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Sustainable Energy for Africa (SE4A 2021)

Abstracts and biographic notes

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Monday 8 November 2021

Energy is crucial for achieving the Sustainable Development in Africa

9:00 – 10:00 ***SESSION 1 : OPENING SESSION***

Chair: Hippolyte Agboton (Benin)/Philippe Goyens (Belgium)

Keynote speakers:

Nazaire Padonou, President of ANSALB
Philippe De Maeyer, Permanent Secretary of RAOS
Atef Marzouk, Acting Director Infrastructure and Energy of the African Union
Fadila Boughanemi, UE
Xavier Leblanc, Ambassador of Belgium to Benin and Togo
Norbert Hounkonnou, President of NASAC
Minister of Energy of Benin
Minister of Higher Education and Scientific Research of Benin

10:30 – 12:15 ***SESSION 2***

Chair: Thierry d'Almeida (Benin)/ Jean Snoeck (Belgium)

THEME 1 - Energy access and socioeconomic development as primary drivers, part 1

10:30 - 10h45	Rajaâ Cherkaoui El Moursli (Morocco)**,** *Moroccan National Energy Strategy*
10:45 – 11:00:	Fadila Boughanemi (France), *International cooperation in research and innovation is a strategic priority for the EU*
11:00 – 11:15:	Nopenyo Dabla (Togo), *Renewable Energy as an enabler for socioeconomic development in Africa*
11:15 – 11:30:	Faustin Dahito (Benin), *Les « business models » de la transition énergétique en Afrique de l'Ouest (CEDEAO)*
11:30 – 11:45:	Badr Ikken (Morocco), *Three new research and innovation platforms in Morocco*
11:45 – 12:00:	Appolinaire Ki (Burkina-Faso), *title of talk to be announced*

1. « Moroccan Energy Strategy », Prof. Rajaâ Cherkaoui El Moursli,

Resident Member of the Hassan II Academy of Science and Technology, Member of TWAS, Fellow of the African Academy of Sciences

Abstract

Morocco is a country facing the virtual absence of identified fossil energy resources (hydrocarbons, coal) and a heavy dependence on imports, which until 2018 covered more than 90% of national energy needs. Morocco is actively trying to remedy and change this situation.
Morocco's commitment to an energy transition is a proactive political choice made by His Majesty King Mohammed VI, more than a decade ago, through an ambitious energy strategy, based essentially on the rise of renewable energies, the development of energy efficiency and the strengthening of regional integration, accompanied by a strong orientation of adapted innovation and local control. Main Orientations aims to raise the Kingdom's ambitions to exceed the share of renewable energies in the energy mix to more than 52 % in 2030.
This vision has already started to give results. About 48 Renewable energy projects with a total installed capacity of about 4 Gigawatts are already in operation. In addition, more than 50 other projects are under development or implementation. These projects have strongly contributed to electricity production and to the reduction of energy dependence by 8 points since 2009.
It is important to note that Moroccan renewable energy projects are made possible thanks to the establishment of an appropriate legislative, regulatory and institutional framework. This framework is updated regularly to improve the business climate and make the renewable energy sector more attractive to private investment.
Research, development, innovation and industrialization in the fields of renewable energies and energy efficiency are an essential pillar for the success of our energy transition. It was proceeded, first of all, with the creation of an institution dedicated to R&D&I in the field of green energies, notably the Research Institute for Solar Energy and New Energies, for the financial support of innovative research projects with the involvement of industrialists, and then the development of new research platforms at the service of innovation and researchers.
A new strategic vision to 2030 for R&D an innovation in the field of green technologies has been adopted, aiming in particular to further strengthen Morocco's role at the regional and international level in terms of energy transition.
Local industrial integration is also an objective of Moroccan energy model. On this subject, three photovoltaic module factories with 300 Megawatts per year and a wind turbine blade factory with an annual capacity of 1000 MW have been set up.
New initiatives have been launched in these recent years to accelerate the Moroccan energy and the economic transition towards a low-carbon model and to meet the socio-economic needs of the population.

short bio

Prof. Rajaâ Cherkaoui El Moursli received her PhD in Nuclear Physics at the University Joseph Fourier in Grenoble, France. Early 1982, she joined the Faculty of Sciences, University Mohammed V, Rabat as a research-professor. Later in 1996 she was serving as a head of the Laboratory of Nuclear Physics (LNP). With her professional expertise Dr. Rajaâ Cherkaoui has created and implemented several master's degree programs at the university, one of her crucial roles was the building and Strengthening the First Master's Program in Medical Physics in Morocco.

She became Vice-President for Research, Innovation, Cooperation and Partnership Mohammed V University from January 2013 to January 2017.

She was part of the official Morocco's forerunners participants in the international ATLAS collaboration at CERN in Geneva in 1996.

In 2015, Prof. Cherkaoui received L'Oréal-UNESCO award for "Women in Science" as a laureate representing Africa and the Arab States. Rajaa Cherkaoui is the First Moroccan Woman to Win L'Oréal-UNESCO Science Award.

Besides that, she also assigned as resident member at the Hassan II Academy of Sciences and Technology in Morocco. Simultaneously she was an active Fellow of the African Academy of Sciences (AAS).

In 2016, she was appointed member of the Management Board of the Moroccan Agency for Safety and Nuclear Safety and a member of the Scientific Committee of the Spanish.

Professor Cherkaoui was honoured in 2017 by the Organization of Islamic Cooperation (OCI).

In 2018, she was assigned as a member of the International Awards Jury in the Physical Sciences for the L'Oréal-UNESCO Awards for Women in Science. The same year, she was appointed a member of the World Academy of Sciences (TWAS) for the advancement of science in developing countries and of the Organization for Women in Science for the Developing World. In this year, she has been appointed a Member of the Managment Board of the National Center for Nuclear Energy, Science and Technology (CNESTEN/Morocco).

In 2019, she was elected Vice-President for Policy Review and Administration of the board of the Network of African Science Academies (NASAC) (for 2019- 2022).

In 2021, she holds first place across the board, in Morocco, Africa, and the "Arab League" and she enter Top 50 of AD Scientific Index.

2. “International cooperation in research and innovation is a strategic priority for the EU”, Fadila Boughanemi

Abstract:

International cooperation in research and innovation is a strategic priority for the EU. It enables:

- access to the latest knowledge and the best talent worldwide
- business opportunities in new and emerging markets
- science diplomacy to influence and enhance external policy

Multilateral research and innovation initiatives are the most effective way to tackle challenges facing our world - climate, health, food, energy and water - that are global by nature. Working together reduces the global burden, pools resources and achieves greater impact.

The European Commission leads many global research partnerships. These partnerships are important for the EU to meet its international commitments like the Sustainable Development Goals (SDGs).

Fadila Boughanemi will present an overview of the renewed EU Global Strategy for Research, Innovation, Education and Youth, to be adopted by spring, with a specific focus on Africa.

Fadila will highlight the scientific priorities with the continent, and the future perspectives of cooperation in R&I.

Short CV:

Fadila BOUGHANEMI

Nationality: French

Academic qualifications:

- 2004 Ph.D. in Political Science, Institute of Political Science, Aix-en-Provence, France
- 1994 Master in Political Science, with honors (ranked 1 st of promotion), Institute of Political Science, Aix-en-Provence
- 1993 Degree in Political Science, Institute of Political Science, Aix-en-Provence
- 1992 Master Degree in English, University of Aix-Marseille
- 1991 Bachelor Degree in Philosophy, University of Aix-Marseille
- 1990 Preparatory Classes to 'Grandes Ecoles' (Hypokhâgne-Khâgne), Paul Cézanne High School, Aix-en-Provence

Professional experience in the European Institutions:

- 03/2016 – to-date Deputy Head of Unit H2: Asia, Africa, MENA and External Relations, Directorate H "International Cooperation", DG Research and Innovation (DG RTD)
- 09/ 2015 – 02/ 2016 Acting Head of Unit C3: Africa, the Neighbourhood and the Gulf, Directorate C "International Cooperation", DG RTD
- 02/ 2012 – 08/ 2015 Policy Officer in charge of cooperation with MENA, Unit C3: Africa, the Neighbourhood and the Gulf, Directorate C "International Cooperation", DG RTD
- 05/2004 – 01/2012 Policy Officer in charge of cooperation with Africa, Unit N1: International Cooperation Policy, Directorate N "International Cooperation", DG RTD
- 06/1996 – 04/2004 Administrator in charge of research on social exclusion and social integration, Unit K1: Targeted Socio-Economic Research, Directorate K "Human Potential", DG RTD

3. ”Renewable Energy as an enabler for socio-economic development in Africa ", Nopenyo Dabla

Abstract:
Endowed with substantial renewable energy resources, Africa is in a position to adopt innovative, sustainable technologies and to play a leading role in global action to shape a sustainable energy future. Supply unreliability is a concern holding back economic development, with most countries facing frequent blackouts and often relying on expensive and polluting solutions. Clean, indigenous and affordable renewable energy solutions offer the continent the chance to achieve its economic, social, environmental and climate objectives. Sustainable development and use of the continent’s massive biomass, geothermal, hydropower, solar and wind power have the potential to rapidly change Sub-Saharan Africa’s current realities and offer the continent the chance to achieve its economic, social, environmental and climate objectives.
Indeed, Africa could meet nearly a quarter of its energy needs from indigenous and clean renewable energy by 2030. Modern renewables amounting to 310 gigawatts (GW) could provide half the continent’s total electricity generation capacity. This corresponds to a sevenfold increase from the capacity available in 2017, which amounted to 42 GW. A transformation of this scale in Africa’s energy sector would require average annual investment of 70 billion US dollars (USD) to 2030, resulting in carbon-dioxide emissions reductions of up to 310 megatonnes per annum (IRENA, 2015).

Data shows that at least 25 African countries have electricity access rates of less than 40 per cent. Access to clean cooking is still one of the significant challenges, as these countries consistently rely on biomass fuels and technologies for their thermal needs. Additionally, the region’s growing population and economic progress call for a rapid increase in supply on the continent, to which renewable energy must contribute in the decades ahead. Africa therefore has a unique opportunity to pursue sustainable energy development as a basis for long-term prosperity. Tackling today’s energy challenge on the continent and preparing for tomorrow’s needs, therefore, requires a firm commitment to the accelerated use of modern renewable energy sources.

In this context, through partnerships at continental, sub-regional and national levels, the International Renewable Energy Agency (IRENA) has been supporting Sub-Saharan African countries in their transition to a sustainable energy future in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity. More specifically, this support spans across the implementation of the Clean Energy Corridor initiative in Eastern, Southern and West Africa; as well as the regional engagement in Central Africa, and under the access thematic, covering entrepreneurship support and the electrification on rural health facilities. IRENA support is also geared towards supporting countries in the enhancement and implementation of their climate change ambitions.
The objective of this proposed presentation would be to reflect on the role of the energy transformation in order to achieve sustainable development and climate objectives.

Short Bio

Nopenyo Dabla is Programme Officer for the Sub-Saharan Africa region at the International Renewable Energy Agency (IRENA), which he joined in January 2016. He currently coordinates the Agency's engagement in the Sub-Saharan Africa region.

In that capacity, Nopenyo works to support national, sub-regional and continental efforts and initiatives for an increased uptake of renewables with the view of increasing socioeconomic development that comes with the energy transition. He's also got an extensive experience in working with bilateral and multilateral partners in the sustainable development sphere. Prior to joining IRENA, Nopenyo has gained experience in working amongst others at the World Wind Energy Association as well as national NGOs working to promote renewables in rural electrification and rural development approaches.

Nopenyo holds a master's degree in Public Policy from the Willy Brandt School of Public Policy in Germany. He also studied Business Administration at the Hanze University of Groningen in the Netherlands as well as Economics at the Complutense University of Madrid in Spain. He is a national of Togo.

4. « LES BUSINESS MODELS DE LA TRANSITION ENERGETIQUE EN AFRIQUE DE L'OUEST (CEDEAO) », Faustin DAHITO, Groupe ENERDAS et AISER-Bénin (Association Interprofessionnelle des Spécialistes des Energies Renouvelables)

Abstract

La situation énergétique des Etats de la CEDEAO est caractérisée par un faible taux d'électrification (environ 35 % dans le secteur urbain et 8 % dans les zones rurales).

Les réseaux électriques de transport de l'électricité affichent des pertes en ligne de plus de 20 %. La biomasse est la forme d'énergie la plus utilisée par les populations, ce qui favorise du coup la dégradation des forêts et contribue à l'accélération du changement climatique.

L'électricité est une ressource vitale pour la prospérité économique des nations. Les pesanteurs qui minent les performances économiques des Etats de la région sont notamment engendrées par la faible disponibilité de l'énergie électrique par tête d'habitant qui est de l'ordre de 0,6 tep dans la CEDEAO contre 20 tep en Europe et 30 tep en Amérique du Nord. Triste réalité linéaire avec le produit intérieur brute par tête d'habitant.

Conscient de l'importance des enjeux, la CEDEAO a décrété une ambitieuse politique de développement des énergies renouvelables pour endiguer la pauvreté énergétique des Etats et limiter les maux qui freinent la prospérité économique des Etats.

Les directives majeures sur les économies d'énergie et d'efficacité énergétique consolident la politique de développement durable dans les Etats qui ont tous adopté dans leur programme d'action gouvernementale une politique de développement des énergies renouvelables orientés vers l'utilisation de l'énergie solaire photovoltaïque ou thermique, de la biomasse, des éoliennes et de l'hydroélectricité.

Sur le plan législatif et règlementaire, les codes nationaux de l'électricité ont évolué dans un nouveau paradigme de diversification des filières énergétiques. La démonopolisation du marché de l'électricité, a ouvert la voie à l'investissement privé dans tous les Etats. Le mixage responsable de l'électricité des réseaux conventionnels devient la mode du jour accélérant ainsi la densification des capacités nationales de production, la résilience des réseaux électriques face aux aléas du changement climatique.

La nouvelle dynamique en cours a impulsé des initiatives nouvelles. La densification des réseaux électriques ainsi que les capacités de production nationale s'accélèrent dans l'ensemble des Etats des régions. Le développement de la recherche scientifique et appliquée se nourrit également de la formation des cadres experts formés aux sciences et technologies des énergies renouvelables.

Les politiques d'économie d'énergie appellent les stratégies nationales d'efficacité énergétique. De nouveaux Business Models émergent en conséquence, orientés vers le développement des projets en partenariat public privé ainsi que des contrats de performance énergétiques.

Avec le soutien des partenaires techniques et financiers aux Etats, le mouvement de la transition énergétique est en pleine marche dans la région CEDEAO, accélérant le renforcement des capacités des acteurs sectoriels et le développement des nouvelles filières professionnelles. Grâce à la coopération internationale, des joint-ventures et autres alliances stratégiques se créent entre les firmes internationales et les entreprises locales.

Les énergies renouvelables constituent la voie d'avenir du développement durable des nations d'Afrique et du Monde. L'immensité du gisement solaire permet d'augurer des résultats positifs pour l'avenir énergétique de la région.

Short bio

Ingénieur diplômé de Génie Electrique de l'Ecole Polytechnique de Montréal, Faustin DAHITO est Expert en Energies Renouvelables et en automatique. Il détient également un MBA et un Doctorat en Stratégie Industrielle de l'International School of Management et de la St John's University de New-York.

Président du Groupe ENERDAS, une société travaillant dans l'ingénierie et le développement des Energies Renouvelables depuis une trentaine d'années. Il a travaillé dans le développement des centrales solaires pour l'énergie des télécommunications, les réseaux d'adduction d'eau à exhaure solaire ainsi que l'électrification rurale.

Faustin DAHITO a également travaillé dans la recherche appliquée pour le développement de composants électroniques solaires et des systèmes thermiques solaires pour le bâtiment et l'agriculture.

Il assure la Vice-présidence de UNIAFRICA, une chambre de commerce Italo-africaine de promotion des investissements industriels structurants pour le secteur privé en Afrique de l'Ouest et du Centre.

Docteur Honoris Causa de Centre de Réflexion des Nations (CRN) tenant ses sessions au siège des Nations Unies, Faustin DAHITO est aussi Président du Comité Electrotechnique National du Bénin (ANM).

Il assure également la Présidence de AISER-Bénin, l'Association Interprofessionnelle des Spécialistes des Energies Renouvelables du Bénin.

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5. “Institut de Recherche en Energie Solaire et Energies Nouvelles (IRESEN) : three new research and innovation platforms in Morocco (the Green & Smart Building Park ; the Green H2A ; the Green Energy Park)”, Badr IKKEN,

Directeur général de l´Institut de Recherche en Energie Solaire et Energies Nouvelles (IRESEN)

Abstract

“Between 2016 and 2030, the primary energy demand of Morocco will be nearly tripled and quadrupled for electric power. Morocco has a vision to clear the way to becoming a major player in renewable energy, especially solar energy. It is planned to deploy more than 10000 MW of renewable energy across the kingdom in the next 10 years. The share of renewable electricity will be 52%, which will outweigh the share of fossil fuel electricity. To support the national energy strategy, several active institutions were created under the trusteeship of the Moroccan Ministry of Energy, Mines and Sustainable Development: MASEN - The Moroccan Agency for Sustainable Energies, AMEE - The Moroccan Agency for Energy Efficiency, SIE - The Energy Investment Company and IRESEN - The Research Institute for Solar and New Energies. IRESEN has been set up in 2011 by the Ministry of Energy, Mining, and sustainable development, with the participation of the key players of the energy sector in Morocco.

To reach our ambitious target, it was important to have a long term strategy and to develop adapted ecosystems to meet the needs and challenges. The technology adoption is playing an important role. Research and Innovation is fostering the energy transition by addressing optimally energy needs in Morocco while including economic development through local manufacturing of new products and offering specific new services.

IRESEN as an applied research catalyst in renewable energies is facilitating and coordinating the setting up of adapted R&D infrastructure, projects as well as national and international partnerships propitious to knowledge acquisition and innovation. To reach these fixed objectives, a strategy founded on two pillars was elaborated and sat in place:

• bring the university closer to the industry by means of financial support to a high quality applied R&D projects submitted under the framework of a well oriented and focalized call for proposals. Today more than 800 researchers and Phd students are supported by IRESEN to conduct innovative projects in several fields, like adapted solar and wind technologies, use of renewable technologies in industrial applications, water treatment, city and mobility of the future...

•set up the conducive infrastructure and laboratories for R&D jointly with the national universities to create the complementary scientific platforms of excellencies needed in different regions in Morocco while assuring an efficiency and mutuality of resources and respecting the demand/offer approach. To reinforce innovation across Morocco in the field of renewable energy and to promote human resources development, IRESEN developed and set up the first applied research and innovation network in the African continent. It is built around regional platforms for test, research and training in the field of renewables. This territorial network is set around universities and education institutions while developing technology know how transfer mechanisms to local industries. It addresses strategic needs and challenges in relation to energy to position Morocco as a gamechanger in innovation in the field of renewable energies and sustainable development. In addition to the medium and long term scientific vision, the Network will enable the local industry, in close collaboration with academia, to seize market opportunities in a very short term while complying with the so-called innovation criteria: scientific excellence, entrepreneurial skills, robust business model and strong networking.

The genesis of this Network was marked by the creation of the Green Energy Park (GEP), the international platform for test, research and training for solar energy. The "Green Energy Park", a unique test, research and training platform in Africa has been established by IRESEN and the Polytechnic University Mohammed VI in Ben Guerir. It is covering the entire R&D value chain from basic research until proof of concept in the field of solar energy. Built on an area of 8 hectares, the GEP has an internal research platform, which includes several labs with cutting-edge technologies in the field of solar photovoltaic and thermal energies. Topics such as treatment and desalination of water using solar energy, development of desert modules, design of innovative thermal and electrical storage solutions and development of industrial applications of solar thermal energy are considered as major concerns of the Green Energy Park. The distinctive character of the GEP lies in the fact that the platform includes full size outdoor test platforms, which is a critically important factor for testing and validating solar components and technologies in real conditions. Different solutions regarding technology improvements, in design and in materials for hot Moroccan regions are developed and can be implemented in different regions in Africa.
Today three new research and innovation platforms are under construction, the Green & Smart Building Park, addressing the African city of the future, the Green H2A dedicated to power fuels as well as the first platform outside Morocco, the Green Energy Park MCI (Morocco Ivory Coast). The infrastructures will be also expanded to cover the nexus Water energy and the agro-energy. The aim of the this green continental research & Innovation network is to support and accompany the emergence of a green economy in Africa through a strong linkage between academia and industry. "

Speaker biography:

Mr. Badr Ikken received an engineer degree in mechanical engineering and industrial production & solar systems from the Berlin Institute of Technology. He wrote a thesis on production technologies of hard materials.
During 8 years, he worked in the Department for Machining Technology of the Institute for Machine Tools and Factory Management (IWF) in Berlin, first as a research associate, then as a project manager. In the Institute for Production Systems and Design Technology (Fraunhofer IPK), he served as leader for several industrial projects involving companies such as Siemens Power Generation, INA Schaeffler, Saint-Gobain Diamantwerkzeuge, SGL Carbon,.. Between 2008 and 2010, Badr Ikken served as CTO of the multinational company Lunos-Raumluftsysteme. During this period, he developed and launched two new production lines in Germany. He also expanded the production in China.
In September 2010, he joined the Moroccan Agency for Solar Energy (MASEN) as Director of Integrated Development, in charge of Industrial Integration and R&D. He co-founded the Moroccan-based National Institute IRESEN (Institute of Research in Solar Energy and New Energies). He is the Director General of IRESEN since July 2011 and established 2016 the largest solar research platform in Africa, the Green Energy Park and he is currently building a network of applied research centers (Green Energy Park, Green & Smart Building Park, Green H2A,..)
Badr Ikken is Vice-President of the new climate economy commission of the Moroccan Confederation of Enterprises (CGEM), member of the board of the National Center for Scientific Research (CNRST) and represents Morocco in different international commissions.

