% of the population of these areas can benefit of advantages linked to electricity. To provide electricity in these areas by increasing the scope of the electrical grid is often costly and has challenges. Therefore decentralized hybrid renewable energy systems (HRES) can be the best solution. However, various aspects and problems must be taken into account when the major discussion is about the optimization of a stand-alone hybrid system. Placement, optimizing operation costs, reliability, unmeet loads and acceptable power quality are some of these problems. In general these problems are linked to the design and control strategy of the system.

This course first presents the energy situation in Africa and particularly in sub-Saharan Africa region. Second, the main technologies used in rural electrification in sub-Saharan Africa countries are presented. Hybrid renewable energy systems are then presented and their advantages are pointed out through a case study.

Biography: Dr. Daniel Yamegueu

Dr. Daniel Yamegueu has a Master of Science degree and a Doctor of Philosophy degree in energy Engineering. He is Assistant Professor in Energy Engineering at the International Institute for Water and Environmental Engineering (2iE), Burkina Faso. Since 2012, he researches and lectures at 2iE. He has been the adjunct director of Education in charge of the Bachelor Degree and since 2014, he is the head of Laboratory for Solar Energy and Energy Savings (LESEE) at 2iE. Dr. Yamegueu's research is actually mainly focused on solar PV and hybrid energy systems. He was co-applicant of the proposal submitted at VolkswagenStiftung seeking for funding of SE4A schools.

Contact: dan.yamegueu@gmail.com / daniel.yamegueu@2ie-edu.org

Energy in nexus context-analysis (energy-water-food security-climate change mitigation)
Driess Zejli
National School of Applied Sciences-Kenitra, Morocco

Abstract
The sustainability of food, energy and water is vital for human life but it is negatively affected by an unprecedented and emerging combination of pressures, threatening environmental and social systems beyond critical thresholds.
The global human requirement for these natural resources is expected to increase substantially with the increase in world population that is projected to reach 9.6 billion by the middle of this century. In addition, climate change will have a huge influence on water and food availability.

Until recently, the three natural resources and climate change have been viewed as separate and distinct. However, all the four sectors are dependent on each other and all are highly interconnected; an approach newly called the Water-Energy-Food-climate change Nexus. The idea of the Nexus was popularized by the Bonn Conference held in 2011 in preparation of the United Nation (UN) Rio+20 Conference.

Biography: Driss Zejli

Driss Zejli started his professional activities as researcher in the National Center of Scientific and Technical Research (CNRST-Morocco) in 1986. He was co-founder of the Unit of Renewable Energy Economy and Technologies (TEER) at the CNRST in 1995. He headed this unit from 2005 to 2014. In September 2014, he moved to the National School of Applied Sciences (ENSA-K). He was Chair of the NGO named “Moroccan Society of Renewable Energy Development” (SMADER) from March 2013 to March 2016. He is author and co-author of many papers, conferences and books on both renewable energies and renewable energy powered desalination. He organized and co-organized many meetings.

His main research interests are in solar energy, wind energy, renewable energy powered desalination, energy-water nexus, economic aspects of renewable energy and energy policy.

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Design, Simulation and Control of a Hybrid Solar-Mini Hydro Renewable Energy System

Emmanuel Tanyi, Ndeta Beuma’a and Chu Donatus
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Abstract

Small-scale hydro-electric systems, driven by waterfalls, are low cost solutions to the problem of rural electrification in some African communities. A 50KW hydro-electric system, designed to supply electricity to a village, can cost as little as 20% of the cost of a solar system of the same capacity.

But when the hydraulic head from the free-falling water is not sufficient to provide all the power needed by the community, a hybrid combination of solar and hydro resources becomes necessary. The design of such solar-hydro systems poses problems of optimization and Automatic Control. The solar component must be optimally designed to provide the smallest possible power output needed to supplement the output of the hydro-electric generator. This optimizes the overall cost of the hybrid system. The Automatic Control system monitors the solar and hydro sub-systems, schedules the power outputs of the two sub-systems, primes the set points of the hydro-electric generator, stabilizes the hydro-electric generator when the hydraulic head fluctuates and displays useful information about the two subsystems, in real-time.

After designing hybrid systems, its operation must be simulated to ensure that all design objectives are satisfied. This is a necessary prelude to the construction of the hybrid system. In this project, LABVIEW is used for the simulation and control of the hybrid system.

This paper discusses and illustrates these issues of design, simulation and control, within the context of the rural electrification of some villages in Cameroon.

Keywords: Hydro-electric Generator, Rural Electrification, Hybrid Systems, Automatic Control, Cost optimization
The Challenges of Hybrid Renewable Energy for Rural Electrification: Sustainability, Control and Cost
Emmanuel Tanyi, Musong Louis Katche and Tounsi Foku Willy
Faculty of Engineering and Technology, University of Buea, Cameroon
Email: emmantanyi@yahoo.com, musonglouis@yahoo.com, willysytis@gmail.com

Abstract
Rural electrification is an urgent problem in the development of Africa. In many African countries, the electricity grid is limited to the urban centers, leaving the rural populations with no electricity.
For quite some time now, many researchers and stakeholders have recognized that Renewable Energy is the solution to the problem of rural electrification. But the pace of rural electrification is still very slow. For many rural inhabitants the hope and promise of their salvation through Renewable Energy have not yet become a reality.
The slow rate of rural electrification is due to the challenges associated with the deployment of community-scale Renewable Energy systems. The greatest challenge is cost. Solar energy, which is the most abundant resource, is still very expensive to deploy on a community scale. This has led many designers to consider hybrid combinations of resources as design options.
But Hybrid Renewable Systems bring other challenges. The primary challenge is cost optimization. A hybrid system is only justified if the combined cost of its subsystems is lower than the cost of a solar system providing the same power output. This is a design constraint for all hybrid combinations: solar-wind, solar-hydro and solar-biomass. In addition to this constraint, solar-biomass hybrid systems pose the problem of sustainability of the biomass resource. Solar-hydro hybrid systems pose the problem of automatic control of the hydro-electric generator to maintain transient stability against fluctuations in hydraulic head. The problem of transient stability is also encountered in solar-wind hybrid systems when there are fluctuations in wind speed.
This paper discusses these challenges and illustrates them with practical examples from the rural electrification of some communities in Cameroon.

Keywords: Renewable Energy, Rural Electrification, Hybrid Systems, Automatic Control, Cost optimization, Sustainability

Biography: Prof. Emmanuel Tanyi
Professor Emmanuel Tanyi is the Dean of the Faculty of Engineering and Technology of the University of Buea, in Cameroon. He has been active in engineering training in Cameroon for thirty years and has made significant contributions in shaping Engineering Education in the Cameroon Higher Education system. He has held several academic and administrative positions, including Head of Department of Electrical and Telecommunications Engineering at the National Advanced School of Engineering (Polytechnique), in Yaoundé; Director of Studies of the College of Technology of the University of Dschang; Adviser to the Cameroon Government on the Sustainable Management of Cameroon Forests and Training of Forestry Technicians and Engineers; Dean of the Faculty of Engineering and Technology of the University of Buea.

He did his University studies in England, culminating in an Honors Degree in Electrical Engineering from the University of Liverpool, in 1983, a Master's degree in Automatic Control Systems Engineering from the University of Sheffield, in 1984 and a PhD in Automatic Control Systems Engineering from the University of Sheffield, in 1988.

He has supervised over twenty PhD theses and more than forty Master of Engineering (MEng) theses and is author of scores of articles in peer reviewed journals. His current research interests include Hybrid Renewable Energy Systems and the Optimal Control of Systems. His work on Renewable Energy has led to numerous outreach activities in Cameroon. He has signed a MoU with thirty one Local Governments (Councils) in Cameroon, for the design and deployment of rural electrification systems. He has also added an urban dimension to his outreach activities, to solve the problems of
frequent load shedding and high electricity bills in some institutions. The most recent of these systems is a 5KW solar system in a boarding school of six hundred students, located in Awae, twenty two kilometers from Yaoundé. He is currently designing a 15KW Solar system for an Ophthalmology Hospital in Yaoundé. He is an active ANSOLE member and ANSOLE focal point at the University of Buea. Contact: emmantanyi@gmail.com

Theatre for Development

Maryam ABDI & Emelda Ngufor SAMBA

*Actor & Teaching Artist - Chicago, IL, USA
Department of Arts and Archaeology, University of Yaoundé I, Cameroon

Abstract

Theatre for Development is a universal theatre practice that can serve as a pedagogical tool placed in the participants’ hands. The participants are compelled to become active contributors in the creation of theatre that supports the change of oppressive or mismanaged conditions. My programming aims to raise awareness and educate by giving a voice to important societal issues that are often overlooked. I do this through the creation and development of performance pieces that serve as teaching moments for the people involved in the creative process, as well as for the audiences who view it.

This program will be a rewarding experience for the students selected for ANSOLE’s Summer School because it will give them an opportunity to marry the science they learn, as well as express themselves in an artistic manner; discoveries will be made on both intellectual and emotional levels. The project I plan on carrying out will be created and executed by the students/scientists themselves. The themes will be uniquely personal and I (& my potential team) will help facilitate the students’ thoughts.

I plan on applying the notable dramatist Augusto Boal’s technique entitled “Forum Theatre” for this workshop. With Forum Theatre, there is no separation between the spectator and the actor; instead, the *spect-actor*, a Boalian term, is compelled to become an active contributor in the creation of theatre that supports the change of oppressive conditions.

Throughout the School, we will practice therapeutic drama exercises and pivotal discoveries. I will give the students opportunities to explore their capacity to achieve their scientific dreams. The participating Students will create five to ten minute anti-model sketches that represent obstacles they face in achieving these scientific dreams. At the end of the conference, the Students will present their anti-models to the rest of their conference, who will then be given the opportunity to take part in the forum process. This means the audience will participate in the recreation of the anti-model sketches that the Students created by volunteering to improvise on stage and change the drama. This type of participatory theatre inspires forward thinking for all those involved.

Drama has the capacity to ignite change across the world. Theatre is an aspect of everyone’s life, no matter who they are. If theatre was used more as a tool for social improvement rather than simply entertainment, we would be living in a more conscious world. Who better to practice progressive theatre with than the youth, our future? They have the power to make positive change for themselves and their communities, and I would like to help bring about that awareness. I believe this type of workshop enhances the lives of young people. Theatre for Development workshops emphasize that we are all humans and we all deserve to be heard. It creates a universal language through theatre.

Biography: Maryam Abdi

Maryam Abdi is a dedicated artist, scholar, Yoga professional, and traveler who thrives in new environments. She has worked and lived abroad in Cameroon, Paris, Avignon, Mysore, Warsaw, and Tehran throughout her artistic career; she has also explored a number of travel/work destinations throughout the world. Shortly after her rigorous education as a Magna Cum Laude Double Major in Theatre and French (University of Evansville, Université Catholique de Paris), Maryam was selected among top applicants across the country as a Fulbright Scholar, researching Theatre for Development in Cameroon, Africa. After her training in India, Maryam employed her entrepreneurial skills with her own business as a private/group Yoga instructor (Goaly Yoga) in the greater Seattle area, now
in Chicago, IL. She has maintained several clients, as she naturally makes strong connections with others thanks to her bright spirit and caring nature. Maryam is interested in companies who promote international exchange, arts, social justice, women’s’ rights, energy conservation/solar energy, and above all, education. She is a natural with children and enjoys teaching kids’ swimming + lifeguarding for most summers when she's not acting, singing, or teaching her heart out.

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Biography: Dr. Emelda Ngufor Samba

Emelda Ngufor Samba is senior lecturer and Head of the Performing Arts and Cinematography Section of the University of Yaoundé I, Cameroon where she offers courses in Performing Arts. She has facilitated and co-facilitated several workshops in and out of Cameroon. Her interest and participation in Theatre for Development as a tool for bringing about transformational change in society dates back to 1997 when she first assisted in running a TFD workshop on early pregnancies, forced marriages, and the education of the girl child. Since then this interest has taken her to rural communities, centres for the disabled, rehabilitation centres for juveniles, prisons, secondary schools and universities where she has challenged workshop participants and later on audiences to rethink their present situations and dare alternative approaches to resolve existing problems. She has written numerous research papers on Theatre for Development and her book, Women in Theatre for Development in Cameroon, Participation, Contributions and Limitations, highlights her interest in different societal issues and how she has used TFD to address them. Presently she is researching on David Cooperrider’s Appreciative Inquiry as an alternative approach to Theatre/cinema for Development as opposed to the problem-posing approach that TFD practitioners have adapted from Paulo Freire. No Bills with the Sun a play on solar energy was the outcome of her first TFD workshop on renewable energy, a workshop that took place at the University of Yaoundé I during ANSOLE DAYS, 2010. Her interest has also extended in developing a concept for Cinema for Development practice in Cameroon.

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A Multi Hybrid Energy Lab for model based training and applied research: Fuel Cell - PV - Wind Technologies

NadjiaThomas
Heliocentris Academia International GmbH, Berlin Germany

Abstract:

Multi Hybrid Energy System consisting of regenerative sources like photovoltaic (PV), a generator (electrolyze and fuel cell), battery storage and a programmable load provides a versatile base to study the components and a manifold of decentral and autarkic energy systems.

The didactic approach for advanced training and applied research seamlessly integrates the three essential steps of knowledge gaining; providing a turnkey solution: observation and measurement, modelling and curve fitting to derive a quantitative description of the components solar cell, battery and fuel cell, application in PV simulation, battery state-of-charge (SoC) calculation and operating point visualization on characteristic curve.
Tailored tools ease the use of advanced data analysis functions like curve fitting. On system level arbitrary PV, generator and load profiles allow for studies on dimensioning and energy management (e.g. battery cycling) while the operating state (battery, generator or boost) is visualized by a real time energy flow diagram (Sankey). An application programming interface (API) allows for individual applied research applications, like user defined energy management algorithms (e.g. applying the SoC).

Biography: Ms Nadjia Thomas
Ms Nadjia Thomas has roots from Algeria. She is Sales Manager EMEA/APAC at Heliocentris Academia International GmbH, Berlin Germany. The company is specialized in Multi Hybrid Energy Lab for model based on Training and Applied research in Fuel Cell, Photovoltaics and Wind Technologies.
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Global Change & Challenges: The Transformation of the Energy System and the Key Role of Plastics
Reinhold W. LANG
Institute of Polymeric Materials and Testing, Johannes Kepler University Linz/Austria

Abstract
To identify some of the key technological challenges from a global perspective, reference is made to the Sustainable Development Goals 2030 (SDGs), adopted by the UN General Assembly in September 2015. As addressed explicitly in SDG 7, but also pervading numerous other SDGs, a key aim is meeting the needs of the growing global population for affordable, clean energy. In this context it is now increasingly acknowledged that the transformation of the current fossil fuel and nuclear based energy system to an energy system substantially-to-fully based on renewable resources within the next decades is at the core of any future Sustainable Development path. While numerous questions remain regarding the required future energy technology mix along with the underlying material technologies driving needed innovations, it is quite obvious that the selection of adequate materials is of prime importance for the entire energy transformation chain in general, and for the primary conversion of solar energy into electricity or heat in particular.

In his lecture, Professor Lang will argue that any advanced or accelerated deployment of renewable energy technologies will depend on (1) a new perspective on the energy system according to the methodological principles of “Inversion – Integration – Innovation”, and (2) substantial contributions from materials science and in particular from polymer science and the polymer industry. To accelerate the penetration of polymers in such technologies, at least four innovation goals must be met: improved functionality and performance, enhanced cost effectiveness, guaranteed quality and durability, and robust/multifunctional and attractive design. By exemplifying these innovation goals with case studies, the presentation will explore the current status and the prospects of such technologies based on plastics. Considering these perspectives, some consequences and implications for academic education and research in engineering sciences will be deduced. These will also be addressed in context with SDG 17 (“Partnership for the Goals”) in specific relation to Africa/Europe partnerships. Reference will be made to specific examples of Africa/Europe collaborations in the renewable energy field, demonstrating that such collaborations in science and education may be of great mutual benefit.

Biography: o. Univ. Prof. Dipl.-Ing. Dr. mont. Reinhold W. Lang
Professor Lang graduated in 1978 at the University of Leoben (A) with a Dipl.-Ing. degree in Polymer Engineering and Science, and he obtained a PhD degree in 1984 at Lehigh University (USA). He then joined BASF AG (D) from 1984 to 1991, holding a research and group leader position in the field of advanced composites. In 1991 he became Full Professor at the
University of Leoben (A). Acting also as Director of the Polymer Competence Center Leoben (PCCL) from 2002 to 2008, he had a leading role in establishing and developing the PCCL to about 100 employees. Since September 2009 he holds the Chair of Polymeric Materials and Testing at the Johannes Kepler University (JKU) Linz (A), also heading the institute with the same name. The research focus of Professor Lang is in the fields of “Mechanics, Fracture and Fatigue of Plastics and Polymer Composites” and “Polymeric Materials & Sustainable Development”. He is author and co-author, respectively, of more than 230 papers. In his role as initiator and coordinator of large, multi-partner collaborative research projects (science and industry), he has successfully applied for and directed a publically funded research budget of about EURO 65 Mio. over the past 15 years. Thus he currently acts as Project Director of the Austrian research project platform SolPol, focusing on polymer related innovations for solar technologies.

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The Global Environment and Sustainable Societies: The Greening of World Society
Veronika Wittmann
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Abstract
For most of the 20th century the common-sense division of academic labour was taken for granted: Natural scientists investigated the non-human world. Social scientists concentrated on people and societies. However, by the 1980s things were changing as knowledge of global environmental problems emerged, and it has become clearer that the fate of the natural and social worlds is inevitably intertwined.

By the 1980s, more people thought globally. More problems were recognized as intrinsically global. More civil society organizations spread globally. More institutions operated globally. In that process, environmentalism as a global force unsettled old ways of doing things: it helped crystallize a global field, in which individuals and states related to both the system of states and humankind itself.

Globalization unfolds in part through a contest of world images. How groups of people define the global situation has real consequences for the way they live in it. It applies especially to global environmentalism, a branch of which now prospers and a worldview very different to the one that sustained much of globalization thus far.

Whereas, conventional globalization relativizes individual and society in relation to a larger human setting, radical environmentalism relativizes human world society itself in the context of the earth as ecosystem. That dependence is an integral part of global consciousness. From 19th century roots, environmentalism has grown into an influential global movement. Its ecological results may be mixed at best, but as a social innovation reshaping world society it has already had a major impact.

Biography: Prof. Veronika Wittmann
Veronika Wittmann works as an Associate Professor for Global Studies at the Department of Modern and Contemporary History at Johannes Kepler University Linz, Austria.

She was enrolled in the PhD Programme of the Austrian Academy of Science 2000-2001 and was a Junior Visiting Fellow at the Institute for Human Sciences in Vienna 2000-2001. She also worked at the United Nations (UNDP) in Ecuador in 2002. She has undertaken several field research works in Sub-Saharan Africa, e.g. Zimbabwe 1997 and South Africa 1999-2000. She received her venia legendi for Sociology at Johannes Kepler University Linz in 2013.

Her research areas include World Society and Globalization, Gender and Development Studies (focus on Sub-Saharan Africa).

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Energy Saving in Air Conditioned Buildings in Tropical Regions
Yezouma Coulibaly
International Institute for Water and Environmental Engineering (2iE), Ouagadougou, Burkina Faso.

Abstract:
Energy saving is a major challenge for buildings in Tropical regions like some African countries, mainly due to air conditioning and some other energy consuming equipment. Usually air conditioning represent 60 % or more of the energy consumed in air conditioned buildings. The two other items of energy consumption being lighting and computer equipment. Water heating is also a challenge for must hotel buildings mainly. This course is meant to introduce trainees to some of the techniques of energy saving in buildings regarding these challenges. The course covers energy conservation methods for buildings including:

- air conditioning,
- lighting
- water heating
- office equipment

The energy conservation is analyzed with particular emphasis on techniques for reducing energy costs. Trainees learn how to evaluate energy system performance, improve energy efficiency, and demonstrate cost savings attainable through energy conservation.

Biography: Prof. Yezouma Coulibaly
Prof Yezouma Coulibaly devoted his professional career to training and research at the International Institute for Water and Environmental Engineering (2iE) where he started as a lecturer and researcher since 1985. Since then he has been successively appointed: “Study Inspector”, Head of the department of Energy for Rural Development, Head of the department Infrastructure of Energy and Sanitation Engineering, head of the Training and Research Thematic Unit “Energy and Industrial Engineering” at 2iE. Currently he is the scientific advisor to the General Director of 2ie since June 2014.

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Challenges of renewable energy supply from a landscape ecological perspective
Rainer Waldhardt
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Abstract
In contrast to other species, humans depend on the production and availability of human-made energy which is finally added to a certain amount to the global system. Depending on the quality of the energy sources (e.g. fossil, nuclear or renewable), the human-made energy has induced a multitude of direct and indirect effects on nature and the environment on local to global scales. Thus, many factors and measures need to be considered in the ecological evaluation of such effects. To some extent, evaluations are hindered by e.g. time-lag processes, spatial and functional distances between the affected ecosystems and the sites of energy production, ecosystem resilience, and appropriate reference systems. In this regard, integrative and multi-scale approaches are challenging in landscape ecology.
In the lecture, such challenges will be addressed focusing on renewable energy supply chains based on the energetic use of biomasses, wind, water and sun. Examples from different parts of the world will be presented and discussed, and both empirical research and modeling will be considered.

Biography: Prof. Dr. Rainer Waldhardt

Prof. Dr. Rainer Waldhardt is senior scientist in the Institute of Landscape Ecology and Resources Management at the Research Center for Biosystems, Land Use and Nutrition (iFZ) and member of the Center for International Development and Environmental Research of Justus Liebig University Giessen (Germany). His research focus is on the ecological evaluation of former and current land use and the development of sustainable land use options, including those based on renewable sources of energy. In several national and international, interdisciplinary research projects funded by the German Research Foundation (DFG) and the Volkswagen Foundation he has studied and modeled relationships between land uses and land use patterns, consumption of resources, and ecosystem services on local to regional scales.

Additionally, Prof. Waldhardt has contributed to the implementation of renewable energy projects at the local to regional scale in Germany, especially in the context of the energy provision in bioenergy villages.

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A short introduction to the terminology and technology of photovoltaics

Elif Arici-Bogner
Energy Institute, Istanbul Technical University;

Abstract
The main motivation in academic studies for photovoltaics today is to combine high solar energy conversion efficiencies together with low cost technologies. Because of the high material consumption in solar panels, further important factors to judge the sustainability of a future photovoltaic technology are the carbon footprint and the availability of materials.

In this lecture, a short introduction to the terminology and technologies of photovoltaics will be given. The topics include, basic functional principles of Si-solar cells, efficiency enhancement strategies and the motivation behind the development of thin film solar cells. As an example for thin film solar cells, advantages and disadvantages of CZTS thin film solar cells will be discussed, in detail.

Biography: Prof. Elif Arici-Bogner

Her activities in the material sciences are characterized by coming in contact with the deficits of opto-electronical devices and trying to address these problems using blends of inorganic nanomaterials embedded in polymer matrices for device optimization.

She studied chemistry and material sciences at Philippus University, Marburg, Germany. Finishing her post-doc studies about organic-inorganic hybrid solar cells at Linz Institute for Organic Solar Cells (2000-2004), she was working as senior researcher at SIEMENS, Corporate Technology, Erlangen, Germany to create new concepts for light emission. 2008-2011, she took an Elise Richter Position at Johannes Kepler University to develop white light emitting diodes. Currently, she is working at Energy Institute, Istanbul Technical University on research and development for low-cost, solution processable CZTS solar cells. She is supervising also young companies in terms of project acquisition and management in related topics. She has 15 patents and over 30 publications in scientific journals.

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Overview on Renewable Energies Sources in Central Africa
C. V. Aloyem Kaze, R. Tchinga

Abstract
Central Africa (Cameroon, Chad, Congo Brazzaville, Equatorial Guinea, Central Republic, Gabon) is one of the regions in the world where the rate of access to electricity is still low. The inaccessibility of this energy leads to an economical delay in this region. Black gold (petrol) flows abundantly in this region but can’t glow due to a decrease in the price on the market. This situation has led to a serious economic crisis in certain countries like Equatorial Guinea, and Chad with the risk of compromising to a serious economical delay. Meanwhile, we can find important sources such as hydraulic, solar and forestry. At the end of the COP 21 conference in Paris, one of the major resolutions was the development of new sources of renewable energy in order to meet up our energy needs and to fight against global warming. According to the report of «Global Status Report 2017», the portion of renewable energy in the world’s energy production in December 2016 is about 24.5% and is distributed as follow: 16.6% for hydroelectricity, 4.0% for wind energy, 2.0% for bioenergy, 1.5% for solar photovoltaic and 0.4% for geothermal energy and the rest. Analyzing energy mix in every country of the region, with more than 48 million inhabitants living in a surface area of 2.7 million square kilometers, reveals the inexistence of an Energy Efficiency Policy, Energy Storage Policy and finally no Master Plan in Renewable Energy capable of defining with precisions the existence of renewable energy potential. We also have a lack of qualified workers to transform the existing resources. This work is aimed at presenting the state of Renewable Energies in Central Africa and recommendations for an optimal exploitation for the socio-economic development of this community.

Keywords: Overview; Renewable Energy; Master plan; Economic development.

References
REN21 Renewables 2017 Goal Status Report

Biography: Dr Vidal Aloyem Kaze
Dr. Aloyem Kaze is a Cameroonian born in 1972. He is married and father of five children. He received a PhD from the University of Dschang, Cameroon in 2012. He is the author of many publications in the fields of thermodynamics and exergy. He is interested in renewable energy, especially in the conversion of solar energy. He lectures at Bambili Higher Technical Teacher Training College, University of Bamenda, Cameroon, and is the National Representative of ANSOLE in Cameroon.

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Integrated Sustainable Development Pilot Project Proposal (ISD-3P), In Mayo-Darle Old Tin Mine Banyo, Adamawa Region Cameroon
Emmanuel Ojong
GMIE-Consult Sarl B.P 646 Limbe, Cameroon
Abstract
Sustainable development instruments can be applied retroactively to attenuate the negative impacts of post-mining environmental damage by harnessing same to create a platform for fostering the empowerment of enclaved and disfavored people through hands-on work and research stations, to forge new pathways towards achieving sustainable lifestyles, greener livelihoods, communities and elevated quality of life.

The project proposal takes a holistic approach by taking into consideration community groups, cardinal sustainable development goals, the ENERGY NEXUS, renewable energy, water, environment, food security, education, health, tourism and others.

The project concept is based on revival of abandoned mining space, by rehabilitating remnant Infrastructures and assets therein to constitute the ISD-3P platform centre. Mayo-Darle, a celebrated but now abandoned old tin mining concession in the South Eastern tip of Adamawa Region of Cameroon, possesses most of these parameters and has been used as a mock case study for this proposal. The ISD-3P’s versatile framework makes it amenable to application in most post-mining environments and to larger non mining target areas to serve as nucleus for inducing and disseminating sustainable development culture.

Though damaged and scared by 20th Century profit centered mining practice, the old tin mine still retains its six square kilometers of concession area, a network of motor able roads, twin lakes and dams, two camp sites, some houses, seven streams and native Fulani herdsmen and a nearby village community.

These basic infrastructures will be rehabilitated to inhabit a mosaic of inter-dependent research and demonstration work stations that specialize each in a cardinal aspect of the sustainable development matrix, water, renewable energy, food security, education for sustainable development, health, animal husbandry, fisheries, tourism, agriculture and small scale tin mining.

The ISD-3P essentially aims at bringing new life to an old mining locality that has wayned and shut down for more than 40 years. If the attractiveness of Mayo-Darle was centered in the past upon mining tin mineralization which drew investors from Europe, workers from Congo, Central African Republic and the different regions of Cameroon, then the new ISD-3P platform will similarly become a regional beacon for inculcating and disseminating sustainable development ideals.

Biography: Dr. Emmanuel Enowfor Ojong
Dr. Ojong has an MSc in Mining Geology from Leicester University U.K and a PhD in Mineral Resources Engineering Economics from the Imperial College of Science, Technology and Medicine London. He took a part-time lectureship at the Department of Geology and Environmental Sciences, University of Buea. He Created and Managed a Professional Masters Programme in Management of Environmental and Mineral Exploitation Systems in Partnership with Académie Franco-Américaine de Management AFRAM and the African University of Management AUM in Libreville Gabon. He is now CEO of Geology, Mines, Industries and Environment, GMIE-Consult Ltd. He was head of a multidisciplinary team of experts for Environmental Impact study of the Mobiling Diamond and Gold Exploitation Project in Yokadouma in the Eastern Region of Cameroon. He was appointed Chargé d’Etudes (Chief of Service) in charge of research at the Department of Industries, Ministry of Industry, Mines and Technological Development Cameroon. He was appointed Chief of Service for Mines and Geological activities in the South West Region of Cameroon, in charge of HSE at National Refinery SONARA.
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Sizing, Design and Technology Selection for PV Isolated Communities powering
Angeles López-Agüera
University of Santiago de Compostela (USC) and Chairman of the CLRLA-UNESCO. Santiago de Compostela, Spain.
Abstract
The basis for achieving the best compromise between performance and cost in a PV system are an appropriated technology selection, an accurate sizing and an optimised installation design. The performance of most common PV panels production technologies available on the market will be analysed as well as the associated degradation processes, both natural and lack of maintenance related. As a result, a most efficient technologies map according to the climatic characteristics of each African region will be presented. Besides, sizing methods based on loss of load probability (LLP) will be introduced and compared, in term of global performance, with the most common sizing methods. Finally, the most efficient PV system design will be explored. Social, economic and geographical users comport will be considered during the design selection. A decision table protocol will be analysed crosswise some examples based on existing projects selected for its validity for the African continent.

Biography: Prof. Angeles López-Agüera
Angeles is full Professor at the University of Santiago de Compostela (USC, Spain) and Chairman of the CLRLA-UNESCO. Member of the International Panel for Climate Changes, she led the Sustainable Energy Application Group (SEAG) at USC and the Energetic Systems Characterization Laboratory (LACEM). She has been Dean of the Physics Faculty at USC, Associated Research at CERN (European Centre for Nuclear Research, Geneva), Coordinator of Master on Renewable Energies and Sustainability USC and Associated Professor at the Padova University (Italy). In her CV are more than 290 international publications, 32 international financed projects, 12 doctoral theses, 45 graduated theses. Her field of research are the design and implementation of Sustainable Communities, the development of adequate technologies and the PV optimized installations.
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Solar Thermal Energy: Case Study in Tunisia
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Abstract
Tunisia is a small country located in Northern Africa sharing borders with Algeria and Libya. Tunisia is an energy-dependent country with modest reserves of oil and gas. About 97 percent of the total energy is produced from natural gas and oil, while renewable energy contributes to only 3 % of the energy mix. The main energy sources used in Tunisia are mainly petroleum products and natural gas. Few rivers could be harnessed for hydropower generation. Tunisia is building other conventional power plants and developing its solar and wind capacities to support economic development.
At present, renewable energies play a minor role in the energy supply. However, the use of solar energy for thermal purposes is very widespread in Tunisia and can be considered as an example of success. On the initiative of the Ministry of Industry and Technology and the National Agency for Energy Management (ANME: Agence Nationale de Maîtrise de l’Énergie), it was decided to launch the National Solar Thermal Promotion Program (PROSOL: Programme National de Promotion du solaire thermique), establishing a financial mechanism to develop in a sustainable manner the market for solar water heaters in the residential sector. Since its launch in 2005, the installed capacity has been more than 600,000 m² in 2014.
According to the Tunisian Solar Plan and other sources, renewable energy (RE) and energy efficiency increases in Tunisia will generate additional employment for between 7,000 and 20,000 people until the year 2030. There are currently 3,391 people employed in the renewable energy and energy efficiency sectors. An economic study suggests that the energy efficiency within buildings generates the most employment, followed by solar water heaters and PV installations and finally by wind energy and Concentrated Solar Power (CSP).
References
Société Tunisienne d’Électricité et de Gaz (STEG).
Agence Nationale de Maîtrise de l’Énergie (ANME).