6. ”", Appolinaire KI

Abstract:
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Short bio

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13:30-15:00 ***SESSION 3***

Chair: Rajaâ Cherkaoui El Moursli (Morocco)/Mansourou Moudachirou (Benin)

THEME 1 - Energy access and socioeconomic development as primary drivers, part 2

13:15-13:30	Bart Biebuyck (Belgium) - *Exploring the first large-scale hydrogen, ammonia and fuel cell related activities and projects underway in Africa*
13:30-14:30	Prem Jain (Zambia) - *Growth of solar energy industry and opportunities*
14:30-14:45	Arnaud Zannou (Benin) - *Les enjeux de la transition vers un mix énergétique responsable au Bénin*

7. “Exploring the first large-scale hydrogen, ammonia and fuel cell related activities and projects underway in Africa.”, Bart Biebuyck

Executive Director of the Fuel Cells and Hydrogen Joint Undertaking (FCH JU)

Abstract

The Fuel Cells and Hydrogen Joint Undertaking (FCH JU) is a public-private partnership supporting research, technological development and demonstration (RTD) activities in fuel cell and hydrogen energy technologies in Europe. Its aim is to accelerate the market introduction of these technologies, realizing their potential as an instrument in achieving a carbon-clean energy system.

Hydrogen is an essential component in Europe’s energy transition. By 2050, it could account for 24% of final energy demand and 5.4 million jobs, according to a FCH JU roadmap report.

Fuel cells, as an efficient conversion technology, and hydrogen, as a clean energy carrier, have great potential to help fight carbon dioxide emissions, to reduce dependence on hydrocarbons and to contribute to economic growth. The objective of the FCH JU is to bring the benefits of this technology to European citizens through a concentrated effort from all sectors.

Fuel cell and hydrogen technology has made significant progress in Europe thanks to forward-thinking policy and targeted funding by the EU and industry. The three members of the FCH JU are the European Commission, fuel cell and hydrogen industries represented by Hydrogen Europe, and the research community represented by Hydrogen Europe Research. Collaboration between European researchers, industry and policymakers in a well-coordinated partnership delivers the most innovative and tangible results, boosting society’s transition to a greener and cleaner world.

Short bio

Bart BIEBUYCK Executive Director FCH JU

Bart Biebuyck is since 16th May 2016 the Executive Director of the Fuel Cells and Hydrogen Joint Undertaking (FCH JU), a public-private partnership aiming at facilitating the deployment of fuel cells and hydrogen technologies in Europe. Under his leadership, a strong emphasis on cooperation with cities and regions led to the creation of the European Hydrogen Valleys partnership with around 40 European regions. Dissemination of project results, building technology awareness and enhanced basic research became his key focusing points.

Before the FCH JU, Bart Biebuyck was at the Fuel Cell department of Toyota Motor Europe where he held the position of Technical Senior Manager. His expertise in the automotive industry includes extensive knowledge related to the deployment of new technologies in the European market. It is as part of the Clean Energy Partnership (CEP) program in Berlin that Bart worked at reinforcing European trials for the Toyota Fuel Cell Vehicle. He also had the opportunity to develop and expand his expertise in Japan, where for two years he worked on the development of Toyota and PSA's small vehicle.

In addition to his industrial experience, Bart has been politically active in his local town since 2006. In 2013 he became the vice president of the City Council, responsible, among others, for the local economy and education.

Bart's term as the Executive Director of the FCH - JU was extended for four years until 15 May 2023.

8. “Growth of solar energy industry and opportunities”, Professor Prem Jain,

UNESCO Chair in Renewable Energy and Environment, Department of Physics, University of Zambia (Lusaka)

Abstract

This talk is an overview of a grand transformation which is taking place on our Earth with renewable energy rapidly replacing the use of fossil fuels. Since the 18th century, fossil fuels (petroleum, coal and gas) have fueled our industrialization and economies by providing cheap and convenient sources of energy. But they have now become a curse for humanity by being the cause of climate change. Burning of fossil fuels results in increasing greenhouse gases into the atmosphere. This is causing global warming by altering the natural radiative balance of the Earth-atmosphere system. Global warming is leading to climate change with adverse impacts on almost all sectors of human activity. Increased adoption of clean renewable sources of energy in place of fossil fuels has emerged as the way to mitigate climate change.

Solar energy is a leading source of renewable energy. Africa in general is endowed with plenty of this resource and is well-suited for its applications. Its use through photovoltaics was prohibitively expensive some decades ago but increased research and development have made it cost competitive. As a result, it is rapidly taking over from fossil fuels. An overview of the uptake of solar energy at global, African and Zambian level is given. Zambia is rapidly embracing solar energy. Four large programs have been set up recently – the IFC/IDC Scaling Solar, German-funded GET-FiT program, European Union - funded *Increased Access to Energy and Renewable Energy Production* (IAEREP) program and the Swedish funded *Beyond the Grid Fund for Zambia* (BGFZ). Opportunities for research, development and capacity building in solar energy are emerging. There is need for African universities to develop out-of-box thinking and bring relevance to their work by addressing the needs of their nations. In this connection, the role of the recently launched Solar Energy Centre (SEC) at the University of Zambia in providing critical support services to the emerging national solar energy industry is highlighted.

Short bio

Prem Jain is Professor in Physics at the University of Zambia where he holds the UNESCO Chair in Renewable Energy and Environment. He has close to four decades of research, development and education experience in the fields of solar energy and climate change and has the distinction of being an internationally respected figure in both the fields.

Prem Jain is relevance/development oriented, interdisciplinary and practical. He introduced the two fields of solar energy and climate change at the University of Zambia about three decades ago. Earlier from 2004-06, Prof Jain served as United Nations Development Program (UNDP) Chief Technical Advisor (CTA) to the Namibian government and founded the Namibian Renewable Energy Program (NAMREP). During 2009-12 he served as UNDP Technical Coordinator and founded the Climate Change Facilitation Unit (CCFU) in the Zambian Ministry of Environment. Recently, Prof Jain founded the Solar Energy Centre (SEC) at the University of Zambia and is currently working to scale it up. His current interests include increased electrification of rural Africa through solar energy. ...

9. « Les enjeux de la transition vers un mix énergétique responsable au Bénin », ZANNOU Arnaud (1) and ASSAN Todéman (2)

1 : Présidence de la République, Unité Chargée de la Politique de Développement des Energies Renouvelables (UC/PDER)
2 : Ministère de l'Energie, Directeur Général des Ressources Energétiques (DGRE)

Abstract

La situation énergétique du Bénin est caractérisée entre autres par un faible niveau de développement des énergies renouvelables dont la part est estimée à 9,8% dans l'approvisionnement électrique, une prédominance de la biomasse énergie (bois-énergie qui représente 54% des approvisionnements nets d'énergie), et un taux encore élevé de dépendance en énergie électrique d'environ 70% (en baisse de 6% depuis 2015). Face à cette réalité, le Gouvernement du Bénin dans son Programme d'Actions (PAG 2016-2021 intitulé « Bénin Révélé ») a fait le choix stratégique de développer les énergies renouvelables (hydroélectricité, énergie solaire, biomasse-combustible) et de maîtriser des consommations énergétiques des secteurs d'activité (industriels, tertiaire, bâtiments administratifs, ménages).

Ainsi, à travers le PAG 2016-2021 et le PND 2018-2025, le Gouvernement entend réaliser une transition vers un mix énergétique « responsable » compatible avec nos besoins de développement et nos engagements internationaux, en faisant des énergies renouvelables et de l'efficacité énergétique, la base d'une satisfaction durable et à moindre coût des besoins énergétiques nationaux. La PONADER et la PONAME constitueront les principaux leviers de cette transition énergétique. Pour y arriver, il y a lieu de promouvoir la technologie ou forme d'EnR la plus adaptée à chaque besoin, d'attirer les investissements privés, d'imposer les normes et règlements adéquats d'EffEn, et d'instaurer une solidarité nationale favorisant l'accès des plus démunis au EnR (énergie décentralisée) et à l'EffEn.

Les actions ou investissements stratégiques déjà en cours ou prévus d'ici 2025 concernent : i) 6 à 7 centrales solaires PV cumulant 75 MW ; ii) 2 barrages hydroélectriques cumulant 275 MW ; iii) la prise en compte des énergies renouvelables et de l'efficacité énergétique dans le cadre des infrastructures des projets phares, dans les secteurs industriel/ménage et pour les centres sociocommunautaires ; iv) la normalisation et la promotion des foyers améliorés et des énergies de cuisson propre ; et v) les mesures et réformes réglementaires (code de l'électricité, électrification hors réseau et normes de performance énergétique), institutionnelles, économiques, fiscales et tarifaires pour attirer les investissements et financements privés.

Cependant le développement du capital humain et des compétences du secteur, la recherche-développement et l'innovation ainsi que la connaissance approfondie du potentiel national d'EnR requièrent davantage d'efforts du Gouvernement et de ses partenaires.

Mots clés : transition énergétique – énergie renouvelable – électricité – efficacité énergétique – potentiel énergétique

Biographie

Arnaud ZANNOU est Expert Sénior en Ressources en Eau, Energie, Climat, Environnement et Gestion des Catastrophes.

Médaillé de bronze aux Olympiades panafricaines de mathématiques, il est titulaire d'un Doctorat en hydrologie et gestion intégrée des ressources en eau, d'un Master en Eau et Environnement et d'un Diplôme d'Ingénieur en Hydraulique et Génie Rural, Eaux et Forêts. Ses travaux de recherche appliqués à la gestion intégrée des barrages hydroélectriques multi-fonctions l'ont conduit aux énergies renouvelables dont il est en charge actuellement à la Présidence de la République du Bénin, après y avoir assuré le suivi des projets « eau et assainissement » du Programme d'Action du Gouvernement.

Précédemment, il a successivement occupé les postes de Directeur Général des Ressources en Eau au Bénin, Membre de plusieurs conseils d'administration d'organismes publics ou de comités de pilotage, Directeur, Coordonnateur ou Superviseur d'une vingtaine de projets/programmes multipartenaires et pluridisciplinaires au niveau national, régional et international, en relation avec les Nations Unies, l'Union Africaine, la CEDEAO et les autorités de bassins transfrontaliers.

Son expertise technique couvre les domaines suivants : planification, aménagement et gestion intégrée des ressources naturelles ; génie hydraulique et rural ; barrages hydroélectriques ou à buts multiples ; hydrométéorologie, climat, développement durable et gestion de risques de catastrophe. Il a conduit plusieurs missions d'expertise et de consultant pour divers organismes notamment UNESCO, DANIDA et NEPAD ainsi que des bureaux d'étude. Il intervient aussi dans l'enseignement et la recherche à l'Institut National de l'Eau du Bénin et à l'Institut International d'Ingénierie de l'Eau et de l'Environnement (2iE) à Ouagadougou. Il est auteur ou co-auteur de plusieurs études, publications et communications scientifiques.

Il est aussi engagé dans la vie associative et politique à travers des implications diverses dans une dizaine d'organisations de la société civile, œuvrant dans les domaines de développement durable, de l'épanouissement de la jeunesse et de l'enfance.

15:30-17:00 ***SESSION 4***

Chair: Norbert Hounkonnou (Benin)/Philippe De Maeyer (Belgium)

THEME 1 - Energy access and socioeconomic development as primary drivers, part 3

15:30-15:45	Atef Marzouk (Egypt) - *Role of Geothermal in Renewable Energy Mix*
15:45-16:00	Michel Boko (Benin) **-** *Energy and Sustainable Development: how to change the paradigm?*
16:00-16:15	Fabrice Lusinde (DRC) - *Acteurs, enjeux et perspectives de l'industrie de l'électricité en République démocratique du Congo… En attendant Inga 3 et Grand Inga*
16:15-16:30	Christian Rakos (Austria) - *Pelletized agricultural residues as alternative cooking fuel for Africa*
16:30-16:45	Claude Fischer-Herzog (France) - *Vers un pacte de solidarité énergétique en Afrique de l'Ouest pour l'industrialisation de la sous-région. Quelles coopérations avec l'Europe ?*

10. ”Role of Geothermal in Renewable Energy Mix”, Atef Marzouk, Ag. Director for Infrastructure and Energy African Union Commission

Abstract

Energy access is the main challenge for Africa and is a high priority at the AU agenda 2063. Currently, over 640 million Africans have no access to electricity, and an estimated 600,000 Africans, mostly women and children, die annually due to indoor air pollution associated with the use of fuel wood for cooking. The paradox is that there are huge energy resources in Africa, both in terms of renewable and non-renewable energy sources , including a potential of over 20 Gigawatts of geothermal resources in East Africa Rift Countries.

Geothermal energy has several attractive properties

- It is a carbon free dispatchable alternative to conventional energy systems.
- It is suitable for both centralised and decentralised power generation.
- It can be used for electricity generation, heating, cooling, green houses, etc.
- Technological progress increases accessible resources and drives down the costs.

11 African countries, namely: Burundi, Comoros, Eritrea, Ethiopia, Djibouti, Kenya, the Democratic Republic of Congo, Rwanda, Tanzania, Uganda, and Zambia called on the African Union Commission to play a role in harmonizing and coordinating the exploration and development of geothermal energy along the East African rift. These countries signed the Addis Ababa Declaration on Geothermal Energy in June 2009, giving birth to the Geothermal Risk Mitigation Fund, commonly known as GRMF. In 2020, Somalia became the 12th GRMF eligible country. GRMF, with a total budget of USD115 million, was created with the support of the German Federal Ministry for Economic Cooperation and Development (BMZ), the EU-Africa Trust Fund for infrastructure (ITF), through KfW and the UK Fund for International Development (DFID).

The overall objective is to encourage innovative financing, by providing grants for partial financing of 3 types of activities: (1) 80% of eligible costs for surface studies; (ii) 40% of eligible costs for drilling exploration wells and testing of reservoirs and (iii) 20% for the infrastructure upgrade (road access, electricity and water supply).

Since the launch of GRMF in 2012, grants totalling over US$ 117 million have been awarded to 30 projects with a potential of 2,800 MW, for a planned investment volume estimated to USD 9.2 billion.

However, several challenges and gaps still remain, among others: (a) inadequate policy, regulatory and institutional frameworks; (b) low levels of financing; (c) low levels of technical skills; and (d) weak geothermal information and databases.

Where policies and institutions exist, weak implementation of policies and regulations, result in uncoordinated markets and inefficient procedures.

Incentives must be increased for private sector participation: tax incentives, Feed-in-Tariffs (FiTs), and Power Purchase Agreements (PPAs), etc.

Besides, Africa is severely affected by the low levels of technical capacity and skills to build and maintain infrastructures that will enable effective operation of geothermal energy systems. The operationalization of the African Geothermal Center of Excellence since May 2018 helps training the African workforce to fill this gap.

The African Union Commission is firmly committed to support and accompany the development of geothermal resources in East Africa and encourages its bilateral and multilateral partners as well as International Financial Institutions to invest both technically and financially in geothermal resources in East Africa which still remains untapped.

Short bio

Atef MARZOUK
Ag. Director for Infrastructure and Energy, African Union Commission (AUC)
Nationality: Egyptian.
Mr. Marzouk is a holder a Master degree in New and Renewable Energy Faculty of Engineering, Cairo University
Over 20 years, Mr. Marzouk has served in the electrical energy production from renewable energy especially from wind turbine, energy strategies and policies, international cooperation; he has held various posts among which:
Manager of the Zafaran wind farm, the biggest wind farm in the Middle East and North Africa, in the New and Renewable Energy Authority (NREA), Egyptian Ministry of Electricity and Renewable Energy,
Senior Engineer at the Haurgahada demonstration wind farm.
In August 2007 Mr. Marzouk, was appointed as Senior Policy Officer in charge of Renewable Energy at the African Union Commission, Department of Infrastructure and Energy. On 1st November 2015, he was reappointed as an Acting Head of Energy Division. From 1st July 2016 the Commission Seconded him as Interim Executive Director at the African Energy Commission (AFREC) in Algiers, Algeria. On 1st December 2018 he was apointed as Head of Energy Division, African Union Commission, Department of Infrastructure and Energy and In December 2020 reappointed as Ag. Director for Infrastructure and Energy .

11. ”Energy and Sustainable Development: how to change the paradigm? ”, Michel Boko, Académicien (ANSALB).

Keywords: green energy, environment, sustainable development, Benin.

Abstract

All life and all production activities are indissolubly linked to of energy. And yet, the use of some forms of energy can hinder the development of life and also production, and therefore development. Historically, political decision-makers have deliberately insisted on the dilemma between social and economic development and the use of energy resources such as biomass, fossil hydrocarbons and nuclear energy.

Faced with the awareness of the costly risks associated with the use of some energy resources, environmentalists have agreed to proceed by standardizing the induced effects under the carbon balance. The carbon footprint is, for environmentalists and for defenders of the theory of sustainable development, a comparable measure to justify the policy and technological choices of policy makers.

"The culture of carbon balance" is a new philosophy whose objective is above all the globalization of the induced effects of development at different spatial scales. According to the principle of Think globally, Act locally, no development policy, regardless of the time horizon and geographical scope envisaged, can be freed from the constraint of future negative impacts.

Some technologies that are considered harmless to the environment are, in fact, not harmless, either because they degrade the environment by their very location, or because their production generate gases. The problem is that, beyond the degradation of the aesthetics of the landscapes and the obstacles to certain production activities (fishing, trawling, agriculture, livestock), the manufacture itself of equipment to produce green energy generates these gases whose equipment is intended to reduce production.

The author therefore suggests referring in a systemic way to the carbon balance of each mode of energy production in order to have an objective reference frame allowing to take the decision closest to the Sustainable Development Goals and the 2030 Agenda.

Short bio of Michel Boko

Michel BOKO est un professeur des universités (CAMES) à la retraite. Il est spécialiste de géographie physique et aménagement du territoire (géomorphologie et climatologie), des sciences de l'environnement et d'écologie industrielle. Il est titulaire d'un doctorat de géographie tropicale, d'un certificat de géomorphologie, d'un certificat de météorologie spatiale et d'un doctorat d'Etat en Géographie-Climatologie. Il a participé aux quatre premiers rapports du GIEC, à plusieurs sessions du séminaire international sur l'eau de Stockholm. Il a suivi une formation postdoctorale en formation en sciences de l'environnement et le développement durable à l'université d'Amsterdam.

Michel BOKO est Chevalier de l'Ordre International des Palmes Académiques du CAMES, Co-Prix Nobel de la Paix (2007), Médaillé d'honneur de la Ville de Grenoble et Commandeur de l'Ordre National du Bénin.

Il occupa le poste de conseiller technique à l'aménagement du territoire et à l'environnement auprès du Président de l'Assemblée Nationale, puis celui de secrétaire scientifique de la Commission Nationale du Changement Climatique. Il fut membre du Conseil Economique et Social du Bénin pendant dix ans où il occupa le poste de président de la Commission Développement Rural et Environnement pendant cinq ans.

Après avoir créé le Laboratoire de Climatologie de l'Université d'Abomey-Calavi, il a mis en place et fait fonctionner le Centre Interfacultaire de Formation et de Recherche en Environnement pour le Développement (CIFRED), puis l'Ecole Doctorale Pluridisciplinaire Espace, Culture et Développement (EDP-ECD) de l'UAC et ouvrit l'Université de Parakou.

Michel BOKO est membre de l'Académie Nationale des Sciences, des Arts et des Lettres du Bénin au sein de laquelle il exerce la fonction de président de la Commission Permanente Climat et Environnement. Il est membre de l'Association Internationale de Climatologie et de plusieurs groupes de travail du NASAC sur le changement climatique et les ressources en eau, la pollution de l'air, changement climatique et santé en Afrique.

Il a enseigné dans plusieurs universités africaines (Bénin, Togo, Gabon, Congo-B) où il a donné des cours de : climatologie dynamique, changement climatique et développement, gestion de l'environnement et écologie industrielle, réchauffement climatique et santé humaine.

Il a dirigé plus de soixante thèses de doctorat. Il est auteur et co-auteur de plus de 230 publications dont plusieurs livres et comptes rendus de séminaire.

12. “Enjeux et perspectives de l’industrie de l’électricité en République démocratique du Congo… En attendant Inga 3 et Grand Inga”, Fabrice Lusinde wa Lusangi Kabemba,

Directeur Général Adjoint de la Société Nationale d’Electricité, SNEL SA en RDC

Abstract
La situation énergétique de la République démocratique du Congo (RDC) est caractérisée entre autres par une prédominance de la biomasse énergie (bois-énergie représente 90% des approvisionnements nets d’énergie), une dépendance accrue aux importations d’électricité (10% de la consommation totale d’électricité en 2020) et une importante fracture énergétique entre la mégapole de Kinshasa, les villes et centres urbains, les provinces minières et les provinces agricoles-forestières.

Malgré une production de plus de 12 TWh en 2020, la RDC est un importateur net d’électricité ! En 2030, la RDC pourrait ne pas atteindre l’ODD no 7 et 84 millions de congolais vivront toujours sans accès à des services énergétiques modernes.