Biography: Prof. Amel Ben Fredj Romdhane
She is a professor at the Faculty of Sciences of Tunis, University of Tunis El Manar, Tunisia and member of the Laboratory Advanced Materials and Quantum Phenomena. Her research is concerned with theoretical and experimental investigation of magnetic field effect on the delayed fluorescence and photoconductivity, in molecular crystals. Photophysical and electrical properties of organic materials, such as molecular crystals and polymers as solutions and thin films. She focuses in particular on the intermolecular inter and intrachain interactions (H and J aggregates), the processes of energy transfer in singlet excited states and exciton diffusion.
Magnetoresistance effect in organic semiconductors, for magnetic sensor applications. She is a co-founder of ANSOLE.
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The International Year of Global Understanding
Benno Werlen
Friedrich-Schiller University Jena, Germany

Abstract
Global thinking and global action demand global understanding. The IGU Initiative for an International Year of Global Understanding (IYGU), proclaimed by the international councils for the Natural, Social and Human Sciences, aims to bridge the gap in awareness and knowledge between local acts and global effects through research, education, and information.
The IYGU recognizes that global social and climate changes require a global level of understanding. It provides information on culturally differentiated sustainable actions to reach global sustainability. And most of all: it develops a blueprint for a new geographical view of a radically changing world.
Every day we all experience how globalization has brought and is bringing far-flung places and people into ever-closer contact. New kinds of supra-national communities are emerging at an accelerating pace. At the same time, these trends do not efface the local. Globalization is also associated with a marked re-affirmation of cities and regions as distinctive forums of human action. All human actions remain in one way or the other regionally and locally contextualized.
The IYGU addresses the ways in which we inhabit an increasingly globalized world. Everyday geography-making is essential for the constitution of geographical realities. Our world faces social, cultural, and economic change, as well as a changing climate. Human actions play a key role in creating such worldwide challenges. However, human actions also provide solutions. If individuals know what their day-to-day routines mean for the planet, they can take appropriate action to help overcome global challenges.
The IYGU wants sustainable change that starts from the bottom and thus focuses on essential daily activities such as eating, drinking, housing, working, travelling, and communicating. Why do we make the choices that we do? Which societies make more globally sustainable choices? Natural and social scientists will jointly provide answers.
Ultimately, the IYGU encourages everyone to make daily decisions in the light of global challenges.
The presentation highlights the IYGU’s action program and its network, the latest significant achievements, and how one can become an active part of the first international year proclaimed by the international councils of the natural, social, and human sciences.
Biography: Prof. Benno Werlen

Benno Werlen, PhD (*1952) is known as the founder of the action centered geography and the geography everyday regionalizations. He is considered to be one of the most influential German-speaking geographers. Currently he is the chairholder for Social Geography at the Friedrich Schiller University Jena since 1997. He holds degrees from the Faculties of the Humanities, and Natural Sciences and worked at the Universities of Kiel, Fribourg, and Zurich, and was a guest professor at the universities of Salzburg, Geneva, Nijmegen, and the ETH Zurich. He has been a visiting scholar at the University of Cambridge (King’s College), the London School of Economics and the University of California, Los Angeles (UCLA).

As a ‘key thinker on space and place’ (Sage 2011), he published widely on society-space relations under globalized conditions. He served as a panel member for the European Research Council for Advanced Grants (2008-15), the French National Research Agency (ANR) in the field of Social and Human Sciences (2008-12), as Chair of the IGU Commission ‘Cultural Approach in Geography’ (2004-16). Currently he is a Member of Council of the Taihu World Cultural Forum (China) as well as chair of the IGU Commission ‘Global Understanding’. He has published more than 15 books published in several languages and more than 200 papers in scientific journals and books, has given over 200 keynote presentations at universities across five continents in the fields of geography, sociology, economics, political sciences, philosophy, history, cultural anthropology, and linguistics, and organized more than 50 scientific conferences and conference sessions on all continents.

Benno Werlen graduated from the faculty of humanities in Geography (Fribourg 1980) with a dissertation on the critique of ‘Functionalism in Geography, Social Sciences and the Humanities’. In addition to geography he studied ethnology, sociology, and economics, and began his academic career as a geographer in 1980 at the faculty of natural sciences at the University of Kiel (Germany). He primarily worked on an action-centered and space-oriented scientific research approach. The widely acclaimed book ‘Gesellschaft, Handlung und Raum’ (Steiner 1987, 3rd edition 1997), published in English translation as ‘Society, Action and Space. An alternative Human Geography’ (Routledge 1993). The most recent book publications are ‘Global Sustainability’ (2015, Springer) and ‘Knowledge and Action’ (Springer 2017).

He is the founder and executive director International Year of Global Understanding approved by the General Conference of UNESCO in November 2013 and proclaimed by the three major science councils of the Human (CIPSH), Social (ISSC) and Natural sciences (ICSU).

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Development of Organic Solar Cells with High Efficiency and Stability

Dr. Sarah Holliday, Prof. Christine Luscombe

Clean Energy Institute (CEI) and Materials Science & Engineering Department, University of Washington, Box 352120, Seattle, WA 98195-2120, USA. smgh@uw.edu

Abstract

Emerging solar photovoltaic technologies such as organic and perovskite solar cells offer great potential for manufacturing high-efficiency solar cells via ultra low cost, roll-to-roll printing methods. This can be of great benefit in terms of deploying solar energy globally, but in particular for many African nations who are able to leapfrog conventional fossil fuels in favour of renewable alternatives. Several steps are needed to take these technologies from the initial research phase to market readiness. Specifically, the devices must combine high efficiency, long-term stability and low-cost to be commercially viable. Our research incorporates all these aspects, including detailed investigations into the factors that contribute to the photochemical degradation of organic solar cells. Based on these findings, we are developing new materials combinations and processing conditions that can deliver high efficiencies whilst greatly enhancing the device stability. The recently launched Washington Clean Energy Testbeds at the University of Washington offer users the opportunity to prototype large
area, roll-to-roll printed solar cells and battery materials, reducing the barrier to turning science and engineering discoveries into market-ready technologies. These facilities will allow us to transfer our knowledge of the degradation process in organic semiconducting polymers in order to develop a technology that maintains high efficiency whilst reducing the cost of production and increasing the operating lifetime.

Biography: Dr. Sarah Holliday
Sarah Holliday is a postdoctoral researcher in the Materials Science & Engineering Department and Clean Energy Institute at the University of Washington, Seattle. She carried out her PhD at Imperial College London, UK, where she developed a new generation of non-fullerene acceptors for organic solar cells. She is now working in the group of Prof. Christine Luscombe studying the factors that affect the stability of organic solar cells, as well as investigating new ways to improve the performance of CZTSSe solar cells through nanoparticle ligand manipulation. She is interested in all aspects of scaling up low-cost, printable solar energy technologies and is looking to engage in cooperation with colleagues in Africa in order to build potential collaborations in solar energy research. She recently became a member of ANSOLE. Contact. sarahgeneste.holliday@gmail.com.

Materials Design in Organic Solar Cells
Daniel Ayuk Mbi Egbe
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Abstract
The first part of the lecture focuses on generalities about organic semiconducting materials for opto-electronic applications followed by materials design methods geared at obtaining efficient materials for organic solar cells applications.¹
In the second part of the lecture, the focus will be laid on photoactive materials emanating from my research, which are widely known as poly(arylene-ethynylene)-alt-poly(arylene-vinylene)s (PAE–PAVs).² The systematic study of side chains effect on photovoltaic response of this class of materials will be presented and discussed.

Acknowledgement: FWF is acknowledged for financial support through grant N° I 1703-N20

References

Daniel A. M. Egbe
African Network for Solar Energy, Ebertstr.14, 07743 Jena Germany
Abstract
The principle of “passing on/sharing” has governed the actions of the African Network for Solar Energy (ANSOLE) from its inception till date. This presentation demonstrates the link of this principle to the Second Law of Thermodynamics based on examples from day-to-day running of ANSOLE.

Biography: Prof. Daniel Ayuk Mbi Egbe
Daniel A. M. 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). Prof. Egbe 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). In May 2015, he initiated the research platform BALEWARE (Bridging Africa, Latin America and Europe on Water and Renewable Energies Applications), which was officially launched on the 12th of December 2016 at the Nelson Mandela African Institution of Science and Technology (NM-AIST), Arusha, Tanzania.

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. He also acted as an independent evaluator of the Association of African Universities in 2015.

In the same year, he was appointed the first Distinguished Brian O’Connell Visiting Fellow of the University of the Western Cape, South Africa. In 2017 he is involved in evaluating the East African solar energy research network activities funded by the International Science Programme of the University of Uppsala Sweden. He is the initiator and director of the Volkswagen-Stiftung-sponsored “Sustainable Energetics for Africa (SE4A)” schools.

He has published more than 120 peer-reviewed articles and coauthored a book on renewable energy in Sub-Saharan Africa. He speaks more than 5 languages, and is father of 4 children.

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Abstract and Biography of Selected Participants

Recent achievements in solar drying
César Kapseu
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Abstract
Drying technologies in Central Africa are even less developed compared to the countries of North and West Africa. Also, laboratories in universities and independent organizations have set up dryer prototypes. Some have already been implemented in several sectors such as drying cocoa and coffee. Given the often difficult access to conventional electricity sources, developing countries are focusing
on improving the old conservation method, which is sun drying. Thus, traditional solar drying techniques that are disappearing in rural areas today, there are indirect (figure 1), direct (figure 2), mixed and hybrid solar dryers; Biomass dryers and a few times electric dryers.

Figure 1: indirect solar dryer with energy storage and photovoltaic feeding

Figure 2: direct solar dryer for foods

References


Biography: Prof. César Kapseu
César Kapseu holds a Chemical Industries Engineering degree from the National School of Chemical Industries of Nancy in 1983 and a PhD from the National Polytechnic Institute of Lorraine (1989) in France. Since 30 January 1984 he is a professor at the National School of Agro-industrial Sciences of the University of Ngaoundere; He was head of the Department of Chemical Engineering and Engineering from 1994 to 2006 in the same institution. He held several international positions including representative of the Saharan Africa Network Committee Process Engineering researchers applied to the Food Industry of the Agence Universitaire de la Francophonie, AUF (2000-2006); member of the Committee of Experts in Central Africa Office AUF (2000-2005); member of the Board of Section VI "bio-Processes and Post-harvest technologies" of the International Commission of Agricultural Engineering; member of the Board of the International Symposium series on Drying (IDS’); scientific advisor to the International Foundation for Science (Sweden); associate professor at the National Polytechnic Institute of Lorraine (Nancy, France); professor in the Regional Excellence Cluster Brazzaville, Congo; expert in the journal “Cahiers d’Etudes Francophones / Agricultures; regional representative of the African Network for Solar Energy in Central Africa. He has won several national and international scientific awards including the Scientific Award of the AUF (1997 Knight of Merit of Cameroon (2005); ATLAS / AAI (USA) Alumni Award 1999 Medalist Chevreul (Paris, France) in 2009 ; member of the Academy of Sciences of Cameroon from 2009, Albert Einstein Award for Excellence (ABI, USA) in 2011, Ambassador of Sciences (TWAS, UNESCO) in 2013; Officer of the Order of Merit in Cameroon 2009. He is author of 216 scientific publications, including 9 books His latest works focus on renewable energies in Sub-Saharan Africa in 2012, Cane Sugar in sub-Saharan Africa, processes and trades in 2014 and valorisation of industrial and agro-process wastes in 2015.

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Improved direct feedback linearization technique for transient stabilization enhancement of DFIG-based wind power systems
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Abstract
An adaptive direct feedback linearization technique (DFLT) more suitable for transient stability and voltage regulation of wind power systems based Doubly-Fed Induction Generator (DFIG) is investigated in this work. From the third order model of DFIG, an adaptive nonlinear controller is derived with power angle and mechanical power input assumed to be not available for measurement. Therefore, a finite time estimator for the unmeasurable mechanical input and an online computing technique for power angle and its reference are presented. Additionally, the controller proposed is computationally low demanding and takes into account structural constraints of the control input. The main feature of the proposed control scheme is its robustness with respect to major disturbances and the fact that only local information is required. Simulation results in the case of 4-machine wind power system shows that fast response, robustness, damping, transient stability as well as voltage regulation are all achieved satisfactorily.

Keywords: DFIG, Direct Feedback linearization, parameter estimation, transient stabilization, voltage regulation

References

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Dr. Nguimfack is a specialist in Electronics and Power Systems. He received a Second Cycle Technical Teacher Diploma (2005), MSc (2010) and a PhD (2016) in Electronics, Electrotechnics and Automation (EEA) from the Universities of Douala and Dschang. He is currently an Assistant Professor in the Department of Electrical and Power Engineering, Higher Technical Teachers Training College (HTTTC), University of Bamenda, Cameroon. His research interests include nonlinear control and applications to power system stability, FACTS, Energy conversion and Renewable Energy. He is author of several scientific papers related to power systems and renewable energy fields. Dr. NGUIMFACK is a member of the African Network for Solar Energy (ANSOLE).
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Effects of Dipping Cycles on the Optical and Electrical characterization of CZTS
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Abstract
For the past decades, the naturally occurring mineral of Cu$_2$ZnSnS$_4$ (CZTS) has received so much attention by many research scholars as a promising alternative absorber layer for thin film based photovoltaic devices. This is because the material exhibits outstanding desirable properties since it consists of non-toxic, abundant, inexpensive, an ideal direct bandgap of 1.5 eV as an absorber layer and high absorption coefficient greater than $10^4$ cm$^{-1}$. In this study, a two-stage combinatorial process that involve deposition of the Cu-Zn-Sn-S thin film using SILAR technique followed by a sulphurization process in a tube furnace is reported. The deposition of CZTS thin film onto a TCO glass substrate was carried out using a SILAR coating machine with stirrer at room temperature of 27±1°C and the number of dipping cycles was varied between 20 and 70 cycles at an interval of 20, 40, 60 and 70 cycles. The samples were then annealed in a tube furnace at a temperature of 550°C for 30 minutes each. The film samples were further characterized by Raman spectroscopy, XRF studies and UV-Vis spectroscopy. The optical study revealed a direct transition with a band gap energy reducing from 1.54 eV to 1.49 eV with an increase in the number of dipping cycles. It is also evident from the optical studies that the absorption coefficient of the film samples increased with an increase in the number of dipping cycles. The electrical studies showed that the resistivity of the film samples reduced with an increase in the number of dipping cycles while the conductivity of the same film samples increased with an increase in the number of cycles. From the results, it was concluded that CZTS thin film can be obtained using deposition of the Cu-Zn-Sn-S thin film using SILAR technique followed by sulphurization process in a S$_2$/N$_2$ atmosphere.

Key words: CZTS, SILAR, Sulphurization

Acknowledgement
I would like to thank University of Nairobi and IPPS for their financial support that resulted to the success of this project.

Biography: Jacinta Akoth Okwako
Ms. Jacinta Akoth Okwako received her Bachelor of Education (Science) degree in Physics and Mathematics in 2012 from the University of Nairobi, Kenya. She is currently a Physics masters’ student at University of Nairobi in Kenya working on her master’s thesis entitled “Optical and Electrical Characterization of Cu$_2$ZnSnS$_4$ deposited by SILAR Technique”. She is also an Energy Policy Master’s student at the Pan African University, Institute of Water and Energy Science (Including Climate Change)-PAUWES, Algeria. PAUWES is a program initiated by the African Union and implemented with support from GIZ and the University of Tlemcen. Ms Okwako is passionate about renewable energies, thin film materials for solar energy application and energy access with special focus in rural and remote settings. She is an active ANSOLE member.

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A way to optimize the crystalline texture of Cu$_2$ZnSnS$_4$ (CZTS) thin films for photovoltaic applications

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Abstract
In this report, the Taguchi design of experiments methodology was used to optimize the crystalline texture of Cu$_2$ZnSnS$_4$ thin films prepared by the spray pyrolysis technique on ordinary glass substrates. The optimization of the deposition process in order to improve the crystalline texture of films was performed by means of two statistical tools namely, the signal-to-noise (S/N) ratio originally proposed by Genichi Taguchi and the analysis of variance (ANOVA). Substrate temperature, deposition time, the pressure of carrier gas, Cu/Zn+Sn and Zn/Sn ratios were used as the parameters. The obtained films were characterized by X-ray Diffraction, Raman Spectroscopy, Four-point technique and UV-Vis Spectrophotometer to study their structural, electrical and optical properties. From characterization results, the XRD showed that all films have a polycrystalline structure with peaks attributed to the kesterite phase of CZTS. All films showed also a preferential orientation along the (112) axis, perpendicular to the substrate surface, and defined as a direction presenting good photovoltaic properties. The Raman spectroscopy confirmed the presence of CZTS and has also detected impurity phases identified like Cu$_x$S binary phase. By applying the Taguchi method, the crystalline texture of films were found to be enhanced when the parameters were 400°C, 60 min, 1.5 mbar, 0.95 and 1.03 respectively. The most dominant parameter was found to be the Cu/Zn+Sn ratio with a contribution of 49.6% on the crystalline texture of films.