Ainsi, face à cette réalité, le Gouvernement a libéralisé le secteur en 2014 et entend ainsi : (i) garantir l’accès à l’énergie électrique à tous les congolais, (ii) améliorer le taux d’accès de l’électricité pour favoriser une industrialisation qui se veut verte et (iii) faire de la RDC une puissance énergétique à l’ère de la ZLECAF. Depuis 1923, l’industrie de l’électricité en RDC exploite seulement 2-3% de ses ressources énergétiques (EnR) estimées à plus de 170 GW : son gisement solaire 70 GW, ses ressources géothermiques et gazières et ses ressources hydroélectriques 100 GW (60 GW répartis à travers plus de 700 sites disséminés dans tout le pays + 40 GW site de Inga) et le développement possible d’une filière hydrogène-énergie.

Les actions stratégiques en cours d’ici 2030 concernent notamment : l’ouverture du marché de l’électricité et l’électrification hors réseau, l’éfficacité énergétique, les mesures et réformes institutionnelles (ARE, ANSER), réglementaires (Code de l’électricité), économiques, fiscales et tarifaires. La stratégie devrait s’appuyer sur des mécanismes de financement innovants et des solutions concrètes pour lever les obstacles aux investissements privés et les freins à la mobilisation et l’apport en capitaux (risques pays élevé), à travers des solutions techniquesadaptées à un contexte complexe et d’une grande fragilité. Chaque plan (comptage, stockage, solaire, hydro ou hydrogène) doit reposer sur un business model qui prend en compte : (i) le faible pouvoir d’achat qui peut rendre la demande imprévisible, (ii) l’absence d’infrastructures et voies de communication pour acheminer les équipements les machines dans les territoires enclavés), (iii) les conflits et l’insécurité à l’Est et (iv) la pénurie annoncée des énergéticiens.

La formation des énergéticiens, la recherche-développement, l’innovation et la connaissance approfondie du potentiel national d’EnR requièrent davantage d’efforts du Gouvernement et de tous les acteurs de l’industrie de l’électricité en RDC (y compris les universités).

Mots clés : fracture énergétique - efficacité énergétique - ressources énergétiques - industrie de l’électricité - mécanismes innovants de financement – formation des énergéticiens.f

short bio

Fabrice LUSINDE WA LUSANGI KABEMBA est Expert Senior en Management, Gestion Industrielle et Développement du Secteur Privé.

Il est titulaire d'un Master en Ingénierie (M.Sc.Eng.), Ingénierie et Gestion industrielle et détenteurs de plusieurs certification professionnelles : Minigrids of the future: renewables innovation and resiliency de l'IRENA et Statistiques et Modélisation Energétiques de l'AIE.

Il est actuellement Directeur Général Adjoint de la Société Nationale d'Electricité SNEL SA,

Précédemment, il a occupé les fonctions de Spécialiste en Développement du Secteur Privé (Banque mondiale et SFI) - Coordonnateur de Programmes multipartenaires et pluridisciplinaires en RDC et au niveau régional : Afrique du sud, Burundi, Cameroun, Comores, Djibouti, Gabon, Guinée, Kenya, Madagascar, Ile Maurice, Mauritanie et Niger (2010 à 2017) – et, Directeur responsable des Transactions au Comité de Pilotage de la Réforme des Entreprises du Portefeuille de l'Etat (2004 à 2009). Il a aussi conduit plusieurs missions de consulting pour Trade Mark East Africa (TMEA) et Ernst&Young Congo (EY).

Son expertise technique couvre les domaines suivants : le Management dans l'industrie de l'électricité (SNEL SA) et les institutions internationales (Banque mondiale), la Réforme des entreprises publique en RDC (COPIREP), es Marchés Publics (IRMP Dakar), et (iv) les Questions de Compétitivité, de régulation et de promotion des investissements privés en Afrique sub-saharienne incluant la conception (stratégie, étude sectorielle, étude de marché), la gestion des opérations, la conduite du changement, le renforcement des capacités, la communication (dialogue public-privé et public-public) et le suivi-évaluation. Il intervient aussi dans la formation et l'animation de conférences à l'Institut de Régulation des Marchés Publics du Sénégal - IRMP Dakar, pour la firme SETYM International au Maroc, en RDC et au Sénégal et, à l'Université de Kinshasa (UNIKIN). Il est co-auteur de plusieurs études, publications et communications scientifiques.

13. “Pelletized agricultural residues as alternative cooking fuel for Africa”, Christian Rakos

Abstract

Densification of biomass by pelletization is a technology that has expanded enormously over the last two decades - from a global production of 2 million tons in the year 2000 to over 40 million tons in 2020. The reason for this development is, that it is the most economic way of upgrading biomass to a fuel with consistent properties and high energy density. While pelletization was used in the past years mainly to upgrade wood residues and low grade wood, it can be also be used to densify agricultural residues such as rice husks, bagasse, and various types of straw. With the most recent advances of gasifying cookstoves such pellets can be used as a clean burning alternative to firewood and charcoal. The presentation will discuss first experiences with introducing rice husk pellets and improved gasifying cookstoves in Kampala, Uganda and assess the potential of this technology to be widely used in Africa.

Short Bio

Christian Rakos, born 1959, studied Physics, Philosophy and History. From 1988-1998 he worked at the Institute for Technology Assessment of the Austrian Academy of Sciences. In 1998 he joined the Austrian Energy Agency where he was responsible for renewable energies with a special focus on bioenergy. From 2004 to 2005 he worked at the Irish Renewable Energy Information Office as European projects manager. Since mid 2005 he is executive director of the Austrian Pellet Industry Association "proPellets Austria". From 2010- 2016 he was president of the European Pellet Council. Besides managing proPellets Austria he is CEO of Save Energy Austria Ltd., a company producing and trading energy efficiency certificates. Since May 2020 Rakos is president of the World Bioenergy Association.

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14. « Vers un pacte de solidarité énergétique en Afrique de l'Ouest pour l'industrialisation de la sous-région. Quelles coopérations avec l'Europe ? », Mme Claude FISCHER-HERZOG

Présidente d'honneur de Confrontations Europe (Entretiens Européens et Eurafricains) et Présidente d'EURAFRICLAP (France, EPINAY/SEINE)

Résumé

L'Afrique a un potentiel énergétique énorme : gaz et pétrole en Afrique de l'Ouest, et notamment au Nigéria, hydroélectrique au Centre, charbon à l'Est, uranium dans 34 pays, biomasse dans les zones rurales, du soleil partout et elle est entourée de la mer… Par ailleurs les Africains font preuve d'innovations technologiques adaptées à leur réalité. Mais il existe une « vallée du désert » entre ce potentiel et l'accès à l'électricité ! Rien qu'en Afrique de l'Ouest, ils sont 250 millions à ne pas y avoir accès (640 millions dans toute l'Afrique)[1]. Et les choses risquent de s'aggraver dans un contexte de croissance démographique, où la demande croit plus vite que l'offre, et dans celui de la crise globale. Un pacte de solidarité énergétique – tout en respectant les atouts de chaque pays – pourrait se fixer l'objectif d'un marché régulé où l'énergie – qui n'est pas une marchandise comme une autre - bénéficie de politiques publiques et de soutiens (ou garanties) pour des investissements qui sont longs et lourds : construction de centrales, réseaux de transports et de distribution, interconnexion, partenariats public/privé. Comment valoriser les projets locaux répondant aux besoins et aux demandes, les projets transfrontières entre des grandes villes qui irrigueraient les villages ? Malgré des efforts réels avec des institutions de la CEDEAO avec la création du CEREEC (pour les EnR), d'un système d'échanges d'énergie électrique, et d'une autorité de régulation régionale, les coopérations sont faibles, il n'existe pas de véritable stratégie énergétique et il y a très peu d'interconnexion électrique dans la zone. Comment mobiliser les fonds internationaux ? Quels enseignements peut-on tirer de l'Union de l'énergie en Europe ? Les politiques énergétiques des Etats ont tendance à se renationaliser. Pourquoi ? Peut-on transposer nos modèles à l'Afrique ? Comment mieux utiliser les aides au développement et en faire des aides à l'investissement ? Comment organiser une mobilité positive pour le transfert de technologies et la formation des compétences ?

Short bio

Claude FISCHER HERZOG

Institutrice de formation, diplômée de l'Ecole doctorale de Sciences politiques de la Sorbonne, dirigeante du PCF en Lorraine de 1970 à 1990, et de Confrontations Europe comme secrétaire générale puis comme présidente de 1991 à 2014, Claude Fischer dirige ASCPE, une société d'études et de formation qui organise les Entretiens Européens et Eurafricains.

Elle anime une réflexion et l'action pour l'Union de l'énergie et des séminaires pour l'appropriation sociétale du nucléaire en Europe. La 17ème édition des Entretiens Européens Après Helsinki en novembre 2019 (« Une nouvelle ère électrique avec le nouveau nucléaire ») elle a animé la 1_ème édition sur le thème : Le nucléaire et ses innovations au service de la reprise durable en Europe ».

Elle accompagne Philippe Herzog dans sa recherche sur l'identité de l'Europe et le besoin de refondation de l'Union européenne avec la mise en place d'un séminaire *Europe 21*.

Elle plaide pour l'ouverture de l'Europe au monde : c'est ainsi qu'elle anime une plateforme « UE/Afrique(s) » qui prépare Les Entretiens Eurafricains (Ouagadougou en 2016, Paris en 2017, Dakar en 2018) et a créé une association régionale pour toute l'Afrique de l'Ouest en janvier 2017 à Ouagadougou « Eurafrique 21 ». Un séminaire de la plateforme UE/Afrique(s) s'est déroulé en 2019 sur le thème : « Mettre les migrations au cœur de la coopération entre l'Europe et l'Afrique », et en 2020, un colloque a eu lieu à Paris sur « Regards croisés entre l'Europe et l'Afrique face à la crise globale ».

Elle est directrice de publication et édite *La Lettre des Entretiens Européens* et *La Lettre des Entretiens Eurafricains*, *Les Cahiers* et des essais.

Membre du Conseil scientifique de l'Institut du Bosphore, elle a également donné des cours sur l'Europe à l'Institut américain à Paris. Elle a présidé L'AAFEE, l'Association des Amis du Festival de films « l'Europe autour de l'Europe » qui se déroule chaque année à Paris, et a créé « Une semaine Eurafricaine au cinéma » dont la 5ème édition a eu lieu à Paris en juin 2019 « Regards croisés sur les migrations ».

Décorée chevalier de l'Ordre national du mérite en 2006, elle a été faite Chevalier de la Légion d'Honneur en 2010.

Tuesday 9 November 2021

9:00-10:30 ***SESSION 5***

Chair: Bernard Mairy/Hippolyte Agboton,

THEME 2 - Appropriation of renewable energy technologies, dispatchable (hydroelectric, biomass) as well as non-dispatchable (sun, wind) energies

Keynote speaker: Yezouma Coulibaly (Burkina-Faso)

9:00-9:15	Yezouma Coulibaly (Burkina Faso) - *Renewable Energy (RE) penetration rate: Reliable energy, Energy accounting and Energy Indicators for African countries*
9:15-9:30	Joris Proost (Belgium) – *Hydrogen: a Sustainable Facilitator for Decentralised Electricity Production (and Consumption)*
9:30-9:45	Laurent Albert & Francisco Francisco (France & Mozambique) – *General opportunities & advantages of wave power for Africa, including the advantage of wave power's ability to mitigate intermittency (Ghana project)*
9:45-10:00	Jean Bosco Niyonzima (Burundi) – *Flow measurements conducted on the Mwogere River in Burundi with an hydrometric current meter using the reduced points-method in order to use a small Banki-Michell hydraulic turbine*
10:00-10:15	*Patrick Hendrick (Belgium) - Mini hydro as an off-grid electricity solution for communities in villages in Africa, South America and Asia*

15. “Renewable Energy (RE) penetration rate: Reliable energy, Energy accounting and Energy Indicators for African countries”, Prof Dr Yezouma Coulibaly

2iE, Ouagadougou

Abstract

Une difficulté majeure rencontrée par les pays africains est la mise en place de comptabilités énergétiques fiables. Celles-ci permettent d’exprimer toutes les productions, transformations et consommations des formes d’énergie d’un pays dans une même unité et dans un même tableau, l’objectif final étant la détermination des indicateurs énergétiques tels que :

- La consommation d’énergie finale par tête d’habitant
- La consommation désagrégée et chiffrée des différents secteurs de la vie économique
- L’intensité énergétique du PIB
- L’indépendance énergétique du pays
- Les parts des énergies conventionnelles, renouvelables, traditionnelles

En Afrique, la prise en compte de cette dernière forme d’énergie dans une comptabilité énergétique est un vrai casse-tête pour les spécialistes de la question. La faute revient à l’insuffisance de formation et de recherche dans ce domaine.
La présente étude se propose de présenter l’importance de l’établissement de comptabilités énergétiques et comment elles sont indispensables pour la mise en place d’une bonne politique énergétique.

Elle passe en revue les problèmes rencontrés à chaque niveau de données statistiques et montre comment il est indispensable que les formateurs et chercheurs du continent s’attèle à la résolution de ce problème des comptabilités énergétiques nationales. Un des objectifs in fine de ces comptabilités énergétiques est la connaissance précise des parts des énergies renouvelables dans le mix énergétique de chaque pays.

Biographie Yézouma Coulibaly

Yezouma Coulibaly a fait ses études universitaires à l'université de Grenoble. Il est docteur de 3ème cycle de l'institut national polytechnique de Grenoble et Docteur d'état de l'UCAD de Dakar. Il a été Lauréat Fulbrith à North Carolina State University, NCSU, Raleigh, USA.
Professeur de l'institut International d'Ingénierie de l'eau et de l'environnement 2iE, il a consacré sa carrière professionnelle à l'enseignement et à la recherche sur l'énergétique physique à 2iE ou il est rentré comme enseignant chercheur en 1985.
Depuis cette date il a successivement occupé les postes d'inspecteur des études en 1987, chef du département Energie pour le développement rural en 1989, chef du département Infrastructure Energie et Génie Sanitaire en 1999, et chef de l'Unité Thématique d'Enseignement et de Recherche « Génie Energétique et Industriel » en 2005.
Co-directeur du centre commun 2iE/Pennsylvania State University de 2014 à 2019, il a pris sa retraite et est professeur associé de 2iE à Ouagadougou.

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16. “Hydrogen : a Sustainable Facilitator for Decentralised Electricity Production (and Consumption)”, Joris Proost

Prof., UCLouvain, RTD Centre for Process Engineering (hydrogen)

Abstract
Hydrogen produced from renewable electricity through Power-to-Hydrogen (P2H) can facilitate the integration of high levels of variable renewable electricity into the energy system. An electrolyser is a device that splits water into hydrogen and oxygen using electricity. When electricity is produced from renewable energy sources, the hydrogen becomes a carrier of renewable energy. Electrolysers can help integrate the variable renewable electricity into power systems, as their electricity consumption can be adjusted to follow wind and solar power generation, where hydrogen becomes a source of storage for renewable electricity. Although such hydrogen production technologies (especially alkaline and PEM electrolysers) are still further maturing, fossil parity for electrolytic hydrogen can already be achieved as of today in a number of sectors where hydrogen from renewables stands out as the best-performing option to meet climate targets and comply with local emissions regulations. Moreover, based on state-of-the art CAPEX and OPEX data for electrolysers, the necessary scale for obtaining such fossil parity can be surprisingly small, on the order of a few MW only. Such small-scale fossil parity for electrolytic hydrogen has the important advantage of allowing a de-centralised local H2 production. In that case, renewables can be harvested anywhere, and used directly for the local production and consumption of green, electrolytic hydrogen. This is a significant paradigm shift with respect to the fossil fuels based centralised hydrogen production at refineries, the latter also requiring an additional cost to transport the H2, both in terms of Euro/kg and CO2 footprint.

Short Bio

Joris Proost, Full Professor, UCLouvain
Prof. dr. ir. Joris Proost holds a Master and PhD in Materials and Process Engineering from Louvain University (KULeuven), Belgium in 1994 and 1998, respectively. After spending 3 years at Harvard University, both as a Fulbright Scholar and a Fellow of the Belgian American Educational Foundation (BAEF), he joined the Faculty of Louvain University at Louvain-la-Neuve (UCLouvain) in 2003, where he has been a tenured Full Professor since 2009. His current research interests focus on electrochemical process intensification, with a particular interest in developing new reactor and electrode technologies for renewable hydrogen production.
He has received the Morris Cohen Award (2013) from The Electrochemical Society to recognize outstanding research in the field of electrochemical engineering, and has been awarded with the Oronzio and Niccolò De Nora Foundation Author Prize (2012) of the International Society of Electrochemistry for the best paper published in Electrochimica Acta. Full bibliographic details can be found at https://uclouvain.be/joris.proost.
Prof. Proost is currently the Belgian representative at the Hydrogen Technology Collaboration Program (TCP) of the International Energy Agency (IEA), for which he has been involved as one of the subtask leaders in Task 38 on Power-to-Hydrogen. He was also invited as a participant of the high-level strategic IEA H2 workshop in February 2019 in Paris, and acted as a Peer Reviewer of the resulting seminal report The Future of Hydrogen that has been launched mid-June 2019 at the meeting of the G20 energy ministers in Tokyo.

17. ”Western Africa's year-round even swell waves could produce more reliable, renewable power than even the vigorous waves of Northern Europe”, Laurent Albert, CEO Seabased, & Francisco Francisco, PhD, Energy and Environment Manager, Seabased

Abstract

Sustainable development depends on access to, and quality of, electricity. Currently only about 10% of the electricity distributed by the world’s grids comes from variable renewable energy sources such as wind and sun because grids must have a reliable power source to deliver a predictable baseload of electricity to their end users. When the sun sets or the wind stops, they must turn to a flexible power source such as diesel.
Wave energy, however, is a reliable and predictable source of variable renewable energy. Grid operators can know, from 5-to-14 days before they need the energy, what amount of the baseload wave can provide.
Several studies have determined that the wave climate in parts of West Africa is optimal for wave energy to be incorporated into the renewable mix. Such a move would not only increase the potential baseload and reduce the intermittency issues of using renewables but would allow renewables such as solar and wind to sell more of their power because, in tandem with wave, their intermittency is reduced.
It has long been assumed that wave energy is only an option where the wave climate is vigorous, such as Northern Europe. However, our studies show that a more moderate, steady swell wave climate may be even more promising in terms of power production. West Africa’s wave climate is mild, with annual mean values of significant wave heights between 1-1.5 m, energy period of ca. 8-12 s and wave power value of ca. 6-12kW/m. The availability, capacity factors and electricity generation are estimated to be high most of the year except for November and December. An installed capacity of 100MW, yields to an estimated annual electricity generation of ca. 340GWh for a capacity factor of 40%. The annual resource availability factor is ca. 80%, which is high when compared to several other parts of the world with stronger climates. In terms of electricity conversion, this study concludes that though the wave climate of West Africa is not dramatic, it is sufficiently steady to produce a significant portion of the area’s electricity year-round.

Short bio

Laurent Albert, Chief Executive Officer and Chief Technical Officer, Seabased

is a French civil engineer and MBA who has held senior executive positions in Europe and Asia in both high-end tech and marine renewables in Naval Group (formerly DCNS), Naval Energies, and TechnipFMC. He joined SEABASED as CTO and CEO early 2019.

Francisco Francisco, Energy & Environment Officer, Seabased

has a PhD in Electrical Engineering and conducts feasibility studies for Seabased's commercial wave energy parks. Originally from Mozambique, and now a resident of Sweden, Francisco was a research fellow with OceaNET - Marie Skłodowska-Curie Actions where he developed hardware based on sonar systems for sub-sea environmental monitoring. He has worked with Seabased since 2017.

18. ”Use in Central & East Africa of the Banki-Michell turbine, low cost, robust and easy to maintain”, Jean Bosco Niyonzima [1,] Patrick HENDRICK [2]

(1)University of Burundi, Faculty of Engineering Sciences (FSI), Lecturer in Electromechanical department
(2) Université Libre de Bruxelles, Département Aéro-Thermo-Mécanique, Avenue F.D. Roosevelt 50, CP 165/41, 1050 Bruxelles, Belgique

Abstract

The Burundi energy situation is characterized by low production consisting of imported electricity of around 15 MW, a local hydropower production of 34 MW and a thermal production of 45 MW. Through the National Plan Development, called PND BURNDI 2018-2027, Burundi aimed to develop sectors that generate economic growth such as the energy sector. In the energy sector, Burundi must improve energy production from many resources such as water, solar, biomasses, peat, urban waste as well as geothermal resources. In the field of hydropower, Burundi as well as the Central and East Africa has significant hydropower potential that must be developed by building small (even micro) hydropower plants which could improve the socio-economic development of the population. The Banki-Michell turbine is therefore a hydraulic turbine that can be used for the electrification of rural areas. This turbine is characterized by relative simplicity and great robustness. Due to the double effect of the flow of water in the rotor, this turbine presents a good efficiency in comparison with Pelton and Francis which are naturally expensive turbines. Due to its simplicity in construction and maintenance by local engineers and technicians, this turbine is therefore of great interest for Burundi and for other countries from Central & East Africa which have the same hydrological conditions as Burundi. A Banki-Michell test bench was then designed and installed at the Université Libre de Bruxelles to analyze its efficiency and its adaptation to the hydrological conditions of the southern countries such as Burundi. According to the results obtained, this turbine presents a good efficiency over a large range of discharge. The efficiency varies between 40 and 60% for a flow range varying between 15 and 20%. Above 20% of the nominal flow, the efficiency of the turbine reaches ± 70% with a maximum of 74% corresponding to 50% of the nominal flow. According to a study made for the Mwogere river at the Ryamukona site (Burundi), this site has a gross hydroelectric power of about 88 kW, an electricity that could be used to improve the socio-economic life of the population of this locality.

Keywords: Banki-Michell turbine, Turbine efficiency, nominal flow, turbine sizing, electrical load.

Short Bio

Dr. Ir. Jean Bosco NIYONZIMA is a graduate of the Université Libre de Bruxelles (ULB) for his PhD (May 2020) and his Master of science in electro-mechanical engineering / Energy option (2014). At the end of his PhD, he was recruited as a lecturer at the Burundi University (UB) since September 2020. Jean Bosco is teaching in teaching subjects and programs such as: Turbomachinery, Renewable Energy, Modeling and Simulation, Fluid Mechanics, Thermodynamics, etc.
During his PhD thesis, Jean Bosco Niyonzima designed and installed a test bench for the Banki Michell turbine which is currently operational at the hydraulic laboratory of the ULB (ATM department). In Burundi, he has already led a flow measurement campaign leading an isolated site of the Mwogere river.
Nowadays, he is part of a mixed team from the University of Burundi and the Ministry in charge of energy. This mixed team is aimed to coordinate together their respective objectives and missions in order to support the country's strategy and priority programs of development.
In research field, Jean Bosco's research is focused on renewable energies in general, and hydraulic micro-turbines in particular.
However, Jean Bosco Niyonzima lives with a great ambition, with which he wants to create a national center for designing and manufacturing small hydraulic turbines, which would contribute in improving the rate of electricity access, and consequently the socio-economic conditions of the African rural population.

19. “Mini hydro as an off-grid electricity solution for communities in villages in Africa, South America and Asia”, Patrick Hendrick

(ULB – VUB – KULeuven) - (submitted 07/02/2021)

Abstract
For isolated energy systems, or off-grid systems, and local energy communities, due to the variability of natural sources, the combination of sources with a suitable (small) storage system reduces or solves the intermittency problem and the match between demand and generation, in addition to contributing to the decarbonization of the local energy system. Several studies have shown the technical feasibility and potential use of renewable hybrid energy production systems, using solar and wind sources with pumped storage and a small pack of batteries (10-20 kWh).
As a first example, in Tucuruí, Amazon region, Brazil, in the construction of the hydroelectric plant, due to the topography of the region, after the formation of the water reservoir, more than 1700 islands were created, which, due to geographic, technical, political factors do not currently have connection to the local distribution grid. Presently, all communities located there seek to supply their own energy demand using diesel generators, known for their very polluting emissions and high long-term costs.
A second example will be considered for a very poor African country as Burundi.For the case of Burundi, for example, the over-dependence on hydropower as the main energy source for its power supply has been hampering its economy. Its total power supply registered a reduction of 40 % due to a reduced volume of water in 2009. However, this country is endowed with many options for renewable energies (RE) such as hydropower and solar PV. As there are not enough fossil fuel resources discovered yet, RE is a more important strategic component for diversification of its national energy supply. The objective of this presentation is to demonstrate the viability of a hybrid system using solar PV (and, even better, floating PV or FPV) with pumped hydro energy storage (PHES) and small battery energy storage (BES) applied to an off-grid population. This hybrid solution can bring all electricity needs to rural population in African countries at a very reasonable cost (LCOE) of roughly 5-10 c€/kWh, with a minimum maintenance requested and a long lifetime of the complete solution. This can be implemented together between the national organizations as Ministries and central administration, supporting financially, the local population and its small manufacturers and workshops and, finally, universities helping for the design and implementation of the hybrid solution and the training of the local agents.
In both cases, Amazonia and Burundi, the PHES solution that is proposed is to use low cost global solutions, as PaTs (Pump-as-Turbines) or BMT (Banki-Michell Turbines or Cross-Flow Turbines).
The example of an island in the dam lake region of the Tucuruí powerplant, in Brazil, will be completely explained. When sizing the proposed system, the use of a PaT with variable speed and the rational use of water are adopted as criteria. The hybrid system proposed is compared with a single PV system currently installed, in order to analyze the feasibility and the implementation advantages. The proposed system proved to be technically and economically attractive, fully meeting the demand with a PaT energy around 6.3 kW in pump mode and 11.2 kW in turbine mode, for one day of operation. Working with a volume of water of 129 m3, the project guarantees a payback period of 2.5-3 years only.

Keywords: small hydropower – green electricity - turbomachines – hybrid solutions hydro-PV-BES

Short Bio (max 500 words)

Patrick HENDRICK is Professor in Turbomachinery Engineering in Belgium, at ULB (Université Libre de Bruxelles), VUB (Vrije Universiteit Brussel) and at KULeuven. He is a Senior Expert in Energy, Climate, Environment and more specifically Energy (electricity) Storage. He is a reviewer for about 15 highly reputed Peer-Reviewed Journals from Elsevier, IMechE, IEEE, ASME or MDPI.

His research work is related to hydropower with mainly small hydropower systems (less than 10 MWe) and the coupling between renewables (as PV and Wind) and storage solutions as in pumped hydro energy storage (PHES). He is also very active in the field of the energy (heat and cold) recovery from the water in the sewer of cities.

He is currently Head of the Department of Aero-Thermo-Mechanics (ATM) at ULB in Brussels, with about 55 researchers and technical staff. He is a member of the Board of the Joint Program JP HYDRO of EERA (European Energy Research Alliance) and more specifically the Leader of the Task on Societal and Environmental Impact of Hydropower. He is a Member of the Board of BERA (Belgian Energy Research Alliance) and even a previous Chairman of BERA (2015-2018).

He is Administrator of the Belgian Society of Electrical Engineers (SRBE-KBVE) and Administrator of the Energy Investment Society of Wallonia (SRIW Energy).

His technical expertise covers the following areas: hydraulic machines, hydraulic systems, water flow measurements, test facilities and testing, energy storage, environmental impacts, societal acceptance, combination of electricity storage solutions, hidden hydropower (using existing reservoirs or cavities), …

He conducted different cooperation programs with Southern countries like Brazil (Amazonia region), RD Congo, Burundi or Cameroon.

11:00 – 12:30 ***SESSION 6***

Chair: Monique Ouassa-Kouaro (Benin)/Bernard Mairy (Belgium)

THEME 3 - Energy systems that are secure, competitive and compatible with a sustainable and inclusive development of the continent (part 1)

Keynote speaker: Wisdom Ahiataku-Togobo (Ghana)

11:00 – 11:15	Wisdom Ahiataku-Togobo (Ghana) - *Energy systems that are secured, competitive and affordable, and compatible with a sustainable and inclusive development of the continent*
11:15 – 11:30	Youssouf Ali Mbodou (Tchad) - *Système de paiement échelonné «Pay As You Go » : rendre l'énergie solaire accessible pour les ménages et les petites entreprises*
11:30 – 11:45	Douglas Baguma (Uganda) - *Remot, an IoT digital tool made in Africa for offgrid energy systems*
11:45 – 12:00	Edi Assoumou (Benin) - *Challenges of long term power system transition in West Africa: the case of the Ivory Coast*
12:00 – 12:15	*Luc Van Den Durpel (Belgium)- Nuclear Energy Tomorrow as Critical Enabler towards a Sustainable Future*

20.”Energy systems that are secured, competitive and affordable, and compatible with a sustainable and inclusive development of the continent.”, Wisdom Ahiataku-Togobo

Abstract

Sustainability is at the heart of energy policies these days. Globally, countries are promoting access to affordable energy to improve the living standards of their citizens and to meet their development goals. Energy is an important topic in international politics. It is scarce and affects so many aspects of the global economy. That is why, it is important to determine the sustainability of energy systems. (Grigoroudis et al., 2019). Technologies that harness energy from natural sources in the form of biomass, wind, solar, hydro and many others are being adapted by countries all over the world because of wide-spread belief of their sustainability (Carley, 2009; Sawin and Flavin, 2006). Unfortunately, utility scale deployment of these technologies has not been very successful in most sub-Saharan African countries.

To ensure that the technologies for harnessing these energy sources are indeed sustainable, it is important for an assessment to be conducted before any decision is made. (Grunwald, 2011). The United Nations refers to three dimensions of sustainable development; the economic, social, and environmental dimensions which have formed the basis of sustainability as far as the United Nations and its Sustainable Development Goals are concerned.

This presentation will challenge the assumptions that renewable energy technologies are likely to be sustainable in a country, simply because the energy sources are.

It will look at sustainable energy technologies within the context of sub-Saharan Africa to ascertain their “sustainability” and the policy considerations that must be made in choosing them. It will go further to propose a model for determining sustainability taking into consideration country context and conditions.

Profile of Mr. Wisdom Ahiataku-Togobo

Mr. Wisdom Ahiataku-Togobo is the Director for Renewable and Alternative Energies at the Ministry of Energy, Republic of Ghana.
He holds a BSc degree in Physic and Mathematics from the University of Ghana, Legon and an MSc degree in Renewable Energy from the University of Oldenburg, Germany.
He also has a post graduate Diploma in Economics (Investment Appraisal and Risk Management) from Queens University, Kingston Canada.
He started his carrier in the renewable energy sector in 1989 as an Associate Programme Officer with the then National Energy Board and has over the years developed his skills and capacity in the implementation of various renewable energy programmes for rural energy access.
He was the Renewable Energy Expert for the World Bank - Ghana Energy Development and Access Project (GEDAP).
He has also worked as the Project Coordinator for the UNDP Household Energy Programme in Ghana.
Mr. Ahiataku-Togobo is a Board Member of the Ghana Nuclear Institute and a founding member of the International Renewable Energy Agency (IRENA).
He was also a visiting lecturer at the University of Oldenburg, Germany and has a number of publications, articles and reports on renewable energy and sustainable development to his credit.
He worked as Chairman for the Committee that developed the Ghana Renewable Energy Master Plan (REMP) in 2019.
He is currently pursuing his PhD on Sustainable Energy Policy at the University of Energy and Natural Resources, Sunyani.
Mr. Wisdom Ahiataku-Togobo is married with three children.

21. « Système de paiement échelonné « Pay As You Go » : rendre l'énergie solaire accessible pour les ménages et les petites entreprises », Youssouf Ali Mbodou,

Tchad, société Kouran Jabo

Abstract : Kouran Jabo est une entreprise sociale, basée au Tchad, dont l'objectif est de rendre l'énergie solaire accessible pour les ménages et les petites entreprises, grâce au système de paiement échelonné « Pay As You Go » intégré aux kits solaires que nous proposons.

Le Tchad est, après le Burundi, le pays ayant le plus faible taux d'accès à l'électricité au monde, avec un accès proposé à seulement 10,9 %1 de sa population. Le réseau national, alimenté à 98 % par des énergies fossiles, ne couvre que quelques parties du territoire – principalement la capitale, N'Djamena, or plus de 78 % de la population vit en zone rurale. Ainsi, en 2017, seul 31,4 % de la population des zones urbaines et 2,2 % des zones rurales bénéficiaient d'un accès au réseau, laissant 14 millions de tchadiens sans électricité2. Un réseau qui est, de plus, peu fiable, sujet à de nombreuses interruptions du fait sa vétusté, et très coûteux. Faute d'accès à un réseau de qualité, la population se tourne donc vers des alternatives d'éclairage – lampes à pile, feux de bois, groupes électrogènes, bougies, lampes à kérosène… – peu durables, coûteuses, polluantes et pour certaines, dangereuses pour leur santé. Ces alternatives représentent un coût annuel pour l'ensemble des ménages d'environ 384 millions d'euro3 et sont responsables de l'émission d'environ 2 millions de tonnes de Co2 par an. En plus des besoins en éclairage, il devient aujourd'hui de plus en plus nécessaire d'avoir accès au téléphone ; or, dans les zones rurales, charger un téléphone mobile coûte entre 0,50 et 1 euro et requiert de longs trajets à pied, souvent d'1 à 2 heures. Il apparait ainsi nécessaire de trouver de nouvelles alternatives pour ces populations. Ce projet a pour objectif de contribuer à une amélioration de l'accès à l'électricité au Tchad, via la diffusion d'équipements individuels fonctionnant à l'énergie solaire.

Bio :

Youssouf Ali Mbodou est un entrepreneur social, diplômé de l'Université de Lille en Commerce et Management des Affaires Internationales, titulaire d'un certificat sur l'avenir du marché de travail et le contrat social de MIT, il est aussi diplômé d'un Master en Management de projet et d'une Licence en Finance. Il commence la vie professionnelle avec des petites entreprises innovantes, après avoir travaillé pour ces entreprises à Bruxelles, Paris et Dubaï, il décide de rentrer au Tchad afin de fonder la société Kouran Jabo pour répondre à la pénurie de l'électricité et palier aux alternatives polluantes et coûteuses comme des lampes à pile, lampes à kérosène et des bougies lumineuses comme solution d'éclairage au Tchad. La société, dont le nom signifie « l'énergie est de retour » en arabe Tchadien, a pour objectif de fournir de l'électricité propre via des panneaux solaires aux familles à faible revenu, cela répond à l'objectif de développement durable 7. Le travail commencé avec Kouran Jabo depuis 2017 lui a valu des prix au niveau national, régional et international, en 2018 cité par RFI parmi les innovateurs Africains de l'année, par ailleurs il est aussi le participant de cohorte de SIBC 2019 de l'AFD organisé à Marseille.

1 Banque Mondiale, 2017 :
https://donnees.banquemondiale.org/indicateur/EG.ELC.ACCS.ZS
2 CIA World Fact Book :
https://www.cia.gov/library/publications/the-world-factbook/geos/cd.html
3 Off-grid Solar Market Trends Report 2016, page 8

22.”Innovex, a producer of IoT digital tools made in Africa for off-grid energy systems”, Douglas Baguma

Abstract

Innovex is a technology company with hardware and software development teams offering a service 100% made in Africa. Innovex aims to spur Africa’s social-economic transformation through the development of novel technologies. The key company competences include embedded systems, connected devices, web and software development, and wireless communication technologies. The company was founded in 2016 by Douglas Baguma K and David Tusubira, both graduated from the Makerere University. The 2 co-founders came to the realization that solar energy had the potential to bridge the energy access gap for the 30 million Ugandans remaining without electricity, but were frustrated the technology was not reaching Ugandans fast enough. Douglas & David took on this problem by helping installers and distributors of off-grid solar energy systems to scale up using digital tools. There are 300 active solar companies in Uganda alone, and thousands more in sub-Saharan Africa.

The team has developed ‘Remot’, a cloud-based IoT solution enabling solar companies, EPC and distributors to remotely monitor and manage their energy systems. Innovex’s ‘Remot’ system consists of a locally manufactured smart meter and an in-house cloud-based web system. The smart meter tracks a number of parameters from the solar system including; solar production, battery health, and load consumption. This data is then sent wirelessly to the cloud-based web platform. Using data analytics, the cloud-based platform provides useful performance information and key system alerts such as; battery state of charge, system overload, and extreme ambient and battery temperatures alerts. With these data driven features, solar companies can remotely diagnose any faults and quickly respond to prevent product breakdowns. Technicians are able to establish points of failure prior to site visits, allowing them to respond with the appropriate components and knowledge necessary to conduct repairs.

‘Remot’ has transformed the way many of these solar companies do business such as better aftersales support and opening up pay-as-you-go for larger size solar systems. This has reduced overall downtime and improved accessibility of solar systems and equipment. Many of these solar assets are installed in facilities such as health centers, schools and SMEs across the 5 countries in the East African region i.e. Uganda, Kenya, Tanzania, DRC and Ethiopia.

Innovex stands out as a true African grown inspiration and has received support and recognition on the international stage from partners such as OVO, CISCO, Energy 4 Impact, the Netherland Trust Fund (NTF). The company received additional extensive support from the Royal Academy of Engineering in the UK, Energy Saving Trust under the Efficiency for Access Coalition and later the Carbon Trust under the Transforming Energy Access program.

Working with the Carbon Trust under the Transforming Energy Access (TEA) program Innovex has established a local SMT and plastic manufacturing facility for its products. This establishment seeks to ensure local value addition by providing better job opportunities for local product developers in the solar energy space while increasing accessibility to product spare parts. Innovex has also stimulated the local product development industry by sourcing product components and making them available at affordable prices on the local market.

Biography

Douglas Baguma has over seven years' experience working in the Renewable energy industry majorly focusing on Solar energy. He is an internationally trained Renewable energy engineer with a bachelor's degree in Civil and Environmental Engineering, a Post Graduate diploma in Business Administration in Uganda with further business training at Kellogg School of Management as an exchange fellow. Douglas is currently the managing director at Innovex that is transforming the distribution of off-grid energy systems and equipment using IoT digital tools. Douglas is driven by the dream of global access to affordable, reliable, sustainable and modern energy. He has vast experience in business and a commendable acumen of integrating innovation with business. He has been part of various entrepreneurial fellowships in and outside Uganda such as the Global Innovation through Science and Technology in South Africa, the Mandela Washington Fellowship and the E-founders' program with Alibaba in China.

23. « Challenges of long term power system transition in West Africa: the case of the Ivory Coast », Edi Assoumou,

Edi.assoumou@mines-paristech.fr
Center for Applied Mathematics, Mines ParisTech, PSL Research University

Abstract:

One of the most pressing development issues for West Africa is the need for a rapid expansion of a currently undersized power system in order to fuel its economic development objectives and enhance the living conditions of a fast growing population. Power consumption per capita in the region is typically less than 5% its levels in OECD countries. Yet if electricity access is, and should be, the short to medium term priority, this need for more installed capacities will also have to take into account the overarching target of a transition towards a sustainable energy system in the second half of this century.

In this research work we will review the main power system expansion issues for West Africa and illustrate the implications of a cost optimal transition towards a low carbon power system for the case of the Ivory Coast. We will focus on a medium term horizon, 2030, as well as the longer term, 2050, which is necessary to account for the inertia in investment decisions. Our assessment is based on a TIMES model for the power system of the Ivory Coast. The model minimizes the total discounted cost of the system over the simulation horizon and computes a consistent trajectory. We compare 4 prospective scenarios and discuss the outcomes of each scenario in terms of production costs, investment needs, independence, CO2 emissions and potential jobs.

Short bio

Edi Assoumou is a senior researcher in energy system analysis at the center for applied mathematics of Mines ParisTech where he develops long-term prospective models based on the MARKAL/TIMES platform for different systems. His main research areas include modelling long term transition pathways of energy systems including future low carbon power systems, sustainable mobility and cities, energy and water nexus, biomass, and energy demand and lifestyle implications. Edi has been involved in several European and French research projects and has provided external expertise to various commissions or institutions.

24. ”Nuclear Energy Tomorrow as Critical Enabler towards a Sustainable Future", Luc Van Den DURPEL[1], Jean-Jacques Gautrot[2], Sylvain Hercberg[3], Henri Zaccai[4], Partners Road-to-Nuclear

Abstract:

Nuclear energy is again seen as a critical enabler for global socio-economic development and prosperity while preserving our environment. Nuclear energy has been contributing since the 1960s to a decarbonized, safe and economic energy generation providing energy independency and stable forecastable pricing, broad economic benefits as high-level jobs and industrial capabilities, and welfare to nations benefiting from the nuclear science and technology applications as food safety, biodiversity preservation and nuclear medicine.

While most nuclear power parks around the world are essentially light-water reactor (LWR) based providing primarily electricity, our sustainable energy needs will need not only an increasing amount of electricity but also process heat for water desalination, industrial processes, district heating and generation of hydrogen for a variety of applications. While LWRs will remain the backbone for many nuclear power parks around the world, the introduction of Small Modular Reactors (SMRs) and even more Advanced Nuclear Reactors (ANRs) may bring more market-adapted nuclear energy solutions for emerging and specific applications for nuclear energy.

This presentation will bring a summary of:

- The developments worldwide regarding SMRs and ANRs with particular focus on developments within the USA, Canada and Europe;
- The expected timeline for such SMRs and ANRs and the prospects they may bring for African countries;
- The expected economics for such tomorrow’s nuclear, and;
- The options for associated fuel cycle and waste management.

The paper and presentation will provide the attendees an up-to-date view on the key development challenges for such more market-adapted nuclear energy solutions and the prospects such developments may provide to African countries in their decision-making regarding nuclear energy use.

[1]Nuclear 21, Waasmunster, Groenstraat 34, Belgium
[2]Evocati Consulting Alliance, Boury en Vexin, 4 Imp Vignes, France
[3]S.HERCBERG Conseil, Paris, 16 rue Brémontier, France
[4]*HZC* International, Paris, 16 rue Saint-Sébastien, France.

Short bio of Luc Van Den Durpel

Dr. ir. Luc Van Den Durpel is currently founding partner of Nuclear-21, an expert cabinet supporting governments, utilities, industry, regulators, waste agencies and R&D-laboratories in nuclear science and technology, particularly nuclear energy, development decisioneering. He was scientific director from 2008 on and until April 2015 Vice-President Strategic Analysis and Technology Prospective at AREVA's Corporate R&D. During the 2000s, he joined US-DOE's Argonne National Laboratory in the context of Generation-IV and especially nuclear energy system scenarios and was conducting technical-economic studies on advanced nuclear energy systems and advanced nuclear fuel cycle R&D and waste management at the OECD Nuclear Energy Agency during 1998-2001. He graduated in 1989 as civil engineer and nuclear engineer from the University of Ghent (Belgium) where he also obtained his PhD on nuclear energy systems analysis. He initially conducted research at the Nuclear Research Center in Belgium as nuclear engineer and graduated at Vlerick and INSEAD business schools.

He is Board Member of American Nuclear Society next to (executive) committee member of various organisations and member of the Scientific Council (Conseil Scientifique) of the French CEA.