Keywords: CZTS absorber; Kesterite; crystalline texture; Taguchi method; spray pyrolysis; optimal configuration.

Acknowledgment: Joël Hervé Nkuissi Tchognia is grateful to the ICTP (The Abdus Salam International Centre for Theoretical Physics) and ANSOLE (African Network for Solar Energy) for financial support within the framework of the Intra-African Exchange (INEX) program.

Biography: Dr. Joël Hervé Nkuissi Tchognia
Dr. Joël Hervé Nkuissi Tchognia has a Msc and a PhD in Materials Science. He obtained his PhD using the ICTP-ANSOLE INEX fellowship, which allowed him to spend 3 years at the University of Mohammed V in Morocco. As a new PhD graduate, he is Research Assistant in the laboratory of Materials Science of the University of Yaoundé I (Cameroon) and looking at the same time for a Post-doc position. Dr. Tchognia's research is actually based on Materials science for PV applications. He is author of more than 10 scientific papers related in material design for solar cells applications field and has attended to many conferences in Morocco and South Africa. He is an active ANSOLE member since 2012.
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Policy Implication in Energy Efficiency and Conservation in Building: Case Study in Rwanda.
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Abstract
Rwanda is targeting to reach 70% of energy accessibility in 2017/2018 and reducing energy losses from 23% to 10% within the same period. This articulated energy situation, target to be achieved where the country targets to reach the annual average rate 11.5% of Rwanda’s economy growth in the range 2013-2018 [1]. Rwanda as country with a high growth in economy needs a reliable and sustainable energy for continuing speed up the national’s economy. The increase in energy consumption has great effect on environment and climate which implies that strong measures on promoting energy efficiency should be taken and enforced [2]. The energy efficiency and conservation are the cheapest and fastest form of generation and also as a key player for sustainable development.
in many economies in the world. Energy efficiency is very important and cost effective of meeting energy demand for sustainable development [3].

The practice of energy efficiency in all Rwandan sectors will increase the sustainable use of our national environmental resources and then contribute to national economic growth as well as sustainable development. The energy efficiency especially in building has the ability to stimulate economic development due to the fact that it leads to saving of national income. This will be achieved by controlling energy consumption in building through the building energy audit. Reduction of building energy consumption will be achieved by setting and enforcing policies on energy minimum standard for building appliances and changing building occupants’ behaviour. Finally, mobilization, sensitization through energy efficiency practice and conservation will help to achieve the objective of reducing inefficiency building energy use. These will be done through the energy audit practice in all energy sectors consumers. The energy audit of the public building was conducted for the purpose of carrying out the building energy use and energy gap therefore the recommendations to the building users and building owner were provided in this research.

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Biography: Jean d’Amour Mwongereza
Jean d’Amour Mwongereza is final Master student in Energy Sciences Department, Energy Policy Track at Pan African University Institute of Water and Energy Sciences (Including Climate Change) [PAUWES] in Tlemcen/Algeria. He has a Bachelor’s degree in Applied Physics Department/ Renewable Energy Option from former Kigali Institute of Science and Technology (KIST). He is also Assistant Lecturer of Physics at Integrated Polytechnic Regional Centre East (IPRC-EAST)/ Kibungo-Rwanda.

Mr. Jean d’Amour MWONGEREZA’s master thesis research is actually focused on energy performance in building.

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Renewable Energy Entrepreneurship and Energy supply in Africa
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Abstract
With 600 million Africans hungry for electricity, building large power plants to supply energy to national grids is only part of the solution since the majority of all African populations live in remote areas. Moreover, the effectiveness of such model is not systemically convincing due to cost, time and means required. Off-grid is proven to be part of the best answer in addressing the crucial energy need of today’s Africa. A new breed of renewable energy Entrepreneurs is emerging in the continent; they are finding innovative solutions to the shortage of sustainable and affordable energy supply, and generating revenue at the same time.

As we continue to make renewable energies more widely available and affordable, one of the most exciting areas of opportunity becomes what entrepreneurs can contribute to the sector. Renewable energy Off-grid is poised to take off — if local entrepreneurs can get the institutional, socio-political and economical enabling environment to scale their business. However, as renewable energy African entrepreneurs seek to grow and benefit more consumers, several challenges are hindering their adventure.
This paper depicts the framework of renewable energy entrepreneurship in Africa, the challenges, opportunities and future perspectives.

**Keywords:** Renewable Energy Entrepreneurship, Africa, Start-ups, Perspectives

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**Biography: Safiatou Nana**

Ms Safiatou Nana, holds a Master in Energy Engineering from the Pan African University Institute of Water and Energy Sciences -PAUWES located in Algeria. She previously had a Bachelor degree in Electrical and Energy Engineering from the 2iE Foundation - International Institute for Water and Environmental Engineering in Ouagadougou, Burkina Faso. Miss Safiatou has recently co-founded a Youth Association called "Youth for Energy Saving", which brings together young professionals in the energy sector or other stakeholders, to act towards raising awareness of energy saving in schools, university residences and other public buildings in her country Burkina Faso. She is member of many scientific networks in the energy area including ANSOLE and is also currently running her own blog dedicated to renewable energy field at www.ener-j.blogspot.com. Contact: safiatounana@yahoo.fr

**Study and realization of a mini Solar PV water pumping/turbine system for the production of the small electricity**

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**Abstract**

Hydropower is a renewable energy source which remains the main energy source in Cameroon. In Africa, Cameroon possesses the highest hydroelectric power stations after The Democratic Republic of Congo [1]. Many parts of Cameroon are rural in nature and consequently do not have electrical distribution lines in many parts of villages and farms. Distribution line extension costs can run from USD 10,000 to USD 16,000/km, thereby making availability of electricity to small water pumping projects economically unattractive [2]. These remote villages and farms can benefit the hydroelectricity especially the micro one since they are blessed with water (rivers and ground water). However, some remote regions have river without waterfall. From that a question arises: How can we create a waterfall for the treatment by turbine action in order to generate electricity?

Cameroon has huge solar potentials which make solar photovoltaic powered water pumping/turbine system more cost effective in these areas’ small scale applications. Investing in such a system coupling solar energy and hydro-energy can provide tremendous benefit to the people of Cameroon and the environment due to its low population and its political stability. With the increased use of water pumping systems, more attention has been paid in this paper to their design and realization with turbine integrated in order to produce small electricity and achieve reliable operation. The study has been carried out in Douala-Cameroon. The direct coupled photovoltaic water pumping/turbine system realized consists mainly of the PV array, AC motorpump, a storage tank (60 litre container), a recovery tank (40 litre container), turbine, charge regulator, battery, AC generator and AC-to-DC power supply. Once the system has been assembled, some tests and measurements on the motor pump, turbine, and AC generator were done to understand the functioning of the prototype. They indicated that the
device works properly under defined specifications. This paper provides technical basis to implement such systems in Cameroon especially for parts which are far away from grid connection.

Acknowledgment
This work was done at SETMA Sarl. We thank the entire technician team for their various contributions.

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Biography: Dr. Paiguy Ngouateu
Dr. Ngouateu has completed his PhD in Energetic at the age of 28 years from Dschang University (Cameroon). He is assistant lecturer in the Department of Renewable Energy in the Higher Technical Teachers’ Training College, University of Buea (Cameroon). He has published more than 10 papers in reputed journals. Dr. Ngouateu is also a member of of the African Network for Solar Energy (ANSOLE). Dr. Ngouateu’s research is actually focused on solar PV and solar thermal energy technologies.

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Development of Nano Polymer Composites as a Spectral Solar Selective Coating Used as Paints for Solar Thermal Absorption
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Abstract
In this article, nanostructured solar selective coatings used in solar thermal collectors are explored. Nanocrystalline black cobalt oxide and black magnetite which used as a pigment doped in a thermal polymer as silicone rubber which used to improve energetic efficiency in solar $\text{Co}_3\text{O}_4 - \text{Fe}_3\text{O}_4$ nanoparticles were prepared by chemical precipitation followed by heat treatment at different temperatures. The structure and morphology of $\text{Co}_3\text{O}_4 - \text{Fe}_3\text{O}_4$ nanoparticles doped in polydimethylsiloxane (PDMS) solved in toluene were characterized by X-ray diffraction, Fourier transform infrared spectroscopy (FTIR). Elemental analysis studied by Energy-dispersive X-ray spectroscopy (EDX). Optical properties studied by UV-VIS and UV-VIS-IR spectrophotometry which showed that for cobalt oxide samples the direct band gap $E_g$ decreases with existence of silicon rubber from 2.1 to 1.9 ev. It was found also for magnetite samples the direct band gap $E_g$ decreases with excitation of silicone rubber from 2.8 to 2.6 eV.

References
Biography: Basma Abdullah Mahmoud
Basma Abdullah Mahmoud is a PhD student in the field of solar energy. She obtained her Master's degree from Benha University, Faculty of Science, Physics Department, Egypt. She also works as a physicist in the new and renewable energy department, Desert Research Center, Egypt, in the development of Egyptian desert areas by solar energy solutions.

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Aggregation control in solution through the usage of temperature, time and antisolvents
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Abstract
The aggregation of poly (p-phenylene-ethylene)-alt-poly (p-phenylene-vinylene)s (PPE-PPVs) in different solvents was studied using photoluminescence and UV/Vis spectroscopy. It was shown that through careful choice and addition of antisolvent the aggregation in the solution can be controlled by usage of temperature and the kinetics of the aggregation process. This knowledge was further used to create films and control how far this aggregation in solution can be transferred into the film.

References

Biography: Rico Meitzner
Rico Meitzner has a Bachelor of Engineering in Energy and Environmental Engineering and a Master of Science in Renewable Energies. He is a PhD student at the Friedrich-Schiller-University Jena in Germany. Before starting his PhD at the University of Jena, he was working at the Fraunhofer Center for Silicon Photovoltaics in Halle/Germany and was focusing on encapsulation and barrier materials for solar modules. His PhD is focusing on the stability of solution processable solar cells and modules. His further research interests are fullerene free organic solar cells, the aggregation of semiconducting polymers and oligomers and upscaling of organic photovoltaics.

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Energy analysis and exergy utilization in the residential sector of Cameroon
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Abstract

In this paper we present an analysis of energy and exergy utilization in the residential sector of Cameroon by considering the sectoral energy and exergy flows for the years of 2001–2010. Exergy analysis of Cameroon residential sector utilisation indicates a less efficient picture than that obtained by the energy analysis. Cooking stands out as the most inefficient end use in the Cameroon's residential sector. In 2010, the energy and exergy efficiency are determined and were respectively 58.74% and 22.63%. Energy and exergy flows diagrams for the overall efficiencies of Cameroon residential sector are illustrated and a comparison with the residential sector of other countries is also been done. To carry out this study, a survey of 250 households was conducted and the sharing of the end uses of energy was done and data were gathered.

References


Designing an Off Grid Solar Photovoltaic Energy System for Rural Health Centers: A Case Study

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Abstract

Good health and well being as well as affordable and clean energy are two vital sustainable development goals developed by the UN charter. Access to electricity is an essential technology for sustainability development and achievement of good health and well-being. In many developing countries, health conditions are seriously affected and lives are lost due to lack of steady reliable power supply or no electricity access for storage of vaccines, surgical operations and use of electrical medical equipment just to mention a few. Developing off grid renewable energy solutions customized for rural health facilities can be a trigger point for developing other health facilities.

In Cameroon where the electricity access rate is 48%, many health centres and hospitals suffer from no access to electricity or interrupted power supply. A case study is the Ntumbaw Health Centre providing health services to a population of approximately 5000 and averagely 20 patients per day. This health centre facility suffers from constant grid power failure (which sometimes last up to 3days) and this complicates nearly every aspect of health centre operations. With such huge challenges, this project which envisages the design of a photovoltaic energy system to aid as backup during power
failures will be a measure to restore health centre operations to normal and saving lives. With an average solar radiation of 4.43kWh/m2/day, a 2.35KW solar PV plant can be designed for Ntumbaw Health Centre with battery bank to attend to three days of autonomy. The estimated cost of this project (excluding labour cost) is at 14000USD. Pivoting on such a system, other photovoltaic energy systems can be designed for rural health centres in the Cameroon thereby providing stable electricity for health.

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Biography: Manjong Nelson Bunyui

Manjong Nelson Bunyui has an M.Eng in Industrial Engineering from the National Advanced School of Engineering in Yaoundé Cameroon and currently pursuing his Master’s degree (MSc) in Energy Engineering at the Pan African University of Water and Energy Sciences in Tlemcen Algeria. He has two years of professional experience as Energy and Maintenance Planner for Diageo Guinness Cameroon. His research interest includes powering health with renewable energy resources and energy and process efficiency in industries. He is a member of the African Network for Solar Energy (ANSOLE) and the International Hydropower Association (IHA).

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Determinants of household energy demand for cooking in Bamendankwe village, North-West Region of Cameroon.

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Abstract

High dependency on biomass has been associated with energy poverty in rural areas in Cameroon. The primary objective of this study was to analyze the determinants of energy demand for cooking among households in Bamendankwe village in the North-West Region of Cameroon. The study used the Household Budget Survey (HBS) and the research focused on the estimation of the relationship between the amount spent on energy by households, household income and characteristics of both the household and its environment. The results indicated that the determinants of the household energy demand for cooking were household monthly income, household size, educational level of family head, the proportion of women in a household, frequency of cooking delicacy and location of a household. The results also showed that each household spends an average of 14,320 frs of its monthly expenditure for energy purchase. Also, it was observed that the main energy demand was the utilization of firewood which constituted 71.2% of the households and only 3% for the use of modern energy sources. This shows that most of the households do not have adequate access to environmentally-friendly modern energy sources. The study recommends deliberate efforts by the government of Cameroon to intervene in addressing the adoption of less expensive modern cooking energy sources especially as the country has enormous potential of renewable energy. Lastly, the government should implement policies to allow access to private sector involvement in providing modern energy alternatives for cooking.
Keywords: Biomass, energy poverty, energy demand, renewable energy, household

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Asobo Ngonla Bertrand is a member of the North-West Chemistry Teachers Association in Cameroon and also a member of the African Network for Solar Energy (ANSOLE). Mr. Bertrand’s research is more focused on biogas production from municipal solid waste and energy efficiency.

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Power quality analysis of a standalone photovoltaic system feeding a controlled induction motor of a grain mill

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Abstract
Cereal flours represent the main food bases of populations of the cities of the sub-Saharan countries and mainly those in the rural areas in these countries. The grain mills used today are driven either by thermal motors or by DC motors. The use of AC motors in this case is limited by the lack of electric power system. If the limits of DC and thermal motors are taken into consideration, the use of the AC motors to drive the grain mills is of the interest. The photovoltaic system is proposed to be used as power system. It is therefore necessary to find strategies for inserting these motors into this power system by limiting or reducing the starting currents and the harmonics distortions generated. In the present work, the functioning of a grain mill with a motor controlled through a variable speed drive (VSD) and supplied by a photovoltaic (PV) system with battery storage under different load conditions is simulated. The current total harmonics distortions \( (THD_i) \) generated by this system as well as some electrical parameters for different scenario of motor rotation frequency and loads rates are assessed.

The grain mill load ranges for which effects of harmonics distortions on the PV system are reduced have been determined.

Biography: M. Etienne Tchoffo Houdji
M. Etienne Tchoffo Houdji has a MSc Degree in Material Sciences. He is Assistant Lecturer at the Department of Renewable Energy, The Higher Institute of the Sahel (ISS), University of Maroua - Cameroon. His teaching activities include Geometrical optics, Electrostatic, Basics of electronics and electronics practicals, Photovoltaic solar energy teaching and practices.

M. Etienne Tchoffo Houdji is an active member of the “African Network for Solar Energy” (ANSOLE) and member of the “Cameroon Physical Society” (CPS). His research activity is actually focused on the Physics of Solar Cells and Photovoltaic Systems.

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An optimized electricity supply systems of Central African countries by 2030

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Abstract

Africa is highly endowed with all forms of energy resources – both fossil and renewables. Yet, the continent is the only region in the world with the lowest access rate to electricity and clean energy for cooking. Accelerated efforts are needed if the huge energy deficit in the continent is to be closed towards meeting the development goals set in Agenda 2063 and the UN 2030 Agenda for sustainable development. Although, not a highly emitting region, The Paris Agreement on climate change provides the framework and opportunity for Africa to meet its increasing energy needs in a low carbon and climate resilient way. We investigate here, the possibilities to optimizing Central African countries' electricity supply systems using open source energy planning tool (OSeMOSYS), in order to meet the region energy demand by 2030. This is done following two different scenarios: Trade stagnation and Trade expansion Scenarios. By 2030, fossil fuels power based capacity would see a significant decrease in the share of the region total generation capacity to reach about 6%. Hydropower remains the main contributor to the electricity generation mix with up to 80% of the total share. Increased power trade within the region can generate up to 5% total cost savings and can enable countries with small electricity demand to becoming net electricity exporter with up to 50% of their production being exported.