13:30-15:00 ***SESSION 7***

Chair: Michel Boko (Benin)/Jean Snoeck (Belgium)

THEME 3 - Energy systems that are secure, competitive and compatible with a sustainable and inclusive development of the continent (part 2)

13:30-13:45	Joseph Thokozani-Mwale (Zambie) - *The Conundrum of Sustainability of Hydro-Electric Energy as a Renewable Energy Source under Climate Change: Implications for the Resilience of the Water-Energy-Food Nexus of Southern Africa*
13:45-14:00	Mawuéna Medewou (Benin) **-** *Calcul de l'écoulement de puissance dans les réseaux de transport électrique par la méthode de Newton-Raphson : application au réseau de transport électrique de la Communauté Electrique du Bénin*

Energy value chain in Africa (including conversion technology and energy services)

THEME 4 - Management of energy based services in an inclusive and sustainable way (in rural and urban regions) (part 1)

14:00-14:15	Mark Tjebbe Hoekstra (Mozambique) - *Renewable energy and productive water for irrigation purposes in Mozambique*
14:15-14:30	Carrasco Pedro (Spain) – *Chaos, Fractals and energy from the oceans*
14:30-14:45	Sandiswa Qayi **-** *Energy Challenge in Africa using case study of AET innovations in energy efficiency*

25. "The Conundrum of Sustainability of Hydro-Electric Energy as a Renewable Energy Source under Climate Change: Implications for the Resilience of the Water-Energy-Food Nexus of Southern Africa", Joseph Thokozani Mwale, Mulungushi

University, School of Agriculture and Natural Resources, Kabwe, Zambia

ABSTRACT

The global concerted effort of ensuring energy security for all people is premised on the perceived sustainability of renewable energy resources such as hydro-electric energy, solar energy, and wind energy. This disposition is shaped by the lived human experience of the negative effects of intensifying the use of fossil fuels for energy generation. In the Anthropocene age of the Earth's history during which industrial production, mining, and agricultural production are intensified to meet the socio-economic needs of the burgeoning human population, Global Environmental Change (GEC) has emerged as an extraordinary outcome of the human-environment interaction. Central to the challenge of the 21st century within the Anthropocene period is the Climate Change phenomenon. Climate change, evidenced by long-term shifts in weather parameters, is predicted to bring unprecedented social and environmental transformations in the regions of the world that notably have low adaptive capacity. While the scientific evidence of climate change is overwhelming, the transformations it induces at local scales are poorly understood from the sustainability perspective. This creates a knowledge gap for policy decision-making and pragmatic action on managing the syndromes of climate change impacts such as increased water scarcity for water supply and sanitation, food production, and hydro-power generation. The scientific discourse of this presentation is focused on the sustainability of hydro-electric energy as a renewable source of energy under the climate change scenario.

Hydro-electric energy is interrogated for sustainability through the Complex Adaptive Systems (CAS) theory, which is increasingly seen as a scientific frontier transcending the natural and social science disciplines, and having a profound effect on the future of science, engineering, and industry. Complex adaptive systems are typically characterised by co-evolutionary dynamics based on complex behaviour that emerges from the interactions among system components and their environment. Within this theoretical perspective, a co-evolutionary approach is used to navigate the resilience of the water-energy-food nexus of Southern Africa against the syndrome of unsustainability of hydro-electric energy as a renewable energy source under climate change.

Under the changing context of socio-economic development in Southern Africa that is characterised by high population growth rates, high energy demands, inter-annual variability of temperature and rainfall; the viability of hydro-electric energy as a source of energy within the water-energy-food nexus is uncertain. Given that the survival of human civilisation critically depends on the water-energy-food nexus to a larger extent, quantitative understanding of the co-evolutionary dynamics of climate change and water availability for the water-energy-food nexus is essential. Therefore, the co-evolutionary perspective reveals a spectrum of interdependencies, synergies and trade-offs in the water-energy-food nexus under a changing climate. To this end, the vision of a sustainable energy future for Africa under the context of climate change is critically dependent on a robust triple helix model of science, technology, and innovation to develop adaptive capacities and higher levels of resilience in the face of climate change. This calls for science-policy dialogue to create an enabling environment, linkages, and stakeholder partnerships for young scientists to navigate the complex development challenges of our time.

SHORT BIOGRAPHY

Mr. Joseph Thokozani Mwale is a Zambian citizen born in Chipata, Zambia on 8th March, 1978. He is a personable man with social interests in family, religion, and diverse entertainment. Professionally, he is fundamentally an Agricultural engineer and a Water resources specialist, holding a Bachelor of Engineering (B.Eng.) degree of the University of Zambia, and a Master of Science (M.Sc.) degree of the University of Zimbabwe. With this education portfolio, he has served as an Agricultural specialist in Irrigation engineering in the Department of Agriculture in Zambia; and he is currently serving as a Lecturer in the Department of Natural Resources at Mulungushi University in Zambia. He is also a member of the Engineering Institution of Zambia (EIZ), and the Zambia Academy of Sciences (ZaAS). His particular research and professional interests are directed at understanding transformation of Coupled Human and Natural Systems (CHANS), and optimizing human-engineered systems for social and environmental sustainability. To this end, his latest scholarly and professional works are focused on pursuing the frontiers in sustainability science, particularly applying the co-evolutionary approach to modelling transformations that occur in complex adaptive systems such as urban ecosystems, agro-ecological systems and aquatic ecosystems within the domain of Earth System Science.

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26. « Calcul de l'écoulement de puissance dans les réseaux de transport électrique par la méthode de Newton-Raphson : application au réseau de transport électrique de la Communauté Electrique du Bénin », Mawuéna MEDEWOU,

UAC Bénin, Taskforce chargée de la rédaction des procédures d'exploitation du réseau interconnecté du WAPP

Abstract
Dans le cadre du projet d'interconnexion des réseaux électriques des pays membres de la CEDEAO porté par le Système d'Echange d'energie Electrique Ouest-Africain (EEEOA), des directives d'exploitation ont été définies par l'Autorité Régionale de Régulation du Secteur de l'Electricité de la CEDEAO (ARREC) en vue d'assurer une exploitation efficiente du réseau interconnecté. Chaque opérateur s'oblige à respecter ces directives aux fins de garantir la stabilité et la fiabilité de la fourniture de l'énergie aux pays de la CEDEAO.

Ce document a pour objet, de réaliser l'étude de l'écoulement de charge sur le réseau de transport existant de la CEB et de proposer des solutions notamment pour le respect des exigences relatives au niveau de tension requis sur les lignes d'interconnexion ou aux points de raccordement avec les opérateurs voisins. Après l'inventaire des infrastructures de transport et de production de la CEB et le relevé des charges sur les points de consommation, un modèle de son réseau a été réalisé ainsi que le schéma unifilaire.

Le calcul de l'écoulement de charge a été réalisé avec l'algorithme de Newton-Raphson et les tensions aux nœuds ont été calculées à l'aide du logiciel CYME. A partir des tensions calculées aux divers nœuds, des solutions d'amélioration ont été proposées pour ramener les niveaux de tension aux valeurs admises par l'autorité de régulation.

BIOGRAPHIE

Ing. Mawuéna MEDEWOU est né le 15 août 1965, il est marié et père de quatre enfants.
Après son baccalauréat série Ti1 obtenu en 1986 à Lomé, il a été admis à l'Ecole Nationale Supérieure d'Ingénieurs de Lomé où il obtint la Licence Professionnelle. Il a intégré en 1993, la Communauté Electrique du Bénin (CEB) où il occupa successivement les postes suivants : (I) Chef Section Electricité à la Centrale Hydroélectrique de Nangbéto, (II) Directeur-Adjoint Région Togo, (III) Directeur Régional Bénin et actuellement (IV) Directeur de l'Administration et des Ressources Humaines.
En 2001, il s'est inscrit à l'IFTS au Togo où il obtint le Diplôme d'Ingénieur de Conception option Génie Electrique.
Il obtint en 2018 son Diplôme de Master de Recherche Option Génie Electrique à l'Ecole Doctorale des Sciences de l'ingénieur de l'Université d'Abomey-Calavi où il poursuit actuellement ses études doctorales.
Il est l'auteur de plusieurs publications et communications notamment sur le développement et l'interconnexion des réseaux de transport électrique.
Monsieur MEDEWOU a été membre de la Taskforce chargée de la rédaction des procédures d'exploitation du réseau interconnecté du WAPP ; il est actuellement membre du Comité des Ressources Humaines et de Gouvernance du WAPP.

27. « Renewable energy and productive water for irrigation purposes in the provinces of Manica and Zambezia (Mozambique) », Mark Tjebbe Hoekstra

Keywords : rural development, access to energy, renewable energy, productive use of energy, productive water use, solar pumping, agriculture, irrigation

Abstract :

According to the Global Climate Risk Index for 1999–20181, Mozambique is the country most affected in Africa by climatic events2 after Madagascar. Flooding, cyclones and severe drought events interfere with food, water and livelihood security systems. In the present context of climate change, notably with temperature rise that will affect crop yields, current farming systems of Mozambique will be highly affected in the near future if appropriate irrigation and agricultural practices, based on sustainable production and climate resilience, are not developed. Although irrigation is specifically mentioned in governmental plans and strategies, most installed water pumping systems aimed to contribute water access for domestic use, whereas irrigation additionally will increase income-enhancing opportunities.

The use of renewable energies for irrigation purposes integrates synergies between energy, water and food systems, ecosystems that are particularly vulnerable to climate change and essential for sustainable human development.

Our interventions in Mozambique are part of The Renewable Energy for Rural Development (RERD) program started on September 2010. The RERD1 (2010-2016) first phase focused on installations of photovoltaic systems in schools, health centers and administrative buildings .

The second phase RERD2 (2018-2024) renewable energy component of 12 M€ and the recently added RERD2+ irrigation component of 10 M€, build on RERD1 outcomes and lessons learned, concluded with a list of recommendations amongst which an increased attention to productive uses of energy as well as development of mini-grids and water pumping systems, with a focus on productive use of renewable energy and the irrigation sector.

Enabel foresees the development of about 1,000 solar-powered irrigation installations on 900ha of - irrigated - agricultural land in the provinces of Manica and Zambezia with 1,010 farmers applying the best irrigation and agronomic practices.

By promoting Solar Powered Irrigation Systems (SPIS) , our intervention covers 5 main sectors including energy, water, agriculture, environment /climate change and private sector development, highlighting the need of a multi-sectoral approach and an inter-sectoral coordination between sectors.

1https://www.researchgate.net/publication/339817169_GLOBAL_CLIMATE_RISK_INDEX_2020_Who_Suffers_Most_from_Extreme_Weate_Events_Weather-Related_Loss_Events_in_2018_and_1999_to_2018

2 with the 14th place in the world during this period.

Bio Mark Hoekstra

currently at the Belgian Development Agency, Enabel in Mozambique working with FUNAE (National Energy Fund)

Geographer / Economist
University of Utrecht / University of Wageningen the Netherlands

Present position (since 2018): Intervention Manager Renewable Energy for Rural Development (Phase 2), Maputo, Mozambique

Key qualifications:

- rural development and environment focused research, planning, programming and management
- partnership building with, and capacity building of, local partners and government, programme coordination, financial, administrative and human resource management
- supervision, coaching and performance evaluation of programme (multi project) staff
- project cycle management and monitoring and evaluation
- 25+ years of experience in sub-Sahara of which 20 years in a management capacity at national and provincial levels dealing with - at times – large dispersed international and national experts
- 12+ years of experience in the Mozambique

Earlier positions: organization, country, period:

- Enabel, Belgian Development Agency, Democratic Republic of Congo, 2015-2018
- World Wide Fund for Nature (WWF), Mozambique, 2011-2015
- Consultative Group on International Agricultural Research (WorldFish Center), Democratic Republic of Congo, 2007-2010
- Food and Agriculture Organization (FAO), Indonesia 2006-2007
- Swiss Development Cooperation (SDC), Swiss Embassy in Mozambique, Mozambique, 2001-2006
- Fund for Development Co-operation (FOS), Belgium, Angola, 1999-2001
- Food and Agriculture Organization (FAO), Rome, Italy, 1999
- Directorate General of International Cooperation (DGIS, Min. Foreign Affairs), Cape Verde, 1992-1999
- Food and Agriculture Organization (FAO), Burundi, 1990-1992
- Food and Agriculture Organization (FAO), Seychelles, 1988-1990
- University of Utrecht, the Netherlands, 1986-1988
- DHV Consulting engineers, Indonesia, 1985-1986

28. “Chaos, fractals and energy from the oceans”, Pedro Fernández Carrasco

Professor Dr., Arenas Negras Lab., Departamento de Hidráulica, Energía y Medio Ambiente, Universidad Politécnica de Madrid.

Abstract
There are no substantial differences between renewable energy sources between an European country, say Spain and an African country such as Benin. Energy from renewable sources in both cases is abundant, very abundant. If we talk about accessibility and energy innovation is another matter, in the first one there is significant production, a solid and accessible distribution network and a regulated and reliable market. To improve the accessibility to energy is a great goal and how to get an energy network and similar standards cheaply and quickly could be the million euros question. It is even the logical question, but for me it is not the smartest way. To find this million euros question, we must make a big change of glasses, and realize that both energy and the distribution network are costs and not ends in themselves.
If we look at African cities and their growth, we will have, with all due respect, probably an apparent vision of chaos and atomization. Should people living through this atomization wait for an orderly network to be established in a short time, similar to European networks? No, they should not and they will not. Life and the economy follow a growth other than structured planning, in times of an era of exponential transformations associated with communication technology platforms, where Africa is also placing itself at the forefront.
The growth system of African cities is not chaos, it is more like a growth in fractals, that is, small patterns that are repeated almost indefinitely, such as the branches of a tree. On the other hand, we are witnessing an exponential decrease in the price of energy production, if we look at photovoltaic panels, their price has decreased by 85% in the 2008-18 period, according to the Institute of Solar Energy of the Universidad Politécnica de Madrid (2018). We might even think that very soon they would give away solar panels. But it is not only small-scale solar panels, but also offshore wind energy megaprojects have reduced their costs in the order of 40% in less than 5 years, in addition to considerably increasing the power of their turbines, not to mention the drop in price of oil these days.
Ocean energies such as tides, currents, waves and Ocean thermal energy conversion (OTEC), are available on the coasts of the world, a dream come true for a sea energy researcher, but not for the user of our fractal system of consumption in Benin. Both the small scale, exemplified here by solar panels, and the apparent macroscale of ocean energy projects, there is also the small and medium scale for these projects, they must follow parallel paths, the first is a priority for countries as Benin, the second is strategic for both Benin and Spain, and in both cases it requires the generation of experts in the field and entrepreneurs to generate almost zero cost energy for the user. As mobile phones, what is relevant is not the price of the mobile and its energy consumption, which have been reduced comparatively to almost nothing, what is relevant is what you can do and buy with it. How do we generate a productive, low-cost, quality energy fractal network in no time and train ocean energy engineers and entrepreneurs at the same time? A million euros please.

Bibliography
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short bio

Professor Dr. Pedro Fernández Carrasco is full professor at Universidad Politécnica de Madrid in the Water, Energy and Environmental Department since 2003 in the subjects Development and Civil Engineering and also of Ocean Energy in Spain and in the University Don Bosco in El Salvador, Central America. PhD and MSc in Civil Engineering, has also a MSc in Hydrology and a BSc in Social and Cultural Anthropology. Founder of the **Bio Ocean Solutions** an innovative and collaborative virtual network of entrepreneur and researchers in Blue Economy and Open Innovation. He has been invited and participated in many congress and conferences as international expert. He was the professor in charge of organized the week on Ocean Energy and Blue Economy 2017 in the Philippine University in Quezon City, he collaborate with other universities and international and national institutions. He is also advisor to the state energy company CEL of El Salvador in the strategy for ocean energy 2030. He collaborates and regularly supports the Universidad Católica Nuestra Señora de la Asunción, Paraguay, in its activities related to research and sustainable entrepreneurship. He is ambassador and certified facilitator of the entrepreneurship and prototyping methodology Beta Cards. Director of several PhD, master and undergraduate thesis. He was awarded in 2020 by the Madrid Civil Engineering Association as director of "Water for Balanka School, Togo" the best engineering international social project of the year 2019.

29. “Energy Challenge in Africa using case study of AET innovations in energy efficiency”, Sandiswa Qayi,

woman social scientist and economic development practitioner, innovator, Managing Director of AET (Amahlathi Eco-Tech), AFRICA Eastern Cape South Africa

Abstract

Majority of African countries have seen increasing demand of energy brought by urbanization and meaningful economic growth in major cities. This growth in order to be sustainable there is a need for sustainable, accessible, affordable and efficient energy usage. Despite energy mix strategies and policies, the continent is still far below the sustainable development goals in addressing the issues. Majority of African countries such as South Africa are still battling the challenge of continuous rising electricity prices, load shedding or power failures caused by excess energy consumption that result in poor access to affordable and sustainable energy to sustain economic growth. Not only these challenges affect the economic growth but contributes to serious carbon emissions by coal power stations. Despite existing alternative energy sources such as solar, wind and hydro energy, coal power stations to generate electricity for majority of citizens are still primary source of energy supply that can be accessed by majority of people. Excess demand versus limited supply of electricity results in load shedding and interrupted power supplies that results in high electricity costs and further marginalised the poor people as they cannot easily afford alternative solutions hence the need for retrofit solutions.

The paper argues for prioritization of energy efficiency retrofit solution as alternative solution into the energy mix to address the energy challenge in Africa regarding affordability, sustainability and accessibility. The paper addresses this issue by using case study of AET AFRICA water heating and cooling innovations Hotspot and Heat Raiders as retrofit energy efficiency solutions to address the energy challenge in Africa. The two innovations are locally designed and manufactured in South Africa as retrofit solutions for water heaters and cooling devices to address water heating needs and cooling using existing devices. The paper provides this rationale by arguing that water heating and cooling are the biggest energy consumers in ordinary urban settings due to demand for sanitary water and cooling due to climate conditions in Africa. These solutions can improve energy efficiency and reduce energy costs by 30-40% on monthly basis for each household thus improve accessibility to sustainable and affordable energy. This can be achieved by using energy supply from existing coal powered stations to ensure continuous supply of electricity with limited load shedding currently experienced in countries such as South Africa due to high energy consumption caused by inefficient energy usage. These solutions need to be customised for African socio-economic market conditions to ensure affordability and easy installations. The roll out of these devices will not only reduce energy consumption and improve energy efficiency but will significantly contribute to economic growth and job creations as they can be easily manufactured and installed by local people to promote job creations and reduce poverty. Job creation and income generation will then have a bigger economic impact in terms of using energy to address economic development challenges in Africa. The paper understands the limitations of these solutions and that they are not the only solutions but can play a significant role as part of energy mix in addressing the energy challenges especially in countries with high energy usage and demand for water heating and cooling.

BIOGRAPHY

Sandiswa Qayi is a multi-award winner, passionate and driven young woman entrepreneur, innovator, Managing Director and co-owner of AET AFRICA (Amahlathi Eco-Tech) based in Eastern Cape South Africa. She a social scientist and economic development practitioner at heart shaped by her social and academic background.

She holds the following qualifications:
Bachelor of Social Science in Industrial Sociology and Organizational Psychology from Rhodes University, Grahamstown South Africa
Master's in Development studies specialising in Rural Economic Development from Nelson Mandela University
Postgraduate certificate in Business Management and Systems Engineering Approach and Manufacturing (MIT Boston & Regenesy South Africa)

She has more than 8 year's executive and business management experience with more than 10 years project management experience. Her experience include working in the municipal economic development agency as Project Manager and Executive Manager of Abenzi Woodhouse a skills development and furniture manufacturing centre. In 2015 she won FP&M SETA scholarship and was selected as one of the 26 SA companies to participate in the "International Leadership Development program that went to Massachusetts Institute of Technology (MIT) in Boston to study Systems engineering, design & manufacturing approach. She led the company together with her partners to win multi awards and continue to develop and execute strategy for international positioning of AET AFRICA. She is the Eastern Cape grassroots innovation ambassador and attended Festival for Entrepreneurship and Innovation in India and was recently selected to as top 10 SA companies to represent SA innovation entrepreneurs in Switzerland. She's been exposed to travel Africa exploring business opportunities and strategic partnerships in countries such as Ghana, Mozambique and Nigeria and currently one of the SEED Catalyser and SEED Replica program participants and finalist focusing on climate changes and environmental issues.

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15:30-17:30 ***SESSION 8***

Chair: Rajaâ Cherkaoui El Moursli (Morocco)/Brice Sinsin (Benin)

THEME 4 - Management of energy based services in an inclusive and sustainable way (in rural and urban regions) (part 2)

Keynote Speakers: Joseph Essandoh-Yeddu (Ghana), Shaukat Abdulrazak (Kenya)

15:30-15:45	Joseph Essandoh-Yeddu (Ghana) - *Natural Gas Use and Perspectives: Opportunities for Intra- and Inter- African Trade*
15:45-16:00	Shaukat Abdulrazak (Kenya) - *IAEA's contribution to capacity building in Africa for sustainable nuclear energy solutions*
16:00-16:15	Samuel Igbatayo (Nigeria) - *Harnessing waste-to-energy value chain to achieve sustainable development goals : lessons for Sub-Saharan Africa*
16:15-16:30	Susan Pendame (Malawi) - *Electricity Access and Economic Development: The Case for Productive Use of Off-Grid Renewable Energy in Rural Africa*
16:30-16:45	Christopher Kost (USA) - Sustainable and Equitable Mobility for African Cities

THEME 6 - Energy supply chain for all types of consumers

16:45-17:00	Eddie Bilitu (DRC) - *Electrification des milieux ruraux par les microcentrales hydroélectriques en RD Congo*
17:00-17:15	Yannick Useni-Sikuzani (DRC) - *Le Projet CHARLU, vers une gestion durable de la ressource bois-énergie pour une offre sécurisée en charbon de bois et une réduction de la déforestation du miombo*

30. « Natural Gas Use and Perspectives: Opportunities for Intra- and Inter- African Trade », Joseph Essandoh-Yeddu

Ex-Director, Strategic Planning and Policy Energy Commission, Ghana

Abstract

Africa's population currently stands at about 1.2 billion with over 80% in Sub-Saharan Africa and of which 60-70% live in rural and remote communities. Except for a handful, almost all the African countries are classified as least developed or low-income economies. The continent's share of global primary energy consumption is estimated around 3% and is largely traditional biomass accounting for 60-90% and which has been linked to unsustainable practices and deforestation. Currently, about 900 million of the inhabitants lack access to clean and modern cooking fuels like gas. Except for South Africa, Ghana and the northern region along the Mediterranean where electrification rates exceed 85%, the average for the rest of the continent is about 45%. Even where it is available, it is largely known to be unstable, intermittent and consequently unreliable. The continent's overall population is projected to double by 2050 accounting for 25-26% of the global population in 2050 with over 50-60% living in urban areas. These profound changes are expected to drive the continent's economic growth, infrastructure development and, particularly, energy demand which is projected to exceed 1,320 MTOE in 2050, based on existing policies/plans.

Africa however has unique opportunities to pursue a much less carbon-intensive development path based on natural gas to boost clean cooking, electrification access, also compressed-natural-gas (CNG) as clean transport fuel. Africa currently consumes about 110 billion cubic metres which is about 51% of its production. The remainder is largely exported as a primary commodity. Any domestic use is largely for power generation. But unlike oil where the commodity could just be exported without necessarily developing the local market, natural gas requires greater local infrastructure development being it as LNG for export, CNG, or as feedstock for local petrochemical industrialisation, the latter being larger. Gas petrochemical value-chain products include fertilizer, detergents, plastic packaging, lubricants, pharmaceuticals, artificial leathers, adhesives, refrigerants, etc. Revenue from the global petrochemical market is expected to double by 2022 from $550 billion in 2014.

Besides the existing offshore exports, Africa has the potential to promote intra-African trade using the continent's huge gas reserves estimated around 17.7 trillion cubic metres and taking advantage of the existing regional gas pipeline integration which includes West African pipeline (WAGP), Trans-med; Mozambique -South Africa, and could be extended and integrated to form a closed loop around the continent. Such an Intra-African Trade can take advantage of the Africa Continental Free Trade Area pact signed in 2020; which intends to guarantee larger market, Tariff/Duty free exports, decrease trade restrictions, etc. creating opportunities for countries to share advantages in terms of resources or energy supply for instance, justifying investments in small resource market-economies to export to bigger cross-border economies.

Presentation will cover the developments since the completion of the WAGP over a decade ago, the evolving natural gas market, trade (local and international), future market configuration and potential for inter- and intra-Africa trade.

Shortbio JOSEPH ESSANDOH-YEDDU (PhD)

Dr. Joseph Essandoh-Yeddu until late 2019, was Director for Strategic Planning and Policy at the Ghana Energy Commission. Now a consultant, he has over 30 years' experience in the Energy sector, starting as a schedule officer for solar energy in 1989 till his last position as a director.

He developed and implemented the first major solar programmes for Ghana; 1989-1999 and subsequently, provided guidance in the development of Ghana's first Renewable Energy Master Plan; REMP (2030). For these initiatives, he has just been honoured by the International Solar Energy Society (ISES) as one of the **Industry Pioneers** from developing countries in its 50 years of the ISES Solar World Congress (1970-2020) and a century of global solar research and development.

He was a member of Ghana's **Annual Electricity Supply Plan** preparatory team until 2020; also the co-chair of the **national policy taskforce** that reviewed and updated the 2010 Ghana Energy Policy. He chaired the technical committee that prepared the USAID-funded **Integrated Power System Master Plan for Ghana (2018-2040)**, a long-term Electricity demand scenarios for Ghana's Long-Term Development Plans.

Dr. Essandoh-Yeddu led the team that developed Ghana's first **Strategic National Energy Plan** (SNEP2006-2020) where indicative energy demand-supply plan for the country was prepared for the planning horizon. Also, the leader of the Energy Group of the **National Infrastructure Plan** (2018-2047); a l*ong term Development Plan vision of Ghana becoming a High Income Economy by 2057, i.e. 100 years after political independence.*

He also served on the **Ghana's Presidential Commission set up in 2007 to** advise Government on Potential Use of Nuclear Energy for Power Generation.

Dr. Essandoh-Yeddu has been a member of Ghana's team to the UN Climate Change negotiations since 2005. Also, Ghana's representative on the Global Methane Initiative (GMI) Oil & Gas Sub Committee since 2010. He is currently, a **Review Editor** for the **UN IPCC Working Group Three to the 6th Assessment Report** *Chapter 6 (Energy Systems).* He was a **Peer Reviewer** to the International Energy Agency's World Energy Outlook and the Africa Energy Outlook for both 2014 and 2019.

He has been key in the development of natural gas value chain systems for Ghana. He was a member of the team that developed the first natural gas demand-supply plan for Ghana during the development of the West African Gas Pipeline. On the continent, he was a major resource person to Tanzania and Mozambique from 2012-2014 where he made presentations on key commercial issues on Natural Gas Value Chain and Market as prelude to development of the new commercial fields then discovered there.

Dr. Essandoh-Yeddu has BSc Physics from KNUST, Ghana; an MSc. in Energy & Environment from Chalmers, Sweden; and a PhD in Physics with specialisation in Climate Change & Geosciences jointly from the University of Texas, Austin, USA and the University of Cape Coast, Ghana.

Currently an adjunct professor, he was a Visiting Scholar to the University of Lethbridge, Canada in 2014 and to CPEEL, University of Ibadan, Nigeria in 2016.

31. « IAEA's contribution to capacity building in Africa for sustainable nuclear energy solutions », Shaukat Abdulrazak(1),

KEYWORDS: International Atomic Energy Agency, Energy planning and analysis, nuclear energy, capacity building, technical cooperation programme.

ABSTRACT:
The growing demand and limited access to energy in Africa is combined with the pressing global challenge of climate change and the imperative need for clean energy deployment required to meet the United Nations Sustainable Development Goals (SDGs). The International Atomic Energy Agency (IAEA), which mandate **(1)** is to promote the use of nuclear techniques and technologies for peaceful applications, joins the international community efforts to help Africa address this difficult equation.
The IAEA provides support to its Member States to apply nuclear technology safely and sustainably in different fields including for energy systems analysis and planning and supply. The Technical Cooperation Programme is the primary mechanism for the implementation of this support.
In the field of energy systems analysis and planning, the IAEA assists national teams build their capacities using the IAEA energy planning tools **(2)** including the Model of Analysis of Energy Demand (MAED) and the Model for Energy Supply System Alternatives and their General Environmental Impacts (MESSAGE)
Globally, 153 countries and 20 international organisations use those tools that are designed to help countries elaborate sustainable energy strategies and conduct studies for electricity supply and energy options, energy investment planning and energy environment policy formulation.
Recent achievements in Africa include the development of sub-regional energy plans for sustainable electricity supply options for West, East and North African sub-regions through the use of IAEA models. Currently, the IAEA is contributing to a very ambitious initiative led by the African Union Development Agency (AUDA-NEPAD) to develop a Continental Energy Master plan for Africa.
Energy planning is key to help identify the most cost-effective and environment-friendly energy system options, including the potential role of nuclear power. In Africa(3), nuclear contribution to electricity generation for 2020 accounted for 1.5% of total 803 TWh. It is expected that the share of nuclear electricity in total electricity production could be in the range 1.0-1.7% in 2030 and 2.0-3.3% by 2050.

The IAEA provides a wide range of services, support, expertise and guidance to those Member States considering or embarking on new, or expanding existing nuclear power programmes, and helps them apply the Milestones Approach(4), which is a management guide for nuclear power programme development. The IAEA conducts review missions, such as "Integrated Nuclear Infrastructure Review (INIR)" and offers guidelines on developing the necessary infrastructure for a safe, secure and sustainable nuclear power programme.

Currently, the IAEA is providing support to 12 African Member States who are investigating whether nuclear power is an option for addition into their energy supply mix or already developing their nuclear infrastructure for responsible deployment of nuclear power.

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Short Bio

Shaukat Abdulrazak is the Director for the Division for Africa, in the Department of Technical Cooperation, at the International Atomic Energy Agency. Under his supervision, he facilitates IAEA technical cooperation support to 46 countries in Africa.

Before joining the IAEA, Abdulrazak worked as CEO at the Kenya National Commission for Science, Technology and Innovation. He has more than 25 years working experience as a Professor and university administrator, chairman and member of national and international boards, including Chair of the African Technology Policy Studies (ATPS), member of the Kenya National Economic Social Council, Commission of the African Commission on Nuclear Energy and the International Centre for Genetic Engineering and Biotechnology.
Abdulrazak is a Fellow of The World Academy of Sciences, the African Academy of Sciences, the Japan Society for the Promotion of Sciences. He has published over 120 papers in international journals, scientific conference and symposia proceedings. He has been an editorial board member and reviewer of several international refereed journals. His undergraduate studies were at Egerton University, Kenya. Abdulrazak obtained his Master of Science and PhD degrees from the University of Aberdeen, United Kingdom, and his Post Doctorate from the Shimane University, Japan.

32. ”HARNESSING WASTE-TO-ENERGY VALUE CHAIN TO ACHIEVE SUSTAINABLE DEVELOPMENT GOALS: LESSONS FOR SUB-SAHARAN AFRICA”, Samuel A. Igbatayo

Abstract

Waste-to-energy (WtE) value chain has emerged in recent times as an element of renewable energy resources around the world. This is particularly noteworthy against the challenges associated with fossil fuels-coal, crude oil and natural gas-which are increasingly assuming unpopular dimensions in the light of incessant price fluctuations, uncertainty, environmental challenges and the emergent global climate change. A United Nations Environment Programme (2018) report reveals global investment in renewable energy has risen to US$2.9 trillion since 2004, with China emerging, by far, the world’s largest investing country in renewable energy, at an unprecedented 45% of the US$279.8 billion worldwide investment committed to all renewable energy resources over the period 204-2017. In 2017, renewable energy accounted for an estimated 70% of net additions to global power capacity, attributable to continued improvements in the cost-competitiveness of both solar polyvoltaic (PV) and wind power. The emergent paradigm shift from fossil fuels to renewable energy is the major driving force propelling the growth of global waste-to-energy markets. The global WtE value chain is increasingly competitive. The market is projected to rise in value to US$31.8 billion by the end of 2019. Waste-to-energy (WtE) resources are in abundance in Sub-Saharan Africa, against an emergent demographic explosion, which is accompanied by rapid urbanization that is generating considerable municipal solid wastes. While Europe and Asia lead the WtE markets, Sub-Saharan Africa lags is marginalized, constrained by the large upfront investment profile of WtE projects The International Energy Agency (2014) reveals that about 625 million people in Africa lacked access to electricity. In order to achieve universal access to energy, however, Africa requires an investment estimated at more than US$1.5trillion inthe energy sector between 2018 and 2050, spurring Africa’s development partners to launch “The lighting Africa” Programme, aimed at broadening access to energy. Therefore, WtE infrastructure is increasing gradually in Africa recognized as a tool to capture energy for delivery to marginalized communities in several countries. Accessibility to affordable and clean energy, which is associated with WtE technologies, is also critical to achieve the 2030 SDGs in Sub-Saharan Africa.

The major objective of this paper is to shed light on the waste-to-energy (WtE) value chain as a tool for sustainable energy in Sub-Saharan Africa. It employs both quantitative and qualitative analytical methods to explore global trends in WtE value chains and lessons for Sub-Saharan Africa. The paper relies on secondary data from a variety of international and national agencies, as well as scholarly journals and periodicals, complemented by interviews with stakeholders around the region.

Findings reveal an evolving adaptation of WtE technologies to capture renewable energy in Sub-Saharan Africa, but require considerable increase in investment on a pathway to sustainable energy.

Short bio of Samuel Aderemi Igbatayo

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Professor Igbatayo, Samuel Aderemi is an International agricultural economist, with a research focus on renewable energy, Sustainable/Conservation Agriculture, Food security, Climate-smart Agriculture, the green economy, poverty reduction strategies, and rural development; as well as information technology in Sub-Saharan Africa.

He obtained his bachelor of agriculture and master's degree in Agricultural Economics from Texas Agricultural and Mechanical University-Kingsville, Texas, USA, in 1980 and 1982, respectively; as well as Ph.D. in Agricultural Economics from the Federal University of Technology, Akure, Nigeria in 2006. He has over twenty-five years of professional, academic and research experience, covering multi-disciplinary issues, including project design, implementation and monitoring in Food/Agriculture, Entrepreneurship education and allied research at both national and international levels, including the (2019). He rose to become Head, Department of Economics at Igbinedion University, Okada in 2007, where he later became the Director of Entrepreneurship Studies in 2008. He was Head, Department of Economics & Management Studies, Afe Babalola University, until recently and is also Director, Afe Babalola University Consult, the Consultancy unit of the University.

33. ”Electricity Access and Economic Development: The Case for Productive Use of Off-Grid Renewable Energy in Rural Africa.”, Susan Pendame[1],

Abstract
Despite Africa’s tremendous potential for renewable energy, an estimated 600 million people in Africa do not have access to electricity representing approximately two-thirds of the continent’s population (IEA, 2019). The majority of those without access to electricity live in rural areas. Access to clean energy is critical to sustainable economic and social development in Africa. Studies show that whilst there is a strong correlation between electricity access and economic growth, electricity access is does not always trigger economic growth (Moussa, & Cosgove-Davies, 2019). Electricity is often used for various consumption purposes such as lighting, access to information and entertainment which is not sufficient, in and of itself, to spur economic growth (EUEI PDF,2015). The usage of electricity needs to aligned in such a manner that it will spur economic growth through income generation activities of the local population (EUEI PDF,2015). There is therefore a need to move from consumptive use to productive use of electricity in order to realize the potential economic benefits of electricity access. Productive use activities in rural settings encompass local industries such as agriculture and fisheries, light manufacturing such as welding and carpentry and medium scale production such as agro-processing (Lighting Global, 2019). Productive use of renewable energy has the potential to transform rural economies and there is a particularly compelling case for productive use of renewable energy applications in agriculture given that the majority of rural African households depend on Agriculture for their livelihood (Lighting Global, 2019). In addition, productive use of renewable energy enables the diversification of the economic base by enabling the local community to deepen and move beyond conventional economic activities (EUEI PDF,2015). Off-grid renewable energy solutions are best placed to drive rural economic transformation due to their ability to reach millions of people that are not connected to the central grid. Moreover, there is a compelling case for Africa to prioritize renewable energy options given the continents vulnerability to climate change and its limited ability to adapt to negative effects of climate change particularly on agriculture. However, in order to realize the potential for productive use leveraging renewable energy, there is need to overcome barriers to widespread adoption renewable energy for productive use in rural areas.

The aim of this paper is to give an overview of the off-grid renewable energy sector in Africa, to investigate the barriers to productive use of off grid renewable energy applications in rural areas and, following a review of literature, case studies and best practices, offer policy options that can be employed to realize the potential of productive use of renewable energy in aiding rural economic transformation in Africa.

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EUROPEAN UNION ENERGY INITIATIVE PARTNERSHIP DIALOGUE FACILITY. 2015 -

Short bio

Susan Pendame is a Malawian dual qualified lawyer, experienced banker and development finance practitioner with a proven track record in development finance work. Susan has experience in various types on development finance including agricultural finance and renewable energy finance. Susan is currently based in Kenya and works as legal counsel at Eastern and Southern African Trade and Development Bank, providing legal advice on both trade and project finance transactions. Susan has a passion for renewable energy, sustainable development and access to finance. Susan has a keen interest in academic research, policy development and implementation and has undertaken and published in the areas of access to finance and renewable energy.

34. ”Sustainable and Equitable Mobility for African Cities”, Christopher Kost

Abstract

African cities are heavily reliant on walking, cycling, and public transport. Yet most ongoing transport investments in the region focus on the movement of cars, overlooking mobility for the majority of city residents. How can we repurpose transport investments to address mobility for all, especially vulnerable road users?
The talk will explore how cities can develop in high-quality walking and cycling facilities, efficient public transport, and better land use-transport integration, covering the following case studies among others:

- DART BRT: In 2016, Dar es Salaam launched the first phase of the city’s bus rapid transit (BRT) system, the first BRT in East Africa. Serving the key axis of Morogoro Road, the first phase network spans 21 km. Trunk services ply from Kimara to Kivukoni ferry terminal in the city centre, and also along branches to Morocco junction and the Kariakoo market. Median-aligned dedicated lanes ensure that DART riders have fast and reliable commutes without interference from private vehicles and minibuses. The DART system has dramatically reduced commute times for Dar es Salaam residents, who previously faced upwards of 4 hours stuck in traffic each day. For passengers taking DART, a trip from Kimara to the city centre now takes only 45 minutes. In addition, most stations have overtaking lanes, allowing a portion of the fleet to provide express services to key destinations. The system serves over 172,000 passengers on trunk and feeder buses.
- Kisumu Triangle project: The City of Kisumu, Kenya, has begun implementing best practice designs that improve safety for pedestrians and cyclists in line with the Kisumu Sustainable Mobility Plan. Under the World Bank-financed Kenya Urban Support Program, the city launched the KES 241 million Kisumu Triangle project, involving the reconstruction of 1.5 km of walkways along Oginga Odinga Street, Ang’awa Avenue, and Jomo Kenyatta Highway. Tabletop pedestrian crossings were constructed to provide safe, universally accessible crossing points for pedestrians. The project also included storm water drainage improvements, installation of utility ducts, installation of solar street lights, and construction of public toilets.

Through cases of successful transformation, the session will illustrate measures that African cities can take to improve access to opportunities, redress urban inequality, and mitigate emissions of harmful pollutants.

Short bio

Christopher Kost is Director of the Africa Program at the Institute for Transportation and Development Policy in Nairobi, Kenya, since September 2015.
Before that, he was Technical Director in Chennai, India for the same organization since January 2008.
Some achievements in this post were preparing feasibility reports for bus rapid transit and cycle sharing systems, preparing a toolkit for planning cycle sharing systems in India. He co-authored "Better Streets, Better Cities: a guide to street design in urban India".
Before working at the ITDP, he worked as consultant in transportation modeling and assessment of environmental impacts of transportation strategies in cities such as Dakar and Johannesburg.
He holds a Bachelor (2000-2004) and a Master of Sciences (2004-2005) degrees in Earth Systems from Standford University

35. « Electrification des milieux ruraux par les micro-centrales hydroélectriques en RD Congo », Eddie BILITU (reçu 12/07/21)

(Ecole Supérieure des Ingénieurs Industriels/Univ. de Lubumbashi, RDC)

Ce projet porte sur l'étude d'implantation d'une micro-centrale hydroélectrique sur la rivière Tshabula coulant dans le territoire de Mutshatsha province du Lualaba en RD Congo. L'objectif est d'exploiter le potentiel hydroélectrique de cette rivière en vue d'alimenter principalement le village Tshabula ainsi que les villages environnants qui sont restés non électrifiés pendant jusqu'à nos jours.
Pour y parvenir, nous avons effectué une série des descentes sur le site pour y évaluer les caractéristiques hydrauliques telles que le débit disponible et la hauteur de chute brute. Ces dernières ont permis de déterminer la puissance hydraulique exploitable sur le site. Il s'en est suivi le calcul de la puissance mécanique que développera la turbine hydraulique de la centrale. Ceci nous a conduit à la détermination de la puissance électrique que produira la future centrale hydroélectrique.
La puissance hydraulique de la rivière a été évalué à 1424,4kW soit environ 1,4MW. Au regard de cette puissance, le choix a été porté sur une turbine Kaplan à axe verticale capable de développer une puissance mécanique de 1281,9kW à une vitesse de rotation de 333tours/min. cette turbine entrainera un alternateur à pôles saillants de puissance électrique de 1,2 MW sous une tension composée de10kV et de fréquence 50 Hz.
Cette puissance électrique de 1,2MW est considérablement suffisante pour alimenter tout le village Tshabula ainsi que ses environs. Ce village compte une centaine d'habitations, une école primaire, un dispensaire et une maison de formation religieuse de frères salvatoriens. Vu que le Village à alimenter se trouve à environs 100m du site de production, un poste de transformation MT/BT sera installée entre la production et la zone de consommation pour distribuer directement les habitations. Ce poste de transformation aura pour fonction de ramener la tension de 10kV à 400V (en triphasé) ou 220V (en monophasé). Le réseau de distribution sera du type radial aérien adapté économiquement et techniquement au milieu rural.
Cette électrification du village Tshabula et ses environs constituera un puissant outil de de développement socio-économique. Elle permettra aussi de réduire l'utilisation de charbon et de bois de forêt comme énergie principale pour les besoins domestiques dans le village. Signalons qu'il n'existe quasiment pas d'activités économiques dans ce village. Sa population vit principalement de l'agriculture. Dans le milieu rural, la puissance consommée par ménage est estimée à 400W. Cette puissance fournie au village servira pour l'éclairage, le divertissement (téléviseur, radio). Avec l'arrivée de l'électricité dans le Village Tshabula pouvant engendrer une augmentation des besoins en énergie des ménages et une croissance démographique, cette puissance peut aller jusqu'à plus ou moins 800W par ménage. La puissance du transformateur MT/BT à installer sera de 100kVA. Deux autres postes MT/BT seront installés un peu plus loin pour alimenter les environs du Villages Tshabula (villages voisins :…..).