References


Biography: Axel Nguedia

Axel Nguedia is a young MSc graduate in Energy Engineering from the Pan African University Institute of Water and Energy Sciences (including climate change). His experience as energy analyst intern at the UNECA allowed him to get in depth in data gathering, data analysis, modelling, and forecasting. He is currently co-founder of a startup e-Solutions specialized in renewable energy and energy efficiency services (www.energy-sol.wixsite.com/home).

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Synthesis and Characterisation of Organometal Chalcogenide Perovskite

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Abstract

Organometal halide perovskite solar cells have evolved in an exponential manner in the two key areas of efficiency and stability. The power conversion efficiency (PCE) reached 20.1% late last year.
Organo-lead halide perovskites are one of the most promising candidates for use in the production of next-generation solar cells. The generic perovskite structure, ABX₃, allows the synthesis of a broad range of perovskite materials by the simple modification of the building blocks A, B, and X (A = organic group, B = metal and X = halide). The preparation of solar cell materials based on methylammonium lead halides, CH₃NH₃PbX₃ (X = Cl, Br, and I), has been reported. These mixed halide systems are solution-processable and have tuneable optical properties. The optimal bandgap for single-junction solar cell materials is known to be between 1.1 and 1.4 eV. However, the bandgaps of methylammonium lead trihalide (CH₃NH₃PbI₃ or MALT) perovskites are beyond this range. In this study the bandgaps of MALT perovskites were modulated by the incorporation of chalcogenide (S, Se and Te) ions into the perovskites. The electrochemical, electronic and band-gap properties of the chalcogenic MALT perovskite nanomaterials were studied by electrochemical impedance spectroscopy (EIS), cyclic and square wave voltammetries, ultraviolet/visible spectroscopy and photoluminescence spectroscopy. The microscopic properties of the materials were interrogated by high resolution scanning electron microscopy (HRSEM), high resolution transmission electron microscopy (HRTEM) and atomic force microscopy (AFM); while the composition, particle size and structure of the materials were confirmed with X-ray diffraction (XRD) measurements.

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Biography: Dr. Milua Masikini
Dr. Milua Masikini has a MSc and a PhD in chemistry. He is currently a postdoctoral research fellow at SensorLab Chemistry Department, University of the Western Cape, Cape Town, South Africa. He is also a lecturer of Foundations and Advanced Nanochemistry in the Nanoscience MSc program at the University of the Western Cape. His main research areas are based on electrochemistry, biosensors and energy (Solar Cells). His research is focused on synthesis and characterization of Organometal Chalcogenide Perovskites. He has notable publications in reputable journals. Dr. Milua Masikini is a member of the African Network for Solar Energy (ANSOLE) for Democratic Republic of Congo, South Africa Chemical Institute (SACI) and International Society of Electrochemistry (ISE).
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Design of a Plant to Produce Methane and Organic Fertilizer from Biodegradable Municipality Solid Waste (Harare, Zimbabwe)
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Abstract
The rapid growth of population and the growing level of modernization present a significant challenge to the sustainability of our environment. The reckless disposal of solid waste in our cities poses serious environmental and health hazard. Municipal Solid waste (MSW) is a non-flowing, high solid type of waste which makes its handling and management difficult compared to other types of waste that can flow from one location to another.[1] Land filling of MSW is being practiced in Zimbabwean cities. There is however, uncontrolled anaerobic digestion at the landfills leading to the emission of methane and subsequently, fire breakouts. Anaerobic digestion has been successfully used to stabilize municipal organic solid waste and recover energy and other valuable products like organic fertiliser. The goal of the project was to exploit the opportunity presented in the MSW management and the ever increasing demand of energy by designing a plant that produces bio-methane (97wt% purity) and organic fertilizer from biodegradable MSW using anaerobic digestion. The quantitative and qualitative composition of the waste from the city of Harare was determined along with the kinetic data for anaerobic digestion of MSW. A comprehensive mass and energy balance for the process was carried out. The design focused on a cost effective digester to produce gas with 51wt% methane,
48wt% carbon dioxide and 1wt% hydrogen sulphide, a carbon dioxide scrubber to upgrade the gas produced in the digester to 97wt% methane and a conditioning section to produce fertilizer. City of Harare produces 1000 tons of waste daily and 181.1 tons is biodegradable. The design determined that 60 tonnes per day of 97wt% methane and 100 tonnes per day of organic fertiliser are the expected output from the carbon dioxide scrubber and the digestate conditioning plant respectively. A pilot plant was fabricated to ascertain the feasibility of the process.

References

Biography: Chipo Ruth Nomhle Sitotombe
Chipo Ruth Nomhle Sitotombe graduated from the National University of Science and Technology Zimbabwe with a BEng Hons in Chemical Engineering. She is currently pursuing a Master’s degree in Energy Engineering at the Pan African University of Water and Energy Sciences (PAUWES) and is in her first year of studies. Chipo is passionate about developing low cost energy solutions for Africa and energy efficiency in manufacturing industries. She is an excellent leader and the student representative of the PAUWES Energy Engineering Group. Chipo is a member of the African Network for Solar Energy (ANSOLE). Contact: chipostots.d@gmail.com

Enhancing the Solar cell Performance by CdO using Pulsed Laser Deposition as an antireflection film
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Abstract
The energy crises and the global warming due to the emission of CO2 nowadays are strong motivations for the scientists to find alternative solutions of energy and reducing the pollution coming from energy production or consumption. The most promising solution is the renewable energy e.g. solar energy; geothermal; wind energy etc. Solar energy is widely used today in different ways, getting direct electricity by using Photovoltaic (PV) or thermal energy from solar thermal concentrators that can be converted into electricity or used for heating. Also, solar energy can be used in the greenhouse applications such as water desalination. Scientists focus on increase the efficiency of the PV by using high performance materials; enhancing the electrodes. In our Lab, we are trying to increase the efficiency of a silicon PV cell by depositing a thin film of CdO by using pulsed laser deposition technique. CdO films are prepared with different thicknesses; transmission of the visible light spectra is more than 90% and the reflection is less 10%. The efficiency of a silicon solar cell has been increased by 20%.

References

Biography: Tarek Y. Elrasasi
Tarek Y. Elrasasi was born in Egypt, 1975. He has got his PhD in Shape Memory Alloys (smart material) from the Department of Solid State Physics, Debrecen University, Hungary, 2012. His M.Sc. was in wood-polymer composite, from Faculty of Science, Benha University 2003. His B.Sc. in Physics is from Faculty of Science, Benha University 1997. His recent research
Solar Technology for Rural Development in Sudan: A Case study of Lotah Project in Gezira State

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Abstract

This paper tries to assess a pioneer model of agricultural project for small farmers that depends on solar energy for rural electrification for housing and agricultural production. The project is located in Gerzira state central Sudan 30 kilometres to the east of Madani city the state capital. Each unit in the project consists of a house, three acre and water well for agricultural production, currently about 120 units has been established. Through using solar renewable energy the project is aiming at maintaining sustainability by reducing living expenses and agricultural production costs to the minimum. The project utilizes solar energy for houses and drilling water for domestic use and agricultural irrigation. A cost–Benefit analysis has been conducted to assess cost of solar system and conventional electricity system in addition to estimating the profitability of agricultural production under this system and in compare to the traditional system. The Net Present Value in the current analysis was calculated according to the following formula (Adapted from Mustafa, 2006):

\[
NPV = \sum_{i=0}^{n} \frac{C_i}{\left(1 + \frac{r}{100}\right)^i}
\]

Where,
- \(C_i\) = the net cash flow in year \(i\) (\(i = 0, 1, 2, \ldots, n\)), represented by farm income in this study.
- \(n\) = the planning period which equals ten years in the current analysis.
- \(r\) = the discount rate.

The results showed that linking the area to national electricity network is an expensive complicated process that is confirmed by Omer 2011. The results exhibited significant agricultural profits attained under the solar system which is higher than profits under the traditional agriculture because of the production diversity and sustainable water supplies. The study recommends the dissemination of this model in rural areas.

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Biography: Dr. Mohamed Babekir Elgali

Dr. Elgali has a MSc and a PhD in Agriculture Economics. He is an Associate Professor at the department of Agricultural Economics at the Faculty of Agricultural Sciences University of Gezira in Sudan. His research focuses on Water, Energy and Food security nexus. Dr. Elgali serves as a member of the academic international relations at the University of Gezira. He is also a member of international and regional networks and has many published articles in the area of food security, energy and water.

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Evaluation of Losses in a Photovoltaic Conversion Chain

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Abstract

The annual dc-energy produced by a photovoltaic module is influenced by a number of factors, some related to the module itself and others related to the site environmental characteristics. These factors include: cumulative solar irradiance, module power rating at the Standard Test Condition, operating temperature (temperature coefficient influence), maximum-power-voltage ($V_{mp}$) dependence on solar irradiance level, soiling, variation in solar spectrum, and optical losses when sunlight is at a high angle of incidence. The system-level factors which include: array soiling, wiring and terminal resistance, array performance degradation with age, and incompatibility of system components may introduce energy losses due to module mismatch in the array. Therefore, it is paramount to evaluate losses in a photovoltaic conversion chain, and suggest possible mitigation methods in order to improve the efficiency of the photovoltaic system. This helps to maintain the balance between dc generation and load demand.

In this work, the first part is about evaluation of losses in the photovoltaic conversion chain. Secondly, we will present the different loss models and their simulation results. Then in part three, a practical application at the site of Bechar in Algeria is presented. And lastly, the effect of losses on the global dc-energy produced by the photovoltaic array is exposed, by inserting the different loss models in the array.

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Biography: Lukia Nabawanuka

Lukia Nabawanuka has a Bachelor of Science degree in Electrical Engineering and she has just completed her Master of Science degree in Renewable Energy/Solar Energy from the University of Science and Technology Houari Boumediene found in Algiers, Algeria. Ms Nabawanuka is a member of the African Network for Solar Energy.

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Effect of solar chimney and the earth-to-air heat exchanger on space flow pattern and ventilation rate in buildings, Congo climate

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Abstract
Natural ventilation is one of the topics developed by many researchers in order to reduce the
dependence towards fossil and nuclear energy around the world.
Natural ventilation consists to use natural resources instead of classical air-conditioning. Those simple
technical allow to obtain a good comfort produced by air renewable induced by natural forces as wind
and temperature difference in the buildings.
There are many systems of natural ventilation. All natural ventilation systems must satisfy at health
needs, at comfort, at environment condition and at energy saving.
Systems like solar chimney and the earth-to-air heat exchanger help to enhance natural ventilation.
This research is investigating the effect of solar chimney and the earth-to-air heat exchanger on space
flow pattern and ventilation rate to improve natural ventilation in a single room built by using local
construction materials in Congo-Brazzaville in many configurations.

Biography: Aldé Belgard Tchicaya Loemba
Mr Aldé Belgard Tchicaya Loemba defended his master degree in materials
sciences and renewable energies and he is PhD student from Faculty of
Sciences and Engineering of Marien Ngouabi University. His research is based
on solar thermal systems, geothermal systems and energy storage.
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Realization of the emitter of a crystalline silicon solar cell by the sol gel
method
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Abstract
The realization of a silicon solar cell emitter is a very significant stage in photovoltaic technology.
Indeed, the concentration on the surface of boron or phosphorus and the depth of the junction
determines the photovoltaic conversion efficiency of silicon solar cells. Several techniques are used
for the realization of the n+p and n++p+ emitter among which one quotes the diffusion in phase vapor
[1, 2], ionic implantation [3] and diffusion from solid sources [4, 5]. This work will devoted to the
realization of emitters out by diffusion of boron or phosphorus from solid doping sources developed by
the sol gel method associated with the spin coating.
The doping solutions were prepared by sol gel method using methyltriethoxysilane “MTEOS” or
tetraethoxysilane “TEOS” and H₄PO₄ or H₃BO₃ as precursors. The n+ junction was realized by
emulsion of phosphoric acid in isopropanol while the p+ junction was obtained by emulsion of boric
acid H₃BO₃ in isopropanol or by diffusion of Aluminium at high temperatures. Our samples were
annealed at temperatures ranging of 850° to 1000°C in a classical furnace under Nitrogen
atmosphere.
The four point technique has been used to study the electrical properties of n+ p and n++p+ structures.
The results of measurements showed values of the sheet resistance R□ comparable to those of
literature and confirm the diffusion of phosphorus and boron from liquid and solid sources prepared by
sol gel method for realization the emitter of a solar cell.
Keywords: Realization of emitters, Liquid doping sources, Boron or Phosphorus diffusion.
Acknowledgement: Armel Duvalier PENE is grateful to the ICTP (The Abdus Salam International Centre for Theoretical Physics) and ANSOLE (African Network for Solar Energy) for financial support within the framework of the Intra-African Exchange (INEX) program

References

Biography: Dr. Armel Duvalier Pene
Dr. Pene just supported a thesis of doctorate / PhD in Applied Physics and Engineering, Specialty: Electrical Engineering and Industrial Automatic at National Advanced School of Agro-Industrial Sciences (ENSAI) of the University of Ngaoundere. Dr. Pene is a member of the African Network for Solar Energy (ANSOLE) and was the first PhD student to benefit from the ANSOLE-ICTP Scholarship. Dr. Pene’s research is actually focused on Photovoltaic solar energy.

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Operational application of bio based activated carbon and ionic liquid as integrated approach for maximizing bioethanol production
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Abstract
There is a great potential in our country to develop bioethanol from Municipal and agricultural wastes. The major objective of this project is maximizing the bioethanol production through removing inhibitory compound and application of Bronested ionic liquid. The proximate analysis of fifteen single substrate samples was carried out. Based on the proximate analysis result seven types of composite multi substrate biomass samples were prepared. The Bronested ionic liquid p-toluenesulphonic acid (p-TSA) was synthesized with overall yield of 65.11%. It was characterized by FTIR, 1H-NMR and 13C-NMR spectroscopy. Maximum total reducing sugars yield of 95.89% was obtained in p-TSA at 0.5 M concentration, 110 °C, and 3 h reflux time. Activated carbon was used as adsorbent to remove inhibitory compound (furfural). It was prepared from corn cob and used for batch adsorption test. The morphology and surface functionalities of the activated carbon were analyzed by Scanning Electron Microscopy and FTIR, respectively. The laboratory based prepared furfural was characterized by GC-MS and FTIR. The adsorption tests revealed an adsorption equilibrium time of 10 min which is the time where maximum adsorption of furfural by the activated carbon was achieved. The optimum dose (0.8 g) of adsorbent was determined during the batch adsorption test and working pH of the activated carbon was determined as 4. Under investigation, Freundlich isotherm was the suitable isotherm equation for the adsorption of furfural on the activated carbon and it indicated the heterogeneous surfaces of the activated carbon prepared from corn cob. The result revealed that before treatment the optimum fermentation time was 64 h and after treatment the optimum time recorded was 60 h of fermentation. The ethanol concentration before treatment was 9.88 g/100 ml and the concentration of
ethanol enhanced to 10.8 g/100 ml during the fermentation of the hydrolyzate treated with activated carbon.

**Keywords:** Bioethanol, Multi-substrate, p-Toluenesulfonic acid, hydrolysis, Fermentation, batch Adsorption

**References**

**Biography: Dawit Firemichael**
Dawit Firemichael has a BSc and a MSc in Analytical Chemistry. He is full time researcher in renewable energy at Energy & Environment Research Center of Dilla University, Ethiopia. Dawit is also serve as lecturer in chemistry department and is member of many scientific networks in the area of energy and environment. Dawit research is actually focused on biomass based alternative liquid fuels.