Mots-clés : Electrification, Milieux Périurbains, Microcentrales, Energie Hydroélectrique

Short Bio of Eddie Bilitu

Eddie BILITU est Ingénieur industriel en Electromécanique et Chef de travaux à l'Université de Lubumbashi (UNILU).

Actuellement Chef du Département de Génie Electrique à l'Ecole Supérieure des Ingénieurs Industriels (ESI) de l'UNILU, il enseigne plusieurs cours dans ladite Ecole notamment les cours de projet d'électricité, des réseaux électriques, des systèmes électromécaniques, des machines électriques, etc. Avec une expérience de plus de quinze ans dans l'enseignement universitaire, il a participé à l'encadrement d'une cinquantaine des projets de fin d'étude des étudiants finalistes de premier et deuxièmes cycles. Il mène ses recherches dans le domaine des énergies renouvelables (l'hydroélectricité et l'énergie photovoltaïque) en milieux urbains et ruraux dans les pays en voie de développement.

Pour ses études au troisième cycle, il travaille sur un projet d'Identification des conditions d'exploitation des modules photovoltaïques dans la ville de Lubumbashi en RD Congo. Il a participé à l'élaboration de plusieurs projets d'installation des microcentrales hydroélectriques dont un dans le territoire de Kasenga au sud-est de la RD Congo sur la Rivière Luapula.

Précédemment il a occupé successivement les postes de Secrétaire en charge de la recherche et de Secrétaire en charge de l'enseignement au Département de Génie Electrique à l'Ecole Supérieure des Ingénieurs Industriels de l'Université de Lubumbashi. En tant que Secrétaire en charge de l'enseignement au Département de Génie Electrique, il a participé à l'élaboration de Contrat de Performance des enseignements du système LMD (Licence-Master-Doctorat) signé entre l'ESI et la Banque mondiale (BM) en 2018. Dans le cadre des activités politiques, Il a participé au déroulement des élections de 2006 en RD Congo comme chef de bureau de vote dans un centre de vote dans la ville de Lubumbashi.

36. « Le Projet CHARLU, vers une offre sécurisée en charbon de bois et une réduction de la déforestation du miombo autour de Lubumbashi (Haut-Katanga, RDC) », Yannick Useni Sikuzani[1], François Malaisse[2], Jules Atchoglo[3], Quentin Ponette[4], Jan Bogaert[2]

Abstract

Avec un indice de développement humain qui le place en 186ème position sur 187 et plus de 85% de la population qui vit avec moins de 1,25 USD par jour, la République Démocratique du Congo (RDC) fait simultanément face à des défis écologiques, démographiques et économiques majeurs : seulement 2,5% du potentiel du réseau hydroélectrique sont exploités pour assurer la desserte en énergie électrique. Dans la province du Haut-Katanga (Sud-est de la RDC), la libéralisation du secteur minier intervenue en 2002 a entraîné une explosion démographique suivie d'une augmentation de la demande en énergie. Toutefois, la desserte en électricité est caractérisée par la vétusté des installations ainsi que des délestages non planifiés. A Lubumbashi, principale ville du Haut-Katanga, les infrastructures électriques ne sont pas ajustées à l'expansion spatiale urbaine rapide et incontrôlée et les ménages développent des alternatives telles que la quête de bois-énergie pour la cuisson des aliments et des briques. En conséquence, les îlots forestiers régressent en superficie, se dégradent et disparaissent constamment. D'une part, nous avons apprécié la dynamique de l'occupation du sol au sein de la Réserve de Biosphère de Lufira (située à 80km de Lubumbashi) et sa périphérie à partir de l'analyse diachronique de cinq images satellitaires de type Landsat acquise entre 1979 et 2018. Les résultats indiquent qu'au sein de la RBL, les surfaces forestières ont chuté à 11,8 km² en 2018 contre 75,8 km² en 1979. Cette déforestation résulte de l'expansion des savanes boisées (+25,5 km²), ainsi que des champs et jachères (+46,6 km²). Ceci semble suggérer que la production de charbon de bois associée ou non à l'agriculture a été le processus sous-tendant la déforestation observée et qui a milité pour le déclassement de la RBL. D'autre part, nous avons initié un projet sur le renforcement des capacités de gestion durable de la forêt claire de miombo par l'évaluation de l'impact environnemental de la production de charbon de bois et l'amélioration des pratiques vis-à-vis des ressources forestières (CHARLU, 2020-2024). Ce projet vise à améliorer les pratiques de différents acteurs vis-à-vis des ressources forestières en (i) améliorant la gouvernance des ressources forestières, (ii) évaluant l'empreinte spatiale de la déforestation en vue d'envisager les plantations forestières à de fins énergétiques, (iii) en quantifiant les stocks des éléments nutritifs sur les espaces déboisés pour la carbonisation afin de les valoriser à travers l'agriculture (choix des espèces et variétés adaptées), (iv) militant pour l'organisation des producteurs du charbon de bois en association et (v) en optimalisant le rendement de carbonisation à travers l'amélioration des pratiques locales. In fine, l'exploitation et la gestion de la forêt claire de miombo autour de Lubumbashi seront améliorées suite à la transformation des pratiques de production de bois-énergie et d'agriculture itinérante.

Mots clés : Anthropisation, Forêt claire de miombo, Bois-énergie, Services écosystémiques, Gouvernance, Lubumbashi.

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Biographie du Professeur Yannick Useni Sikuzani

Professeur à l'Université de Lubumbashi (UNILU) où il est Doyen de la Faculté d'Architecture. Lauréat de l'Académie Royale des Sciences d'Outre-Mer (Belgique, 2019), membre de plusieurs réseaux scientifiques (SURE : Society of Urban Ecology ; SASA : Society for the Advancement of Science in Africa ; etc.), Coordonnateur/gestionnaire de quelques projets de recherche pour le développement et consultant dans le domaine de la cartographie et aménagement des paysages. Auteur de plusieurs publications scientifiques et collaborateur scientifique à l'unité biodiversité et paysage (Université de Liège, Gembloux Agro-BioTech).

17 :45-18 :45 ***POSTER SESSION***

Chair: Antoine Vianou (Benin)/Philippe Goyens (Belgium)

17:45-17:48	Rotimi Muyima Adedayo (Nigeria) - *A Review of Global Perspective on Geothermal Energy*
17:49-17:52	Coffi Adihou (Benin) - *Etude de la performance d'un chauffe-eau solaire compact à absorbeur muni d'ailettes par le critère d'Entransy détruit*
17:53-17:56	Eddie Bilitu (DRC) - *Identification des modes d'exploitation des modules photovoltaïques dans la ville de Lubumbash*
17:57-18:00	Rock Dake (Benin) - *Use of sorption materials in solar dryers for sustainable production*
18:01-18:04	Pierre Kpantingnangan (Benin) - *Transformation des résidus agricoles, forestiers et déchets biodégradables en 'charbon vert'*
18:05-18:08	Pierre Kpantingnangan (Benin) - *Transformation des résidus agricoles et déchets biodégradables en 'biogaz'*
18:09-19:12	Guy Masudi (DRC) - *Réduction de la pollution harmonique du réseau de distribution électrique de la commune de Katuba (Lubumbashi, RDC) par un contrôle à base d'un filtre actif*
18:13-18:16	Talata Soulemane Modibo Karim (Benin) - *Innovations énergétiques, activités génératrices de revenus des femmes et développement inclusif durable au Bénin*
18:17-18:20	Timothée Nkodi (DRC) - *Optimization of biogas production from cassava peel by Response Surface Methodology*
18:21-18:24	Wirnkar Nsanyuy (Cameroon) - *Fault identification in Distribution transformers: Case of Fako Division, Cameroon*
18:25-18:28	Lorna Omuodo (Kenya) - *Evaluation of Napier Grass for Bioethanol Production for Africa through a Fermentation Process*
18:29-18:32	Victor Zogbochi (Benin) - *Étude de la dynamique de conversion thermo-électrique d'un groupe électrogène à base de moteur Stirling pour la production d'énergie électrique en milieu rural*
18:33-18:36	Laetitia Zoungrana (Burkina Faso)- *Design study of a gasification reactor for manufacturing and experimentation in West Africa*

37. ”A Review of Global Perspective on Geothermal Energy", ADEDAYO, Rotimi Muyiwa

Abstract:
Electricity from geothermal energy had a modest start in 1904 at Larderello in the Tuscany region of northwestern Italy with an experimental 10 kW generator. Today, this form of renewable energy has grown to 15.4 GW in 26 countries of the world producing an estimated 95,098.40 GWh/yr. These “earth-heat” units operate with an average capacity factor of 71.4% (EIA Report, May, 2021); though, many are “on-line” over 97% of the time, providing almost continuous base-load power. This electricity production is serving an equivalent 102 million people throughout the world (Dauncey,2001) which is about one percent of our planet’s population. The development of worldwide geothermal power production can be seen in Figure 1. The large downward spike in the production is the result of the destruction of the Italian field at the end of World War II (WWII). Just after WWII, geothermal power has grown at a rate of 6.2% annually. Electric power from geothermal energy, originally using steam from resources above 150oC, is now produced from resources down to 100oC using the Organic Rankine Cycle (ORC) process in binary power units in combination with a utility level heating project.

Keywords: Geothermal, Wet Steam, Dry Steam, ORC, Renewable Energy, Indirect Cycle Plant. Flash Steam, Binary Cycle Plant.

Short bio

ADEDAYO, Rotimi Muyiwa is a master degree student of Energy Technology & Management in the Department of Mechanical Engineering of the University of Ibadan, Ibadan Nigeria, after 20 years of experience in the industry as an Electrical Systems Engineer.

38. « Etude de la performance d'un chauffe-eau solaire compact à absorbeur muni d'ailettes par le critère d'Entransy détruite », ADIHOU Coffi Wilfrid1,a *, AWANTO Christophe4,d, HOUNGAN Comlan Aristide3,c , ANJORIN Malahimi4,b and SANYA Adjibadé Emile2

1 Institut National Supérieur de technologie Industrielle (INSTI)/Université Nationale des Sciences Technologies Ingénieries et Mathématiques (UNSTIM), Bénin
2 Université Nationale des Sciences Technologies Ingénieries et Mathématiques (UNSTIM), Bénin
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4 Laboratoire d'Energétique et de Mécanique Appliquées (LEMA), Ecole Polytechnique d'Abomey-Calavi (EPAC), Université d'Abomey-Calavi (UAC), Bénin

Résumé

Le présent travail s'est concentré sur l'utilisation du critère d'entransie détruite pour l'optimisation des dimensions des ailettes d'un absorbeur à ailettes pour un chauffe-eau solaire compact. Les dimensions optimisées sont le pas des ailettes sur l'absorbeur, le pas et la hauteur des ailettes dans le fluide caloporteur. Le fluide caloporteur utilisé est de l'eau et la surface du capteur est de 1 m2. Les modèles mathématiques des différentes formes d'entransy détruite ont été élaborés en fonction des propriétés physiques, thermiques et géométriques des différents composants du capteur et de l'eau. Les courbes montrant l'évolution de l'entransy totale détruite ont été tracées sous le logiciel Easyplot après une simulation dans Matlab. Les évolutions de ces courbes ont montré que le pas optimal des ailettes sur l'absorbeur est le plus faible possible, le pas optimal des ailettes dans l'eau est le plus grand pas possible et la hauteur optimale des ailettes immergées dépend du pas des ailettes sur l'absorbeur et la vitesse de l'eau. La différence entre la température de l'absorbeur et celle de la vitre influence les performances du capteur solaire plan.

Mots clés : Ailettes; chauffe-eau solaire compact; d'entransy détruite; hauteur; pas.

NB Definition of entransy (en.wiktionary.org/wiki/entransy)
Etymology : Blend of en[ergy] + trans[fer] + [abilit]y, introduced on 26 February 2007 by a research group at Tsinghua University led by Professor Guo as a basis for optimizing heat transfer processes (Guo, Zeng-Yuan; Zhu, Hong-Ye; Liang, Xin-Gang. Entransy—a physical quantity describing heat transfer ability International Journal of Heat and Mass Transfer, no. 50, pp. 2545–56, available online 26 February 2007). A descriptive concept of entransy, but without using the term 'entransy', was first proposed by Prof. Guo's group in Febr. 2003 as 'heat transport potential capacity'.

Entransy (thermodynamics) Half the product of internal thermal energy and temperature. For a given temperature difference, maximization of the entransy dissipation results in the maximum heat flux and thus corresponds to the optimal heat conduction performance.

BIO
ADIHOU Coffi Wilfrid

Octobre 2018 : Docteur en Science de l'Ingénieur
Date de naissance : 30 Avril 1982
Lieu de résidence : Abomey-Calavi (Bénin)
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Formations académiques

Octobre 2018 : Docteur en Science de l'Ingénieur, Spécialité : Energétique et Environnement Université d'Abomey-Calavi Thème : Optimisation des surfaces augmentées de l'absorbeur pour un chauffe-eau solaire compact.

2012-2014 Diplôme d'Étude Approfondie (DEA) option Energétique et Environnement Ecole doctorale Science De l'Ingénieur (SDI) à l'EPAC, Université d'Abomey-Calavi (Bénin) Thème : Optimisation des dimensions d'ailettes pour un absorbeur à ailettes d'un chauffe-eau solaire compact.

2010-2012 Master en Energies Renpuvelables et Systèmes Energétiques,
Université d'Abomey-Calavi (Bénin)
Thème : Conception et réalisation d'une maquette d'un système de chauffe-eau solaire pour la fourniture en eau chaude à la « CUGO » au CNHU de Cotonou

2003-2006 Licence Professionnelle en Génie Mécanique et Productique, Option Énergétique Institut Universitaire de Technologie (IUT) de Lokossa (Bénin)
Thème : Dimensionnement et choix d'un groupe électrogène pour un château d'eau à Agoïta dans l'arrondissement de Koussoupka (commune de Zogbodomè)

FONCTION OCCUPEE

Depuis Septembre 2019 : Assistant à l'Institut National Supérieur de technologie Industrielle (INSTI) à l'Université Nationale des Sciences Technologies Ingénieries et Mathématiques (UNSTIM)

39. « Identification des modes d'exploitation des modules photovoltaïques dans la ville de Lubumbashi », Eddie BILITU

Enseignant chercheur à l'Université de Lubumbashi/RD Congo

Abstract
La baisse de niveau de la qualité de service électrique en RD Congo a conduit la population à l'utilisation des sources d'énergie électrique alternatives telles que les groupes électrogènes, les modules photovoltaïques ou les petites centrales hydroélectriques. Une étude (Banza et al, 2018) récente a montré qu'environ 3% des ménages sur un échantillon de 5270 font recours à l'énergie photovoltaïque dans la ville de Lubumbashi. Le total des ménages dans la ville est estimé à 230 000. Par extrapolation, on trouve aisément qu'environ 6900 ménages utilisent les modules PV.

Au regard des caprices météorologiques, les équipements PV doivent être utilisés avec rationalité pour les faire fonctionner dans leur zone de rendement optimal.

Pour ce faire, les installateurs et les utilisateurs des équipements sont tenus à être formés et informés sur leurs modes d'utilisation. D'où l'importance de notre projet intitulé « IDENTIFICATION DES MODES D'EXPLOITATION DES MODULES PHOTOVOLTAÏQUES DANS LA VILLE DE LUBUMBASHI »

L'objectif de ce projet est d'Identifier les conditions d'utilisation des modules photovoltaïques dans la ville de Lubumbashi afin de les caractériser. Pour mener à bien notre projet et à cause des contraintes budgétaires et temporaires, nous avons été amené à déterminer la taille de l'échantillon par la formule de Rea. Et nous avons obtenu une taille minimale de l'échantillon des ménages sites photovoltaïques de 113 ménages.
Les premiers résultats ont montré que 42% des modules photovoltaïques ont été installés et exploités en moins d'une année dans la ville de Lubumbashi. Ceci prouve que la population de cette ville s'intéresse de plus en plus à l'énergie photovoltaïque. Les mêmes résultats ont montré les installations photovoltaïques sont plus majoritairement utilisées dans les résidences (maisons d'habitation) que les commerces. Les modules monocristallins sont les plus utilisés dans cette ville et les modules polycristallins n'y sont utilisés qu'à 38%.Environ 41% de modules PV utilisés sont inclinés de 0 à 30° vers le nord. En fonction de la latitude de la ville, l'orientation pour un rendement maximal des modules PV est d'environ 16°nord.

Pour faire face au problème de l'intermittence de l'énergie solaire qui varie annuellement entre 4 et 7kWh/m2, les ménages utilisateurs de modules PV recourent aux batteries Pb-acide comme moyens de stockage d'énergie. Ces batteries, plus rependues sur le marché lushois, ont une durée de vie de 400 à 800 recharges. Moins de 10% de ménages à Lubumbashi, au revenu moyen, recourent à l'utilisation de batteries Li-ion à cause de leur prix relativement élevé. La capacité de batteries Pb-acide utilisées dans les ménages à Lubumbashi varie entre 50 et 500Ah. Cette plage de capacité de batteries offre une autonomie d'un à deux jours pour un ménage utilisant des appareils moins énergivores tels que les lampes économiques (lampes LED, etc.), les téléviseurs LED, la charge des téléphones portables, etc.

Mots-clés : Energie photovoltaïque, conditions d'utilisation, ville de Lubumbashi

Short Bio of Eddie Bilitu

Eddie BILITU est Ingénieur industriel en Electromécanique et Chef de travaux à l'Université de Lubumbashi (UNILU).

Actuellement Chef du Département de Génie Electrique à l'Ecole Supérieure des Ingénieurs Industriels (ESI) de l'UNILU, il enseigne plusieurs cours dans ladite Ecole notamment les cours de projet d'électricité, des réseaux électriques, des systèmes électromécaniques, des machines électriques, etc. Avec une expérience de plus de quinze ans dans l'enseignement universitaire, il a participé à l'encadrement d'une cinquantaine des projets de fin d'étude des étudiants finalistes de premier et deuxièmes cycles. Il mène ses recherches dans le domaine des énergies renouvelables (l'hydroélectricité et l'énergie photovoltaïque) en milieux urbains et ruraux dans les pays en voie de développement.

Pour ses études au troisième cycle, il travaille sur un projet d'Identification des conditions d'exploitation des modules photovoltaïques dans la ville de Lubumbashi en RD Congo. Il a participé à l'élaboration de plusieurs projets d'installation des microcentrales hydroélectriques dont un dans le territoire de Kasenga au sud-est de la RD Congo sur la Rivière Luapula.

Précédemment il a occupé successivement les postes de Secrétaire en charge de la recherche et de Secrétaire en charge de l'enseignement au Département de Génie Electrique à l'Ecole Supérieure des Ingénieurs Industriels de l'Université de Lubumbashi. En tant que Secrétaire en charge de l'enseignement au Département de Génie Electrique, il a participé à l'élaboration de Contrat de Performance des enseignements du système LMD (Licence-Master-Doctorat) signé entre l'ESI et la Banque mondiale (BM) en 2018. Dans le cadre des activités politiques, Il a participé au déroulement des élections de 2006 en RD Congo comme chef de bureau de vote dans un centre de vote dans la ville de Lubumbashi.

40. ”Use of sorption materials in solar dryers for sustainable production”, Rock Aymar DAKE[1], Frédéric KUZNIK[2], Babacar LEYE[3], Igor W. K. OUEDRAOGO[1], Kokouvi Edem N’TSOUKPOE[1*]

KEYWORDS: — Solar energy; Solar dryer; Sorption thermal storage; Dehumidifier; Desiccants; Adsorbents.

Abstract

Among the efforts to reduce post-harvest losses, drying techniques have been broadly used, especially solar drying techniques (*Prakash et Kumar, 2017*). Unfortunately, due to day/night cycles, solar dryers suffer from discontinuity in the drying process, resulting in long drying times. To tackle this problem, many researchers have worked on some concepts (*Bal et al., 2011; Bal, Satya, et Naik, 2010*) in the last decades, including the use of sorption materials. In this work, we review the various applications and concepts regarding the use of sorption materials in solar dryers.
In Africa, some projects have been identified at the Kwame Nkrumah University of Science and Technology (KNUST) in Kumasi, Ghana (*Amankwah, 2019*); the Kenyatta University School of Engineering and Technology in Nairobi (*Thoruwa, 1996; Thoruwa et al., 1998; 2000*), Kenya, and at the Department of Mechanical and Electrical Engineering at Tanta University in Egypt. Basically, two types of applications of sorption materials in solar dryers were found in the different projects: one as a dehumidifier and the other as a thermal storage medium. Sorption beds used as dehumidifier aim at reducing the relative humidity of the drying air in order to increase its drying potential. The operating principle of sorption thermal storage is based on reversible physico-chemical phenomena, which are used to store energy. In both cases, interest has been found in the literature for silica gel and a composite material consisting of a mixture of bentonite, $CaCl_2$, vermiculite and cement in the ratio 6:1:2:1. Overall, solar dryers with integrated sorption materials were found to be technically more advantageous than conventional solar dryers, especially in terms of drying time. The incorporation of a sorption dehumidifier in a solar dryer, usually at the solar collector inlet, generally leads to a reduction of the drying time of 15-30%, although values up to 50% and even 64% have been reported. On the other hand, introducing sorption materials as thermal storage in a solar dryer, mostly integrated at the top in the drying chamber, usually leads to a reduction of the drying time in a range of 30-45%.