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Empirical Modelling of a Flat plate Solar Collector
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**Abstract**
The outlet temperature of a solar water collector is one important parameter to design engineers and researchers. Its prediction provides insight into the hot water temperature of the solar water heater as a whole. The solar collector is the main component in the system hence the need for accurate prediction of it performance [Luminuso and Fara, 2005]. White box modelling techniques have been widely used as a tool to predict collector performance. However, the physical phenomena taking place in solar water heaters are complex and result in complex equations. The prediction of collector outlet temperature \( T_{co} \), is not usually estimated though this metric is important in the determination of system performance [Kalogirou et al, 1999]. In this study, empirical modelling has been tested and validated to model the outlet temperature for a flat plate collector, due to its relative simplicity and it requires little computational time. The model is utilized for a system installed in Alice, South Africa from four input variables, namely solar radiation, ambient temperature, relative humidity and collect inlet temperature. Data were collected on clear sky days during two winter months. Model validation was done by evaluating the correlation coefficient (R-squared), and the percentage mean absolute error which were determined as 0.93 and 5.83 respectively. These results indicate that the model can be successfully used to predict the collector outlet temperature using the given input parameters.

**Acknowledgement:** Eskom is acknowledged for financial support.

**References**
Sustainable Energetics for Africa (SE4A)

Biography: Nothando Ndlovu
Nothando Ndlovu holds a Master in Physics degree from the University of Fort Hare, South Africa, and a Bachelor (Hon) in Applied Physics from the National University of Science and Technology, Zimbabwe. She has held position of Project Manager Assistant, currently she is the Research and Project Coordinator for Millantus Enterprises, Zimbabwe. Her research interests include solar thermal energy, photovoltaics and energy efficiency. Nothando has published in the South Africa Power Engineering Conference Journal, and has made presentations at the South Africa Institute of Physics Conference. Contact: noelee.ndlovu@gmail.com

Sizing a hybrid optimized system for the Inal locality using HOMER software
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Abstract
The production of energy through hybrid systems (renewable energies more diesel) is an option for isolated rural areas without access to electrical grid. This document proposes an optimized dimensioning of a hybrid system using HOMER software for the locality of Inal. This village is located to 447 km from the city of Nouakchott with a population of about 1000 inhabitants, totally isolated both water and electrical grid. Finally, the results of the simulation based on the technical-economic criteria show that the most profitable configuration is: Wind-Diesel-Batteries.

References

Biography: Dr. Nourou Dia
Dr. Nourou Dia is a temporary professor in Department of Physics in University of Al Aasriya, Nouakchott (Mauritania) He teaches Energy policy and fuel cell and hydrogen technologies in the branch "Technologies Systems: Renewable Energy". He is also a member of Applied Research Laboratory in Renewable Energy (Nouakchott) and is responsible of Nouakchott wind farm.

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Synthesis and Characterization of AnE-PVs Polymers with Statistical and Defined Configurations of Octyloxy and 2-Ethylhexyloxy Side Chains
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Abstract

This contribution reports on the detailed synthesis and characterization of three new hybrid polymers of anthracene containing poly(p-phenylene-ethynylene)-alt-poly(p-phenylene-vinylene)s (PPE-PPVs) typified AnE-PVs with total disymmetric configuration of mixed linear (octyl) and branched (2-ethylhexyl) alkoyx side chains on every phenylene units. The polycondensation was carried out using Horner–Wadsworth–Emmons (HWE) reaction between the precisely or vaguely substituted dialdehydes [1] with the two different substituents and the respective substituted bisphosphonate [2]. The resulting polymers (AnEPVII(1), AnEPVII(2), and AnEPVII(mixed)) were characterized by nuclear magnetic resonance spectroscopy (NMR), and absorption and emission spectroscopy in dilute solution as well as in thin films in both aromatic (chlorobenzene) and non-aromatic (chloroform) solvents. It was found that the absorption and the emission spectra were not similar in both solvents. Effectively, the well-defined substituted polymers (AnEPVII(1), AnEPVII(2)) exhibit a red-shift spectra, and this bathochromic shift in the absorption spectra is more pronounced in AnEPVII(1), that suggests the packing order is heavily influenced by the regioregularity and the nature of side chain next to the anthracene units.

Keywords: synthesis, Horner–Wadsworth–Emmons (HWE) reactions, conjugated polymers, regioregularity, absorption, emission.

Acknowledgments

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References


Biography: Dr. Nassima Bouguerra

Dr Bouguerra was born in Tazmalt, Bejaia Algeria on 8 August 1981. She graduated in chemical engineering in 2004 at the University of Bejaia. She then started her master's degree in the same field in December 2008. After 3 years, she graduated having a master's degree in chemical engineering in 2011. ANSOLE helped her to complete her PhD in science under the title “Synthesis of semiconducting polymers with dissymmetrical side chains for organic photovoltaic and optoelectronic applications” and under the supervision of Prof. Daniel A. M. Egbe, on July 03 2017, through the scholarship she received to carry out all her experimental part of her PhD thesis, at the Linz Institute for Organic Solar Cells LIOS at JKU University, Linz-Austria. She is married and plans to migrate to Canada to join her husband and continue researching on organic semiconducting materials:

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Optical properties of polymers and organic photovoltaic cells

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Abstract
The efficiency of the organic photovoltaic cell (OPV) depends critically on the charge generation, recombination, and transport. For highly efficient OPVs, high exciton diffusion length is necessary. In our work, the influence of symmetric alkoxy side chain on exciton diffusion was investigated. We measured exciton diffusion in new poly (1,4-phenylene-ethynylene)-alt-poly (1,4-phenylene-vinylenes) (PPE-PPVs) conjugated polymers by the use of Forster mechanism. We find that exciton diffusion length is small side chain symmetric-dependent. We also find that P8/18 have the biggest Forster radius since it have the highest PL quantum yield. This shows that small differences in molecular structure can't impact very much on the exciton diffusion as compared with the photoluminescence quantum yield impact.

Acknowledgements
I thank N. Bouguerra and D. A. M. Egbe for supplying the photoactive materials N. Bouguerra is grateful to ANSOLE e.V. for financial support through the ANSOLE ANEX program. N. Bouguerra and D. A.M. Egbe thank FWF for research funding through grant No: I 1703-N20.

References

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Asma Saaidia is a PhD student in Faculty of Science Tunis, Tunisia. She is a member in laboratory of advanced materials and quantum phenomena (LMAPQ: Laboratoire des Matériaux avancés et Phénomènes Quantiques). She has a Master degree in quantum physics (superconductivity in graphene) in 2013 to FST. She is member in the scientific networks ANSOLE. Miss Asma Saaidia's research is actually focused on solar PV especially on Influence of optical properties on the efficiency of organic solar cells.

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Varying processing Temperature and additive enabling 50% improvement of BHJ efficiency

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Abstract
Morphology optimization is the present study to design better performing organic photovoltaic devices via solvent additive and temperature processing [1,2]. In this study, we report a comprehensive study on control of polymeric order already in solution via temperature annealing and introduction of non-solvent isopropanol (ISO) to the common solution of anthracene containing poly(p-phenylene-
ethylenylene-alt-poly(p-phenylene-vinylene) (PPE-PPV) copolymer, bearing statistically substituted linear octyloxy and 2-ethylhexyloxy side-chains in 2:3 ratio along the backbone (AnE-PVstat), and fullerene derivative phenyl-C61-butyric acid methyl ester (PCBM). Decent analysis of photophysical data, absorption and photoluminescence spectra, of deposited AnE-PVstat:PCBM thin films proved J-aggregation of the copolymer with straight dependence on the annealing temperature and precence of non-solvent ISO. The influence of the degree of polymer aggregation on the device performance was evaluated by measuring the hole mobility and photovoltaic parameters. Finally, precise control of polymer aggregation led to an overall improvement of solar cell device efficiency of 50%.

References

Biography: Emna Hleli
Emna Hleli is a PHD student on the laboratory of advanced Material and Quantum Phenomena Tunis ElManar –Tunisia. She worked on the elaboration and characterization of the organic devices: diodes and solar cells. She got her Master degree on soft mater .She has a paper as a coauthor about the investigation of organic light emitting diode. She has Bachelor in Sciences physics (SP) in faculty of Sciences of Gafsa–Tunisia.
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Enhanced Performance of Antimony Sulphide Mesoscopic Solar Cells by Employing Nb: TiO\textsubscript{2} Compact Layer
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Abstract
Antimony Sulphide has recently had much attention as a promising absorber material for photovoltaic devices and further studies are now focusing on optimization of the devices to improve their performance. A compact layer of TiO\textsubscript{2} is normally used in Mesoscopic and Extremely Thin Absorber solar cells to block holes from reaching the transparent conducting oxide electrode. Doping of this layer with transition metals and nitrogen has an impact in its electronic properties which influences the device performance. This work reports preliminary results on the enhancement of charge transport in Mesoscopic Antimony Sulphide solar cells with TiO\textsubscript{2} compact layer by doping with Niobium which led to solar cells with improved fill factor and power conversion efficiency (PCE) of 1.7% from 1.3% for devices using pristine TiO\textsubscript{2} compact layer. The enhancement of the device performance is attributed to charge compensation achieved by formation of Ti vacancies which leads to a decrease in selective contact resistance and an increase in charge recombination resistance as expected from the analysis of the impedance spectroscopy measurements.

References
Biography: Benjamin Victor Odari

Mr. Benjamin Victor Odari has a MSc in Condensed Matter Physics and is soon defending his PhD in Renewable Energy at University of Nairobi, Kenya. Part of his research work was done at the Institute of Energy and Climate Change (IEK5), in Forschungszentrum Jülich, Germany under the scholarship of DAAD. He is a lecturer in Physics at Masinde Muliro University of Science and Technology (MMUST), Kakamega, Kenya. Mr. Odari has also participated in two curriculum developments for Bachelor Degree in Electronics and Material Science at MMUST which are waiting approval by the Commission for University of Education. He is a member of the African Network for Solar Energy (ANSOLE) and a number of scientific networks in the energy area in Kenya. Mr. Odari's current research is focused on characterization of materials and devices for solar energy conversion.

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Abstract

Anaerobic digestion (AD) systems are extremely sensitive to changes in environmental variables. Pilot scale of the CSTR will be operated using domestic waste and cow dung (CD) in an optimized ratio of 1/2. Correct design and control of the system's parameters are essential to maximize process efficiency, increase stability, and prevent system failure. Automation systems can both raise plant availability and help meet the transparency requirements of the process. A fully automated continuous stirred tank reactor (CSTR) of about 30 m³ capacity design is propose for biogas plant to analyze waste and produce energy at the University of Port Harcourt, River State (Nigeria). This is to be the first fully automated digester at pilot scale which can be monitored by remote sensing all over the country. Parameters (pH, temp, feeding rate, energy consumption) will be ascertain from a CSTR plant online by using remote monitoring system. The reactor will be allowed to run continuously for days. Average biogas produced per day will be recorded.

Keywords: Anaerobic digestion – Biogas - Automation – Satellite Remote sensing - Nigeria

Acknowledgement: The African Network for Solar Energy (ANSOLE) is acknowledged for initiating SE4Africa Schools and funding thereby creating an avenue for me to present my proposal to the world and seeking for funding knowing too well the Nigeria is a big hub for consumption of energy in Africa.

References:


Biography: Michael Ashindoitiang Agbebia
Michael Ashindoitiang Agbebia is a graduate student of the Department of Geology (Structural Geology option) in University of Port Harcourt with two published articles in the field of geosciences. He is a certified Business planner and Financial Forecaster trained by Pan – Atlantic University Enterprise Development Center under the auspices of YouWin (Youth Enterprise with Innovation in Nigeria). Agbebia is also a chartered Geoscientist (Member Council of Mining Engineers and Geoscientists, (COMEG)) and a distinguished Entrepreneur (Geo-Data Divine-Links Enterprise) offering service in Water Supply Consultancy, Mineral Resources Exploration/Exploitation and Remote Sensing/Geographic Information System Consultancy Services.
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Experiment-based approach for improving the reliability of photovoltaic power supply sources
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Abstract
Up to date, the semiconducting materials based photovoltaic modules are widely used as power supply sources. The major difficulty is the dependence of the reliability of these power supply sources on changes in irradiance and temperature. As an example, it is well known that the operating point of a photovoltaic power supply source moves away from its maximum power point when the irradiance changes. In the other hand, The solar cells constituting these power supply sources are nonlinear dipoles, which intrinsic parameters depend closely on weather conditions.
To solve these problems, various MPPT algorithms have been implemented [1 - 3]. Among these MPPT algorithms, some of them have industrial applications because of their ease of implementation, i.e.: Perturb and Observe (P&O), Hill Climbing (HC) and Incremental Conductance (INC) algorithms. However, the effect of temperature on the performance of solar cells based on semiconducting materials is still poorly understood. In addition, the low cost implementation of algorithms for optimizing the transfer of maximum power from the photovoltaic source to the load, especially in the tropical zone where weather conditions often vary abruptly is still a challenge. It is same for the innovative design of agro-food processing equipment fed by a photovoltaic power supply source for remote rural areas.
This work focused on experiment-based approach for improving the reliability of photovoltaic power supply sources, so that the responses of near to real Simulink model of photovoltaic modules are superimposed with the experimental points. This Simulink model of the photovoltaic modules is used to simulate with a good accuracy the MPPT algorithms.

References


Biography: Prof. Dr. Martin Kamta
Prof. Martin Kamta has a Doctorate in physics of semiconducting materials at the laboratory of ESR spectroscopy, Louis Pasteur’s University of Strasbourg, France. He is associate Professor by Order No. 12/0675/MINESUP/SP-CCIU of December 07, 2012. His main range of scientific research is: Solar Energy: Physics of Solar Cells and Electronic Systems. Prof. Martin Kamta has carried out several solar energy production projects for food processing equipments and for irrigation of vegetable gardens in dry season.

He is a member of the African Network for Solar Energy (ANSOLE), ANSOLE focal point in Ngaoundere and member of the Cameroon Physical Society (CPS).

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Intellectual Property Rights for Renewable Energy Entrepreneurship
Ayuketah Oswalrd Tambe
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Abstract
This paper creates awareness of Intellectual Property issues in the minds of our entrepreneurs and other participants at this seminar especially those operating within the countries of the South where globalization in international trade has increased the need to protect business intangible assets especially between national borders.

The high dependence of African Countries on imported products is a clear indication that creativity and inventive steps are still at the rudimentary stages in Africa where the practice and education of intellectual property in universities, research institutions and other educational and business entities is cause for concern.

Technological development is at the centre of innovations and inventions in these institutions. Therefore, we cannot talk about solar energy for instance without addressing IP issues associated to its generation and management as well as the role engineers and other researchers can play in the promotion of the overall welfare of humanity. This paper is thus an exploratory venture into the whys and hows we can as a people walk towards this goal of bringing our policy makers entrepreneurs and other stakeholders on board in intellectual property management issues.

The first section of the paper makes a cursory presentation of what IP is all about, its importance, the various categories and how IP assets can be generated and protected. The next section deals with why low level of filings of applications for protection and registration by business entities of IP assets from the developing world especially as regards patents in the OAPI Region and the logical consequences. The third section of the paper examines the various levels of enforcement of IP Rights in the OAPI Region and attendant difficulties. The last section, focuses on the way forward especially encouraging government institutions, universities research institutions, private bodies, SMEs and other businesses to appropriate IP assets issues in their policies and strategic development plans if they must reap the benefits of our knowledge-intensive economies in today’s global village.
Biography: Mr Ayuketah Oswarld Tambe

Mr. Ayuketah Oswarld Tambe is a 58-year-old Cameroonian. He is married with four children and he is a Christian. He is holder of a Master’s Degree in Intellectual Property from Africa University, Mutare, Zimbabwe. He subsequently completed an online programme, organised by the World Intellectual Property Organisation (WIPO) Academy on Intellectual Property Management, and was awarded a Certificate in Advanced Intellectual Property Management. He also holds a Bachelor’s Degree in Private Law and a Post Graduate diploma (CPJA) in Youth animation counselling as well as many certificates and attestations of participation in many national and international conferences and seminars.

In terms of job experience, he has held several positions, including the Pioneer General Manager of the National Civic Service Agency for Participation in Development of Cameroon, Technical Adviser in the Ministry of Youth Affairs and Civic Education of Cameroon, National Director/Africa-IC Representative of the Duke of Edinburgh’s Award International Association, Cameroon, Director of Planning, Projects and International Cooperation, focal point Commonwealth and Francophonie, Sub-Director for Communication and Public Relations amongst other duties. Contact: osmarie_p@yahoo.co.uk, Tel: +237 677 120 100

Energy Management and Optimization in Industry: Case of the Chad-Cameroon Pipeline Pump Station 2 (PS2)

Sandy Vanessa Kamdem Yougo
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Abstract

Energy management is the efficient and effective use of energy to maximize profits (minimize costs) and enhance competitive positions. This definition covers many operations from services to product and equipment design through product shipment. Also, waste minimization and disposal presents many energy management opportunities. It is proven that with an efficient energy management program, waste minimization could lead from 5% to 15% of energy cost saving without major investment\(^1\).

Looking into 2013 records, 10988m\(^3\) (69000bls) of distillate were used to run a pump station representing $3.45 million per year spent per year for a pump station (@ $50/bbl.).

Regarding potential savings $170K – $520K with no investment, the Cameroun Pipeline Company has decided to analyze energy usage to identify any potential saving actions that could be put in place in order to achieve efficiency goals.

To determine where we can act and how we can act to identify those potential savings, we have conducted an energy audit on 9 main systems identified on the plant. divided into two groups process system (Crude Oil Topping Plant, Compressed Air, Hot Water, Power generation, Crude Oil System) and Non process system (Offices Building & Accommodations, Restaurant, Exterior lighting). Going through the audit results analysis, energy wastes points were identified on five system (Crude Oil Topping Plant, Hot Water, Power generation, Offices Building & Accommodations, Exterior lighting) and seven key actions was proposed and evaluated (technically & economically). It comes out that on a yearly basis, those seven main actions can be implement with no major investment and will lead to 6.86% of energy consumption reduction representing $240k of saving per year.


Biography: Eng. Sandy Vanessa Kamdem Yougo

Eng. Sandy KAMDEM is a young industrial engineer. She is currently Facilities Engineer for the Cameroon Oil Transportation Company (COTCO) which is a pipeline company headquartered in Douala (Cameroon). Highly passionate in energy efficiency, she has achieved for her host company COTCO 6.86% of energy
Sustainable Energetics for Africa (SE4A)

consumption reduction representing $240k of saving per year with no additional investment just by putting in place an energy optimization program. Contact: vanekoue@yahoo.com

Biography: Christelle Audrey Tchentcheu

Christelle Audrey Tchentcheu was born in Garoua, Cameroon. She received her Bed in Cst Economics (major Economics) in 2012 from the University of Buea, Cameroon. In 2013, she obtained a diploma and a certificate in a year program; Business management and administration from the Pan-African Institute for Development- West Africa, Buea in collaboration with the Institute of Commercial Management, England. In 2014 she moved to Yaoundé to work as an office assistant and analyst of the state of technology at the AIDE CONSULTING Sarl. Tchentcheu later furthered her study at University of Douala, where she did her Masters I in “Gestion Technico Commercial”, 2015. In September 2015, she moved to Germany where she is currently completing her Msc in Economics at the Friedrich Schiller University, Jena.

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Biography: Tina Koch

Ms Tina Koch has a Bachelor Degree in Nutritional Sciences and is currently obtaining her Master Degree in Nutritional Sciences at Justus-Liebig University in Giessen, Germany. For obtaining her Bachelor thesis she worked as a student researcher in South Africa within the framework of a transdisciplinary research project called 'Exploring the potential of local food systems for sustainable rural development - A case study of the Vaalharts area' with a special focus on women's perception and usage of locally produced foods. Besides studying at Justus-Liebig University in Giessen, Germany, she is also working at Centre for International Development and Environmental Research in Giessen where she is currently involved in organization of the Summer School II on Sustainable Energetics for Africa (SE4A).

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Biography: Cristelle Foka Djomsu

Ms Djomsu was born 1984 in Bafoussam Cameroon. She was a student at St Pierre School from 1989 to 1995. As a teenager she studied at Government High School of Garoua where she respectively obtained her probation certificate in Biology and Mathematics in 2003. In 2004 she received her Advanced Level in the same subjects. From 2005 to 2008 she studied at Ngaoundere University where she received a Bachelor in Chemistry in 2007. From 2008 to 2010 she was a student at Higher Teachers’ Training College of Maroua aiming at a career as a secondary school teacher in Chemistry. From 2011 to 2013 Djomsu returned to Ngaoundere for her Master Degree where she finally graduated with a Master in Inorganic Chemistry. Since 2011 she is a teacher of Physics sciences at Government Technical High School of Douala Kounmassi, and PhD student at Ngaoundere University since 2014.

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Biography: Ndeta Beuma’a

Mr. Ndeta Beuma’a is a specialist of solar energy and control engineering. He is currently the CEO of AFNEL Engineering which is a start-up in solar energy, security systems and project design with headquarter in Buea (Cameroon). He is also a graduate teaching assistant in the Faculty of Engineering and Technology University of Buea, Cameroon. He has also served as a renewable energy trainer for the capacity building in renewable energy for different councils in the Southwest Region Cameroon. Mr. Ndeta Beuma’a has a Bachelor in Power Systems Engineering and is currently a Master student in the same field. Mr.
Ndeta’s research is presently focused on automatic control of a hybrid solar-mini hydro renewable energy system
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Biography: Chu D. IWEH
Chu D. IWEH is currently a graduate student (Masters) in the Department of Electrical and Electronic Engineering, Faculty of Engineering and Technology at the University of Buea, Cameroon. IWEH’s developing Master’s thesis research is titled: “Design and Simulation of a Hybrid Solar–Mini Hydro Renewable Energy System for the Rural Electrification of Cameroon”. He also holds a Bachelor’s Degree in Electrical/ Electronic Engineering from one of Cameroon’s State Universities. As an undergraduate at the University of Buea, he was trained as a power systems engineer and he continues to bring these lenses to the work he does in rural electrification. His primary research interests include power systems modelling and control, Renewable Energy solutions and is currently working on a Renewable Energy solution project for a rural community in Cameroon.
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Biography: Tounsi Fokui Willy Stephen
Tounsi Fokui Willy is a final year M.Eng. in Power Systems student in the Faculty of Engineering and Technology of the University of Buea, Cameroon. He obtained his B.Eng. in Electrical and Electronic Engineering optioning in the same institution. He is presently a graduate assistant in the department of Electrical and Electronic Engineering of the Faculty of Engineering and Technology. Tounsi’s research is actually focused on the automatic control of a hybrid solar-wind renewable energy systems.
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Biography: Engr. Musong Louis Katche
Engr. Musong Louis Katche holds of a Bachelor of Engineering (B.Eng) Degree in Electrical and Electronics Engineering from the Faculty of Engineering and Technology, University of Buea, Cameroon. He is a current final year research M.Eng student in Power Systems Engineering in the same University. He currently works at the power systems department of Source du Pays Cameroon at site Bekoko Douala. His present research work is on rural electrification in Cameroon using solar energy.
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Biography: Mengot Esther Ntube
Mengot Esther Ntube is a graduate with a Bachelor Degree in Women and Gender Studies / Law from the University of Buea. She is the South West representative of United Youth Organization (UYO) which is aimed at promoting youths at entrepreneurship and leadership. She first worked with mediaReach a company based on digital marketing and publicity. She is presently working on contract basis with ONZFI (Office National Des Zones Franches Industrielles) an organization that harbours companies under the Free Trade Zones. Mengot
Esther is a person that loves to travel and also try her hands on other things like Event Planning. She is working part-time with Sheriaz Delightz a well-known event planning company. She is interested in renewable energies.
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Biography: Prof. Germaine Djuidje Aloyem Kaze
Prof. Djuidje Aloyem K. Germaine is a Cameroonian born in 1973. She is married and mother of five children. He received her PhD from the University of Yaoundé I, Cameroon in 2007. He is the author of many publications in the field of Friction phenomenon, Thermo lubricity and stochastic processes. She is interested in the Energy Efficiency within Friction phenomenon. She lectures at the University of Yaoundé I, Department of Physics, Cameroon. She is a member of African Network for Solar Energy (ANSOLE).

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Biography: Dr Jean Paul Tchuente
Dr. Jean Paul Tchuente is an Economist and an environmentalist. He is the Vice Dean of the Faculty of Economics and Management at the PKFokam Institute of Excellence. He holds the rank of Associate professor. He is a lecturer of Project Management, Credit Decision, Insurance, and he is a member of the Research Center in Economics and Environment (RCEE). He is also a Consultant at Saar Insurance S.A. He is a Ph.D in Agrarian and Environmental Law, an MBA in Finance, Banking and Insurance.

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Biography: Dr. Eric Njankwa Njabon
Dr. Eric Njankwa Njabon has a PhD in Computational Biophysics and an MBA. He is a lecturer and researcher at the PKFokam Institute of Excellence. He started teaching at the Chadron State College in Nebraska, USA in 2008. He later on accepted an offer Upper Iowa University, in Iowa, USA in 2010. Dr. NJABON returned to Cameroon in 2014 and joined PKFokam Institute of Excellence in 2015. He teaches both sciences and business courses at PKFokam Institute of Excellence. In addition to teaching, Dr. NJABON does research on African debt crises with particular attention on the Economic and Monetary Commission of Central African States, commonly known by its French acronym CEMAC. Dr. NJABON has supervised numerous research projects in the field of economics and development and has a few publication in the Computational Biophysics and Business related fields.

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Biography: Prof. Joseph Yves Effa
Prof. Joseph Yves Effa received his PhD in Electronics from the University of Yaoundé 1, Cameroon. He is Currently Associate Professor in Electronics at Department of Physics from the University of Ngaoundere, Cameroon. He is author and co-author of more than 25 publications in prestigious journals and conferences and he is Reviewer for various international journals. He has more than 12 years’ experience of education and research and he supervised more than 30 Master’s degree students and 1 PhD student. His research interests include chaos detection, synchronization of chaotic systems, nonlinear transmission line, Signal Processing and Image Processing, chaos-based image encryption and renewable energy.

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Biography: Marcelin Pemi Mouzong

Mr. Mouzong has a background of geophysics and electrotechnics. He conducted several research works on gravity data analysis along the Cameroon Volcanic Line and the correlation of the findings with the seismicity of the area. Moreover, his now involved in geothermal energy studies along some crater lakes in Cameroon as well as conducting some experimental and numerical studies of the thermal behavior of solar panels in tropical regions. He also serves as an Assistant Lecturer at the Higher Technical Teachers' Training College-Kumba, Department of Renewable Energy, University of Buea, Cameroon. Contact: mouzong.pemi@ubuea.cm/mouzong2002@yahoo.fr

Biography: Roussel Ange Mbouendeu Tientcheu

Mr Tientcheu is a Cameroonian student of at the National Advanced School of Agro-Industry of the University of Ngaoundere in Cameroon. He is doing a master in engineering and energy processes, with main focus on solar energy. He is the president of the ANSOLE students association of the University of Ngaoundere.

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Biography: Mr Alexander Sipua Ngnoubamdjum

Alexander Sipua Ngnoubamdjum is an international expert in "Renewable Energies for Africa". He did his studies in Economics at the Hamburg University (Germany) and specialized in Solar Energy at the „Solar Energie Zentrum“ in Stuttgart (Germany). He has more than 10 years experience in leading position working with various Solar Energy Companies with focus on Africa. Mr Sipua worked together with academic, commercial and administrative institutions in the realisation of solar projects in several African Countries (Senegal, Ghana, Mali, Kenya, Rwanda, …). At the moment, he is the coordinating as long-term expert of a partnership project in „Professional Training for Solar Energy Technicians” between the Cameroonian institution CPF (Centre Polyvalent de Formation à Mbouo-Bandjoun, Cameroon) and the German institution EBZ (Elektrobildungs- und Technologiezentrum Dresden, Germany). This project is sponsored by the German Federal Ministry of Cooperation (BMZ). Mr Sipua Ngnoubamdjum is an ANSOLE member of the early hours. He was active as a sponsor in the first ANSOLE DAYS which took place in February 2012 in Cameroon. Through the CPF-EBZ partnership project he financially contributed to the successful organisation of the 3rd ANSOLE meeting in Cameroon (ANSOLECAF) held in November 2016 at the University of Bamenda. Contact: info@sipua-consulting.com

Biography: Mr Jean Wouomble

Mr Jean Wouomble was born on the 28th of February 1971 in Mbang, Cameroon. He studied Marketing and Computer Sciences at Institut Samba Supérieur. In 2009 he facilitated the installation of YANDALUX in Cameroon and is its representative in the country. Through Yandalux he realized the installation of solar panels at FOYER DU MARAIN in Douala and did feasibility studies for the solar installation at the University of Ngaoundere. Since 2016, he is local collaborator in the partnership between CPF of Bandjoun and EBZ of Dresden Germany. He has attended two training seminars in Germany (2016 and 2017) and many meetings on renewable energies in Cameroon since 2009, namely ANSOLE event in 2012, fairs and recently the diaspora forum. Contact: wouomblej@yahoo.fr
Biography: Simon Pierre Amboumbe

Mr AMBOUMBE, the incumbent Academic Affairs Officer of the PKFokam Institute of Excellence, doubles as the Head of the Languages Department of the Institute. He studied in Cameroon, at the former University of Yaoundé, Faculty of Letters, Arts and Social Sciences (1975-1979) where he obtained a bilingual degree in French and English languages in 1979. In 1981, he did a 3 month refresher course in German at the Goethe Institut of Bremen (Germany). After his graduation at ENS (Advanced Teacher Training College) Yaounde in 1983, he taught English, French and German in secondary schools. In 1988 he travelled to Britain for further studies. He is a graduate of the University of Warwick, with a Master’s Degree in ELT (1989). From 1989 to 2012, he worked on the Bilingual Training Program of the Presidency of the Republic to teach English and French languages to adults. He's aged 66. He is the Local vice-chairperson of SE4A local Organizing Committee of the PKFokam Institute of Excellence in Yaounde.

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Biography: Murielle Mefo Simo

MEFO SIMO Murielle B. is the Library Officer of the PKFokam Institute of Excellence, and she doubles as the Assistant to the Director of the BEA (Business Excellence Academy), which is the professional training center of the PKFokam Institute of Excellence. She is holder of DIPES II in Computer Science (2010) from ENS (Advanced Teacher Training College), University of Yaoundé I. She is Cameroonian.

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Biography: Mr Cyrlle Gnentedem

Mr. GNENTEDEM Cyrille is a Cameroonian who has a Master in Physics (energy); he is preparing a PhD related to the Modeling of a turbulent CH4/H2/N2 jet flame. He is a lecturer and researcher at the PKFokam Institute of Excellence. He worked as part-time lecturer at the University of Yaounde I before accepting an offer at PKFokam Institute of Excellence in 2015 where he teaches Physics.

In addition to teaching, Mr GNENTEDEM does research; he has started to produce biogas and he is focusing on its optimization. He has made an autonomous hydroelectric generator. Moreover, Mr GNENTEDEM is specialized in simulating turbulent diffusion flame, mainly of hydrogen and methane.

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Biography: Ms Diane Tchuani Tchakonte

Ms Tchuani is holder of a Master Degree of the University of Yaounde I. She is a PhD student in computer sciences under co-supervision from the University of Yaounde I and the University of Grenobles Alpes. The topic of her thesis is on the economy of energy in networks of wireless receivers. She is presently a lecturer in computer sciences at PKFokam Institute of Excellence. Contact: diane.tchuani@gmail.com
Biography: Mr Ernest Signe

Ernest SIGNE is the Administrative and Financial Officer of the **PKFokam Institute of Excellence**. He formerly worked as auditor and controller of Microbank structures of the MC²models, for ADAF (Appropriate Development for Africa Foundation), an NGO. He is holder of a *Maîtrise in Management Science* from the University of Yaoundé II – Soa. He is a member of the local Organizing Committee of the 2017 Summer School, Logistics and Finance Committee of the **PKFokam Institute of Excellence**.

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Biography: Ghislaine Laure Kenmogne Guiadem

I am a young Cameroonian woman, born on the 25th August 1984 in Yaoundé, holder of a Master’s Degree in Administration and Enterprise Management, University of Yaounde II, Soa (2011). I have been working at the **PKFokam Institute of Excellence** since August 2007. First as an Assistant to the Accountant, and I have now taken a full time job as the Admissions Officer of the Institute. As concerns SE4A, I belong to the team in charge of catering and service.

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Biography: Prof. Michael Düren

Michael Düren studied Physics at the RWTH in Aachen, Germany and obtained his PhD in 1987 in the field of particle physics. After being a postdoc at the Max-Planck-Institute for Nuclear Physics in Heidelberg, he habilitated at the University Erlangen-Nürnberg, was interim professor at the University Bayreuth and, since 2001, he is full professor for experimental physics at the JLU Giessen. Since 1988, he is member of the Energy Working Group at the German Physics Society. In 2006, he was co-founder of the interdisciplinary SEPA working group (Solar Energy Partnership Africa-Europe) at Giessen University and in 2008 co-founder of the DESERTEC foundation. In July 2011, he became coordinator of the DESERTEC Academic Network. He is an **ANSOLE** member of early hours! He was co-applicant of the proposal submitted at VolkswagenStiftung seeking for funding of SE4A schools.

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Biography: Dr. Matthias Höher

Matthias Höher studied regional and urban planning at the Justus-Liebig University Giessen and obtained his PhD in the field of regional labor market research. Under the impression of the German reunification he founded a consulting agency in 1990 focusing on community development in Eastern Germany. Eleven years later he returned to Giessen University and became the Managing Director of the Center for International Development and Environmental Research (ZEU). He joined **ANSOLE** as an active member in 2017. He was co-applicant of the proposal submitted at VolkswagenStiftung seeking for funding of SE4A schools and is presently the financial director of SE4A schools.

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Biography: Mr. NOUADJEP Serge N.

Mr. NOUADJEP Serge N. has a Msc in Process Engineering and a Meng. in Agro-Industrial Processes. He is a PhD. student in power systems engineering and currently serving, as Assistant Lecturer and Coordinator of Programme for electrical and electronic engineering at the Faculty of Engineering and Technology, University of Buea. Mr. Nouadjep’s research is actually focused on biomass assessment and conversion to energy: biofuels formulation from seed oils, biogas production process optimization, applications of solar energy for agro-industrial purposes.

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Biography: Fuam FAITH

FUAM Faith has a B.A in English from the University of Yaoundé I. She is a Christian Leader with a Certificate of Achievement on Advanced Christian Leadership from Haggai Institute. She also has a Certificate on a full course of instruction on the Minimum Initial Service Package (MISP) for Reproductive Health in Crisis Situation of the Women’s Commission for Refugee Women and Children in New York (online course organized by Community Education Board -COHEB Yaoundé).

FUAM worked for more than two years as Receptionist and Cashier at Cabinet Medical International, Elig-Esson, Yaoundé before being recruited and posted to the University of Buea under the Ministry of Higher Education (MINESUP) as an Administrative Assistant. She is currently serving in the Faculty of Engineering and Technology in that same capacity. Fuam served as a member of the feeding and lodging committee for the conference organized by ANSOLE in Buea in August 2017. Contact: faith4jesus2003@yahoo.com / faithish39@gmail.com

Biography: Mrs. Philomena NJIEFI

Mrs. Philomena NJIEFI has a BSc. in Economics from the University of Buea. Mrs. Njiefi is currently the Head of Service for Finance in the Faculty of Engineering and Technology. She also took part in the conference organized by ANSOLE in Buea in August 2017 and acted as the president for the feeding and lodging committee ensuring the comfort of the participants with the best lodging facilities and balanced diet. Contact: (+237) 677 51 95 31

Biography: Dr. Ngwashi Divine Khan

Dr. Ngwashi Divine Khan holds a PhD in Electronics engineering from De Montfort University, England United Kingdom. Prior to this he also held an MSc. degree in Engineering Physics from Umeå University, Sweden and a BSc. degree in Physics and Computer Science from the University of Buea, Cameroon. He is currently working as Senior Instructor for the Faculty of Engineering and Technology of the University of Buea. Areas of expertise include Raman spectroscopy of carbonaceous materials, oxide electronics, thin film transistors, carbon nanotube field effect transistors, MOSFETS, High-k dielectrics, fabrication of microelectronic devices, electrical and physical characterization of nano/microelectronic devices. Dr. Ngwashi’s research interest include novel semiconductor materials and electronic devices, degradations in

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Biography: Dr. Pierre Tsafack

Dr. Pierre Tsafack has a DEA in electronic and a Ph.D in Electrical Engineering. He had conducted his PhD research works in applied Electronics conjointly in the Department of Electrical and Telecommunications Engineering - National Advanced School of Engineering - Republic of Cameroon and in “Laboratoire Ampere - Institut National des sciences appliquées de Lyon-France”. He was in charge of practical electronics laboratory from 2006 to 2011 in the Department of Electrical and Telecommunications Engineering-National Advanced School of Engineering. He is teaching and doing research works in the field of renewable energy technologies since 2012 in the Department of Electrical & Electronic Engineering, Faculty of Engineering and Technology, University of Buea-Republic of Cameroon. He is also the head of the department of electrical and electronic engineering at the faculty of engineering and technology of the University of Buea, in Cameroon. Contact: pierro_tsaafack@yahoo.com

Biography: Dr. Walter Gam NKWI

Walter Gam Nkwi holds a PhD in Social History from the Universiteit Leiden, The Netherlands. He is teaching Social, history of science and technology and Labour History at the Department of History, University of Buea, Cameroon. In December 2014 Dr. Nkwi was made the Faculty Officer of Engineering and Technology, University of Buea. He has published widely in book chapters and peer review journals. His latest publication is Kfaang with its technologies: Towards a social history of mobility in Kom (2011) African Modernities and Mobilities: An ethnographic history of Kom, Cameroon, c. 1800-2008 (2015). Contact: nkwi.walters@ubuea.cm

Biography: Mrs Violet NYOKI

Mrs Nyoki Violet has a Double Major Degree in Women and Gender Studies and Sociology and Anthropology from the University of Buea. She is working as an Administrative Assistant in the Faculty of Engineering and Technology, University of Buea. She was a member of the Feeding and Lodging Committee and also served as the president of the Cleaning and Decoration committee for the ANSOLE Summer School 2017 in Buea. Contact: vnyoki@yahoo.com

Biography: Mr Bobofuh Charles KONGE

Mr Bobofuh charles Konge is a holder of CISCO Certifications, working as Computer Lab Technician at the Faculty of Engineering and Technology, University of Buea. I do the preparation of lab practical with Lecturers and also coordinate Lab sessions. I was one of the General Coordinator of the ANSOLE Summer School 2017 in Buea. Contact: charleskonge@gmail.com / boboful.charles@ubuea.cm
Biography: Mr. Tita Fangmbung SAMBITLA

Mr. Tita Fangmbung SAMBITLA is a holder of a BA in Linguistics and is currently a postgraduate student in the Pan African Institute of Development West Africa in the department of Development Studies, reading an MSc in Peace, Conflict and International Relations. Mr. Tita currently works as a clerk in the Faculty of Engineering and Technology University of Buea. He served as a member of the transport and logistics committee during the ANSOLE conference held in Buea on August 2017. Contact: sambitlatita@gmail.com

Biography: Mrs. Emoh Glory AGBOR

Mrs. Emoh Glory Agbor has a diploma in History from Ecole Normal Bambili, DIPES 1 in June 1997 and also a diploma in Credit Management from Pan African Institute for Development. Served as project officer for an NGO CHAMEG Buea and is presently the Auxiliary Store Accountant at the Faculty of Engineering and Technology University of Buea. She was also a member of the feeding and lodging committee for the ANSOLE summer school 2017 in BUEA. Contact: (+237) 650 74 56 44 / 699 69 90 93

Biography: Mr. Jean Carol ZANDA

Mr. Jean Carol ZANDA has a BEng in Electrical and Electronics Engineering (specialised in Power Systems). Currently, he is rounding up with his MEng degree in the same domain in which as thesis is investigating on the environmental effect on photovoltaic module. Mr. Zanda being a final year Masters student was incharge of the Out Door Solar Work Station during the second international summer school on Sustainable Energetics for Africa(SE4A) that took place in the Post Graduate Complex of the Faculty of Engineering and Technology in the University of Buea. Mr. ZANDA is also a member of many scientific networks. Beside studies, he has successfully sized and install a number of PV systems. Contact: zandajeancarol@gmail.com / zanda.jean@ubuea.cm

Biography: Eng. Ayuketah Yvan J. Agbor

Eng. Ayuketah Yvan has a BEng degree in Electrical and Electronics Engineering and presently finishing his MEng in power system engineering at the University of Buea, Cameroon. Engr Ayuketah’s research is focused on hydropower generation as a form or renewable energy resources. He also did a four-month work program at the National Oil Refinery (SONARA). Contact: yvanayuketah@gmail.com

Biography: Mr. Wirnkar Basil NSANYUY

Mr. Wirnkar Basil NSANYUY has a BEng in Electrical and Electronic Engineering (specialized in Power systems engineering). He is Graduate Teaching Assistant at the Faculty of Engineering and Technology (FET) of the University of Buea. He participated as facilitator in the six months capacity building training organized by FET on the Installation,
operation and maintenance of renewable energy systems. He assisted the preparation and Manning of platform four during the ANSOLE summer school in Buea. He also served as a Protocol during the summer school in Buea. He is a year two master student in FET and is researching on “Smart Battery Management for Wind and Photovoltaic energy system”. Contact: wirnkarbasil@gmail.com

Biography: Mr. Kang Roland ABENG

Mr. Roland ABENG has a B.Eng. in Electrical and Electronics Engineering from the Faculty of Engineering and Technology (FET), University of Buea. He is currently a final year master’s student in Power Systems Engineering at the same Faculty. He also serves as the Executive Technical Director of TEFA Engineering Company Ltd. located in Kumba, Cameroon where he oversees all Electrical works. Prior to his current activities, he served as a junior engineer at BELTCON Ltd, a subcontracting company to the country’s lone electrical company, ENEO. His research interest is on small hydropower systems and hybrid energy systems. His current research work is on the “characterization and dimensioning of electromechanical equipment for a micro hydropower station on river yoke and the economic analysis to judge its viability”. Contact: rolyabeng@gmail.com

Biography: Biszan Mukwelle

Biszan Mukwelle is an undergraduate student in the Faculty of Engineering and Technology (FET) at the University of Buea, Cameroon. She is a final year student who majors in Power Systems Engineering in the Electrical and Electronics Department. Fascinated with Renewable Energy. She was a member of the Faculty of Engineering and Technology Student Association (FETSA) for 3 years; once as a Secretary General and twice as an Academic Officer. She did her Academic Internship at the Limbe Power Plant, ENEO. Biszan Mukwelle is currently a volunteer at the Inspiring Change Foundation whose main objective is to inspire youths. Contact: biszanelle@gmail.com

Biography: Mr. Glen Beloa  FORCHA

Mr. FORCHA Glen Beloa is currently third year student of the Faculty of Engineering and Technology (FET). He is currently the Academic Officer of the Faculty of Engineering and Technology Students Association (FETSA) 2016/2017, he has represented the students of the Faculty and the association on numerous occasions. He has been the Secretary General of the University of Buea Electrical and Electronics Engineering Students (UBEES) 2015/2016. He was admitted into the Faculty on 13th October 2014. He obtained his Advance and Ordinary level certificate from Sacred Heart College Mankon Bamenda.

Biography: Dolvie Mansindoung Ndifor

Dolvie Ndifor completed her B.Eng. in Computer Engineering (Telecommunications Engineering) at the University of Buea, Cameroon in 2015. She is currently in her final year of a research masters (M.Eng.) in Telecommunications and Network Engineering, in the Faculty of Engineering and Technology at the University of Buea, Cameroon. Dolvie’s research is focused on the design and implementation of a WTTx (Wireless to the x-Home/Building/Premises) network in Yaounde, as case study. Contact: dolviendifor@gmail.com
Biography: Fuhneh LEWIS

Mr. FUHNEH LEWIS is a holder of DEPET II known in the French acronym as PLET in Electrical and Power Engineering. He is a teacher in the department of Electrical Technology in G.T.H.S OMBE Cameroon. He is currently a year two master student in the faculty of engineering and technology (FET) in the University of Buea Cameroon, soon to defend a thesis after a research done on the topic: Development of a renewable energy map of the south west region of Cameroon: implications for the rural electrification of villages of the region. He has carried out a number of internships with renowned companies in Cameroon one of which was in Ndawara tea Estate where he served in the Electrical control and maintenance department. Contact: fuhnehlewis@gmail.com, fh_lewis@yahoo.co.uk.

Biography: Mr. Elondo S. Mukete

Mr. Elondo S. Mukete hails from Kumba, a town located in Meme Division in the South West Region of Cameroon. He is a holder of the GCE Ordinary Level certificate from CCAS Kumba and the GCE Advanced Level certificate from BGS Molyko-Buea. He is currently a third-year student in the Faculty of Engineering and Technology of the University of Buea pursuing a Bachelor's degree in Computer Engineering specializing in the field of Software Engineering. He has served as the treasurer of the Computer Engineering Students Association (UBCESA) and is presently the Treasurer of Faculty of Engineering and Technology Students Association (FETSA). Contact: elondostephan@gmail.com.

Biography: Miss NGORAN Clare-Joyce FOMONYUY

Miss NGORAN Clare-Joyce FOMONYUY is a final year Power Systems Engineering student in the Faculty of Engineering and Technology (FET) in the University of Buea. She is a member of Women Techmakers (WTM) Buea Branch. She has completed a three months internship in Limbe Power Plant (LPP) and a one month internship in CDC, Rubber Plant in Mukonje. She has been the general organizer and the female sport coordinator of the faculty student association (FETSA) for two years. She is aspiring to study control engineering with focus in the control of hybrid renewable energy systems. Contact: joycetirnyuy@gmail.com.

Biography: Mr. Akupan Rene EBUNLE

Mr. Ebunle Akupan Rene is an Electrical and Electronics Engineer with specialty in Electrical Power systems. He received his B.Eng degree from the University of Buea, Cameroon and he is currently in pursuit for his M.Eng still in Electrical Power Systems at the Faculty of Engineering and Technology, University of Buea, Cameroon. Mr. Ebunle is one of the co-founders of AFNEL Engineering; a small startup Company in Buea. He has a well-developed knowledge in P-V array sizing and installation, security system design and implementation as well as electrical installation of domestic appliances and electronics circuit design. Mr. Ebunle Rene has also work as a technician in one of the Huawei’s solar projects. He worked with a subcontracting Company CCS (Chinise Communication Service) installing an 80kW of grid mini solar system at Bessi village in the North West region of Cameroon. He can be contact:ebunleakupanrene@gmail.com.
Biography: Elizabeth Asobi NGAI
Ngai Elizabeth Asobi is a student at the Faculty of Engineering and Technology University of Buea. A mentor at the STEM (Science Technology Engineering and Math) Girl-Tech Club G.H.S Limbe Buea. Ngai Elizabeth is currently specializing in Telecommunication Engineering at the University of Buea. Contact: asobingai@gmail.com / asobingai@gmail.com

Biography: Messa Erika Stella KAMGA
Kamga Messa Erika Stella is currently a third year student at the Faculty of Engineering and Technology (FET) of the University of Buea, specializing in Telecommunications Engineering. She is currently the Secretary General of the Faculty of Engineering and Technology Students Association (FETSA). Contact: erikakamga29@gmail.com / kamest@rocketmail.com

Biography: Mr. Emmanuel EJUH CHE
Mr. Emmanuel EJUH C. is a holder of the Technical High School Teachers' grade II diploma (DIPET II) in electrical power systems engineering. He is a teacher and the HOD for electricity in Government Technical College Matoh-Butu, Meme division, S.W.R- Cameroon. He has been an auxiliary staff in the COVEP training program for the award of HND and bachelor of technology of the University of Bamenda. His research has been focus on renewable energy specifically; Hydro-electric power and solar energy. Mr. Emmanuel Ejuh C, after defending his DIPET II thesis on Micro-hydro power plant enrolled in the Faculty of Engineering and Technology (FET) for masters of engineering degree in the University of Buea where he is currently researching on “modelling of Photovoltaic systems” Mr. Emmanuel Ejuh was one of presenter of the hydroelectric power station in FET the ANSOLE conference of August 2017 in Cameroon. Contact: emmanoupresi@yahoo.com

Biography: Mr. Terence Awoh EGBE
Mr. Egbe Terence Awoh is a master student at the University of Buea studing Power Systems. His current research is on fault on transformers. Mr Egbe had also carried out researched on renewable energy and smart grid systems. During the ANSOLE conference, he worked on platform 9, indoor hydrogen system. Contact: egbeterence@gmail.com

Biography: Mrs. Nguedjang Kouakeuo Hilary Sorelle
Mrs. Nguedjang Kouakeuo Hilary Sorelle is currently a master student (year 1) in power system engineering at the Faculty of engineering and Technology / University of Buea. She obtained a bachelor of engineering in electrical and electronic engineering (power systems engineering) ranked 2nd of her department. She designed and implemented an automatic thickness based slicing machine which produces 5 different sizes of sliced vegetables depending on the choice of the user; as end of year project in obtainment of her bachelor. Mrs. Nguedjang areas of interest are biomass technologies, hybrid renewable energy systems, electric machines and control. She operates following two mottos: “let’s be the change” and “hard work is the only way”. Contact: nguedjangsorelle95@gmail.com