With reference to this review, the challenges regarding the use of sorption materials in solar dryers were identified. Following these conclusions, a case study is currently underway in Burkina Faso at the International Institute for Water and Environmental Engineering (2iE), focusing on mangoes drying with solar dryers. The objective of the study is to evaluate the time saving achieved by the combination of the innovations "dehumidifier" and "thermal storage" based on silica gel in a solar dryer designed for mango drying. The prototype investigated is an indirect solar dryer with forced convection mainly composed of a drying chamber, dehumidification units, a thermal storage bed, and a flat plate solar collector of 2 m² provided with baffles.

Short biography

Rock Aymar DAKE is a second year Beninese PhD student at the International Institute of Water and Environmental Engineering (2iE) in Burkina Faso. He holds a Bachelor degree in Water and Environmental Engineering (2016) and a Master degree in Electrical and Energy Engineering (2018) from 2iE. He also has an experience working in the private sector as an engineer on various projects related to solar photovoltaics. Currently, in the framework of his PhD thesis, he is working on water adsorption in solar dryers to improve their performance in terms of drying time. Rock is also in charge of tutorials and practical work of thermodynamics at 2iE. He is passionate about food preservation and renewable energy, especially solar energy.

41. « Transformation des résidus agricoles, forestiers et déchets biodégradables en 'charbon vert' », Pierre KPANTINGNANGAN

DG de la Société des Énergies de Demain (SED Sarl)

Abstract

La production de biogaz par nos digesteurs vise à produire une énergie propre et abordable en remplacement de l'énergie du bois de chauffe qui produisent les gaz à effet de serre.
La gestion des matières organiques (déjection animale, sang d'abattage, résidus alimentaires et végétaux divers, etc.) cause des nuisances et pose des problèmes sanitaires. Afin de faire face à ces défis, la Société des Énergies de Demain SARL promeut un système intégré permettant de recycler et de valoriser les résidus organiques issus de la production agricole (déjections animales, résidus de culture et de plantes envahissantes, effluents de transformation d'huile de palme, d'ananas, etc.) pour une production agricole durable elle-même en positionnant la bioénergie contenue dans ces biomasses au centre du système. S'inspirant de l'ingénierie écologique pour boucler les cycles de la matière organique tout en produisant de l'énergie décentralisée.
L'emploi d'un digesteur à biogaz a pour but de récupérer le gaz méthane émanant des matières animales et de matières végétales afin de produire du gaz domestique utile pour la cuisine.
Nous concevons, fabriquons et commercialisons au Bénin deux modèles de bio digesteurs qui produisent respectivement 4 m3 et 1,8 m3 de gaz par mois. Un destiné aux collectivités et aux fermes qui nécessite un lourd financement et une grande quantité de matière première. Le second modèle déplaçable, facile à installer est destiné à la fois aux ménages urbains et ruraux. La majorité des composants entrant dans la fabrication de ces deux modèles proviennent du Bénin même. Seuls quelques composants tels que sac digesteur et micro-organismes sont importés d'Israël et d'autres pays du fait de l'absence d'usine de fabrication et de la technologie de pointe de ces composants en Afrique.
En moyenne 50 kits du second modèle sont installés par an à des clients potentiels qui d'ailleurs sont venus vers nous grâce à nos activités d'exposition, de prospection et autres. Par contre 34 kits du premier modèle sont installés pour les collectivités et fermes avicoles. Les activités de production, d'installation et de vente de kit à biogaz représente en moyenne 45% de nos chiffres d'affaires annuels. Elle est donc bénéficiaire pour entreprise.

Short bio:

Pierre KPANTINGNANGAN, né le 29 septembre 1993 à Zouzonmè (Abomey, Bénin). Directeur Général de la Société des Énergies de Demain SARL (SED Sarl) Représentant du Bénin à l'Atelier de renforcement de capacité sur les prestations des Services Bioénergétiques (ECREEE/CEDEAO)

Pierre KPANTINGNANGAN est ingénieur en énergie renouvelable, diplômé de la Faculté des Sciences et Techniques de l'Université d'Abomey-Calavi, Bénin. Convaincu des vastes opportunités qu'offre le secteur des énergies renouvelables après sa licence en énergies renouvelables, Pierre KPANTINGNANGAN s'est donné les moyens de créer une entreprise dans ce secteur.

Démarré en 2017, la Société des Énergies de Demain SARL s'est fait remarquer très rapidement dans le cadre des projets tels que : les 1er et 2d appels à projets du deuxième compact du MCA au Bénin, le programme EnDev de la Giz ainsi que d'autres. Les travaux effectués dans ces différents projets ont permis de décrocher beaucoup de marchés publics comme privés en installation de générateur solaire (Lampadaire solaire, Adduction d'Eau Villageoise au fil du soleil, Climatisation, Etc.) et en installation des systèmes d'énergies de refonte durable (service d'efficacité énergétique, installation des batteries de condensation). La SED Sarl est connue aujourd'hui dans plus de 40 communes au Bénin et détient une check-list de 500 clients.

S'inscrivant dans le dynamisme de développer le secteur des énergies renouvelables, La SED Sarl offre à ces clients depuis 2018 des services de bioénergie à travers l'installation des systèmes de production de biogaz domestique et la fourniture d'une qualité extrême de charbon écologique (bio charbon). La vision de la SED Sarl à l'horizon de 2025 est d'apporter sa pierre à la réduction de la disparité en énergie au Bénin avec au moins 50000 personnes connaissant une amélioration remarquable de leurs conditions de vie à travers les services de bioénergie qu'elle offre.

42. « Transformation des résidus agricoles et déchets biodégradables en 'biogaz'", Pierre KPANTINGNANGAN

DG de la Société des Énergies de Demain (SED Sarl)

Abstract

La production de charbon vert vise à produire de l'énergie thermique en remplacement du charbon de bois.
Notre atelier de production de charbon vert, situé dans l'arrondissement de Godomey, commune d'Abomey-Calavi, est approvisionné par une grande quantité de matières premières telles que : tiges de maïs ; balle de riz ; fane d'arachide, déchet de scierie, du liant (amidon, gomme arabique…) et de l'eau. Après collecte, découpage en de petits morceaux et séchage des matières, les matières sèches sont carbonisées et compactées avec les déchets verts. Enfin les morceaux de charbon sont séchés.
Nous produisons soixante-quinze (75) kilogrammes de charbon par semaine soit cinq mille quatre cent (5400) kilogrammes de charbon bio par an grâce à deux travailleurs à mi-temps rémunérés à 15000 FCFA le mois. Notre entreprise se finance en vendant directement à 200 FCFA le kilogramme (contre 250 FCFA pour le charbon de bois).
Nous approvisionnons 20 consommateurs finaux dont les ménages et le collectif d'utilisateurs de charbon de bois. La majorité des clients sont venus vers nous lors d'une prospection porte-à-porte donnant droit à une sorte d'incitation aux premiers abonnés.
Aujourd'hui, nous comptons vingt (20) clients actifs avec comme projection cent (100) clients venant de partout à l'horizon 2025. Cette activité occupe en moyenne 10% de notre chiffre d'affaire annuel.

Short bio:

Pierre KPANTINGNANGAN, né le 29 septembre 1993 à Zouzonmè (Abomey, Bénin). Directeur Général de la Société des Énergies de Demain SARL (SED Sarl) Représentant du Bénin à l'Atelier de renforcement de capacité sur les prestations des Services Bioénergétiques (ECREEE/CEDEAO)

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43. « Réduction de la pollution harmonique du réseau de distribution électrique par un contrôle à base d'un filtre actif », Guy Masudi [1,2], Fiston Tshibambe [2], Amos Ntambwe [3], Bonaventure Banza [1]

1. Ecole supérieure des ingénieurs industriels à Université de Lubumbashi,RDC; 2. AEMI SA Lubumbashi / Groupe Forrest International (GFI),RDC ; 3. Société Nationale de l'Electricité (SNEL), RDC.

RÉSUMÉ

Malgré son puissant réseau hydroélectrique, la Société Nationale d'Electricité (SNEL) de la RDC n'exploite que 2,5 % de ce potentiel (soit 2 516 MW) pour assurer seulement 30 % de desserte en milieu urbain. Le déficit d'offre en électricité s'explique par la vétusté de la plupart des installations et le faible taux d'équipement dus au non-investissement systématique. Dans la ville de Lubumbashi, la population qui vit avec moins de 1,25$ USD par jour se rétracte sur le secteur informel pour la survie. Dans la Commune de Katuba, le développement des ateliers électriques ainsi que la pullulation des bureautiques en réponse au chômage quasi-généralisé que connait la ville a entraîné une distorsion des signaux de tension et de courant. Par ailleurs, depuis près de 7 ans, et à travers un partenariat public-privé, l'Atelier d'Electro-Maintenance Industrielle (AEMI) accompagne la SNEL dans la recherche des pistes de solutions pour améliorer la qualité de l'électricité offerte au niveau des ménages. Pour cette raison, cet atelier a mené une étude dans l'optique de quantifier la réduction de la pollution harmonique du réseau de distribution électrique de la commune de Katuba par un contrôle à base de filtre actif. Un total de sept transformateurs a été pris en compte et autour de chaque transformateur, un échantillon de 10 parcelles a été retenu de manière aléatoire. Deux appareils ont été utilisés pour mesurer le courant et la tension : un multimètre RMS et un multimètre ordinaire. Le niveau de pollution est ainsi obtenu par le rapport des valeurs de tensions et courant lues sur le multimètre RMS par celles lues sur le multimètre ordinaire. Les résultats obtenus ont montré que :

1. Autour de 7 transformateurs retenus, il y a 10 ateliers électriques (postes à souder, moulins), 3 écoles, 1 centre de santé, 20 bureautiques. Le reste est constitué des maisons à usage résidentiel comportant des ampoules économiques, chargeurs de téléphones et ordinateurs…
2. En considérant le seuil de 5% de distorsion harmonique en tension comme tolérable, les mesures effectuées attestent que les parcelles qui disposent des ateliers électriques, écoles, centre de santé, bureautiques et maisons résidentielles dépassent le seuil respectivement de 13, 8, 11, 10 et 8 unités. Pour ce qui est du courant, en considérant le seuil de 10% de distorsion harmonique en courant comme tolérable, il ressort des mesures effectuées que les valeurs enregistrées au niveau des ateliers électriques, écoles, centre de santé, bureautiques et maisons résidentielles dépassent le seuil respectivement de 19, 16, 13, 14 et 7 unités.
3. En l'absence des filtres Actif, les simulations faites sur Matlab donnent des valeurs qui s'apparentent à celles collectées sur le terrain. En utilisant le filtre Actif, avec un temps t=2 secondes, qu'au niveau du transformateur (en amont de l'utilisation), le taux de distorsion harmonique qui était de 37,63 %, a été ramené à 6,43 % après compensation. De même pour la tension, le taux qui était de 26,60 % a été réduit à 0,56 %.

Nos résultats soulignent que lorsque le filtre actif est mis en fonction, le courant et la tension de source récupèrent aisément leurs allures sinusoïdales, suggérant qu'il a généré un courant qui suit bien sa référence. Cela implique le bon fonctionnement, l'efficacité, la robustesse du filtre actif et confirme ainsi sa bonne réponse dynamique.

Mots-clés : réseau électrique, charges non linéaires, pollution harmonique, filtre actif, Lubumbashi.

Short Bio: MASUDI MWANA MULENDA GUY DE PLAEN

Guy Masudi Mwana Mulenda
Master en Electricité industrielle à l'Université de Lubumbashi en République Démocratique Congo. Il est Ingénieur à l'Atelier de l'Electro-Maintenance Industrielle du GROUP FORREST INTERNATIONAL depuis 2016 et chargé des cours à l'Université de Lubumbashi. Guy Masudi Mwana Mulenda évolue depuis 2018, sous l'encadrement scientifique du Professeur Banza Wa Banza Bonaventure (Electricien-urbaniste).
Domaine de recherche : Optimisation de l'énergie à l'échelle résidentielle et des quartiers à travers le processus de bio méthanisation.

44. «Innovations énergétiques, activités génératrices de revenus des femmes et développement inclusif durable au Bénin » MODIBO KARIM Talata Souleymane,SEKO OROU Baké Marie Thérèse, TASSO Boni Florent, Monique OUASSA KOUARO

Abstract:

Les innovations introduites dans le secteur énergétique constituent un des leviers pour la vitalité de diverses activités génératrice de revenus des femmes et pour relancer la question du développement inclusif au Bénin. Cette présentation a pour objectif d'analyser les innovations énergétiques au sein des activités génératrices de revenus des femmes capables de participer au bien-être économique et social des communautés béninoises.
Elle s'effectue dans une approche mixte. Les données secondaires ont été recueillies à travers une recherche documentaire. Quant aux données primaires, elles ont été collectées à l'aide des entretiens par questionnaire et avec guides semi-structurés auprès des promoteurs des énergies renouvelables, des femmes entrepreneuses des communes de Cotonou et de Parakou. Des entretiens approfondis et des discussions de groupes ont été menés auprès d'un échantillon d'acteurs retenus à choix raisonné. L'analyse du contenu, le logiciel R ont été mis en avant pour l'analyse des matériaux.
Cette recherche a permis de faire un état des lieux des différentes innovations énergétiques au Bénin avec une particularité sur les villes de Cotonou et Parakou. Il ressort des travaux de terrain, que l'accès à l'énergie est non seulement un fait pour le développement du Bénin, mais surtout impacte le développement des activités génératrices de revenus des femmes. Enfin, l'efficacité énergétique a été évoquée dans le sens qu'elle permet à coup sûr l'autonomisation des femmes et le développement inclusif durable au Bénin.

Short bio

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MODIBO

KARIM Talata Souleymane est de nationalité Béninoise. Doctorant en Sociologie, Anthropologue du Développement, spécialité Migration et mobilité sociale à L'École Doctorale Pluridisciplinaire EDP-FLASH-UAC/Bénin.

Au plan Académique, il a participé à plusieurs colloques au niveau national qu'international. Il est également consultant indépendant et a eu à travailler sur plusieurs axes de recherche tant dans son domaine d'investigation que dans d'autres domaines de recherche. Il a par ailleurs fait des consultations pour le compte d'EDUCO-Bénin sur l'étude diagnostique régionale sur la migration/mobilité des enfants et jeunes en Afrique de l'ouest, sur l'Analyse situationnelle des droits de l'enfant (ASDE) et l'évaluation de la qualité des dispositifs communautaires de protection de l'enfant dans l'Alibori par DEDRAS/ONG.

Actuellement, il travaille pour finaliser au cours de cette année 2019-2020 sa thèse de doctorat sur: « Migration et mobilité des jeunes à Djougou au Bénin ».

45. ”Optimization of biogas production from cassava peel by Response Surface Methodology", Nkodi Mananga Timothée

Abstract:
Cassava is the most produced root in the world. Globally, the five largest cassava producing nations are Nigeria (33.4 Mt in 2003), Thailand, Indonesia, Brazil and Democratic Republic of Congo (DRC) (Dunstan et al., 2017). In sub-Saharan Africa, cassava is one of the main source of carbohydrates of people.

Whatever cassava tubers uses, peeling is the most stage where 1Kg of cassava loose 1/3 of it mass, especially the peelings. They are abandoned on site and constitutes an enhanced risk of environment pollution descreasing soil fertility. There is a need to value peels by producing biogas as fuel.

Biogas production from cassava peels mixed with some animal manure showed that the yield depended on the loading rate and the type of animal manure (Adelekan and Bamgboye, 2009). When mixed peels with urea at various concentrations, Nkodi et al.(2016) obtained the highest yield (80.79 L/KgMS) at 0.01% then that generated form the blend of cassava with animal manure. This was due to the three factors: loading rate, particle size and urea concentration, which were all significant ($p<0.05$) (Nkodi et al., 2020).

The aim of this work is to find the optimal conditions for producing biogas from cassava peels mixed with urea by using the central composite design methodology with three factors: Loading Rate (OLR), Inoculum-Substrate ratio (ISR) and urea concentration (UC). By using 1L diigester capacity the following optimal conditions were found: OLR:14.848%, ISR=0.378 and UC=0.020% with a maximum yield of 3843.676mL.

References

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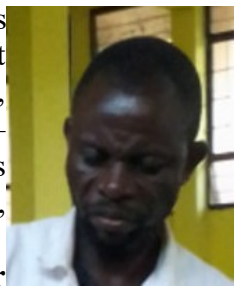
Short Bio



Nkodi Mananga Timothée (+243815133007, nkoditimothee@gmail.com) is a Congolese (DR Congo) and born on 01 febrary 1976. he is a pHD student since 2017 in the University of Kinshasa, Faculty of science and technology, Department of chemistry. After finishing his DEA studies From 2014 – 2016, in the department of chemistry of the University of Kinshasa. studies Field: Renewable energy and environmental protection (Diplôme de DEA., equivalent to Msc)
Title of dissertation: **«Biomethanisation des épluchures de manioc par co-digestion avec l'urée, la bouse de vache et la parche de café».**

Presently, he is a senior lecturer in the Faculty of Oil, Gas and New Energies, University of Kinshasa.

46. ”Fault identification in Distribution transformers: Case of Fako Division, Cameroon”, Wirnkar Basil Nsanyuy 1*, Emmanuel Tanyi 1

Keywords: Transformer faults, Wireless sensors, unbalanced mode, load growth, Cameroon.

Abstract

In this study, the causes of frequent failures in distribution Transformers in Fako Division of the Southern Interconnected grid (SIG) of Cameroon have been investigated. The aim of the study is to bring out amongst other things the common causes of distribution transformer failure in this area. The data on daily operations of transformers from the South west regional office in charge of network operations and system maintenance was collected and analysed to identify faults that often occur. The study showed that distribution transformers failure between 2019 and 2021 in the Fako divisional sub area was over 65% out of the 560 transformers due transformers operating in unbalanced mode while an estimated 20% were overloaded. This study concludes that unbalanced loading and overloading are the major and common causes of failures in distribution transformers in Fako Division during the the aforementioned period, suggesting that serious actions need to be taken such as the installation of wireless sensors that monitor load growth and subsequent replacement of distribution transformers in case loading patterns get to a critical level. This measures if applied on the network will reduce frequent damages in transformers which increase operation cost and it is often shifted to consumers in the form of increased electricity tariffs.

Short Bio of WIRNKAR BASIL NSANYUY

WIRNKAR has a B.Eng. and an M.Eng. from the Faculty of Engineering and Technology (FET) of the University of Buea. He served as a Public Relations Officer (P.R.O), Vice President (V.P) and President of the Faculty of Engineering and Technology Students' Association (FETSA). WIRNKAR served as trainer in a six (06) months Capacity building training organized by FET to train trainees from the 31 councils of the South West Region of Cameroon on the Operation, Installation and Maintenance of Renewable Energy systems. WIRNKAR also served as a Graduate Teaching Assistant (GTA) in FET in the 2016/2017 academic year. He participated in the setting up and manning of Platform four (an Outdoor Solar energy station) and also served as a Protocol in a conference organized by ANSOLE in Buea in August 2017. WIRNKAR is a Ph.D. candidate in FET and he is currently researching on the topic "Use of Wireless Sensor Network for the monitoring and Control of Power Systems: A case study in the distribution transformers in Buea". He is also serving as a Assistant Lecturer in the Faculty of Engineering and Technology (FET) of the University of Buea.

Contact: wirnkar.basil@ubuea.cm/ wirnkarbasil@gmail.com: Tel:+237676780404

47. ”Evaluation of Napier Grass for Bioethanol Production for Africa through a Fermentation Process”, Lorna Omuodo, E-Moto Limited Kenya

Abstract

Ethanol is one of the widely used liquid biofuels in the world. Its uses as Energy fuel is varied: transport fuel, domestic cook-fuel, heating fuel and power production. The move from sugar-based production into the second-generation, lignocellulosic-based production has been of interest due to an abundance of these non-edible raw materials. E-Moto has been interested in the use of Napier grass (*Pennisetum purpureum* Schumach) K1 O1 varieties, a common fodder in tropical East African regions and is considered an energy crop, for ethanol production. Grows well in Marginal lands and

In our study we aim to evaluate the ethanol production potential from the grass and to suggest a production process based on the results obtained from the study.
Pre-treatments of the grass by alkali, dilute acid, and their combination prepared the grass for further hydrolysis by commercial cellulase. Separate hydrolysis and fermentation (SHF), and simultaneous saccharification and fermentation (SSF) techniques were investigated in ethanol production using *Saccharomyces cerevisiae* and *Scheffersomyces shehatae*, a xylose-fermenting yeast.

Pre-treating 15% *w*/*v* Napier grass with 1.99 M NaOH at 95.7 °C for 116 min was the best condition to prepare the grass for further enzymatic hydrolysis using the enzyme dosage of 40 Filter Paper Unit (FPU)/g for 117 h. Fermentation of enzymatic hydrolysate by *S. cerevisiae* via SHF resulted in the best ethanol production of 187.4 g/kg of Napier grass at 44.7 g/L ethanol concentration. The results indicated that Napier grass is a promising lignocellulosic raw material that could serve a fermentation with high ethanol concentration.

Short bio

Lorna Omuodo is a Graduate of Sociology and had a dotting career as a programme officer and Bioenergy expert for many years. She has worked as a nominee for Kenya in developing ISO 13065 sustainable criteria for bioenergy.

Her main challenge in development has focused on the role of Women in Development and especially in freeing them of their burdens and liberation to set them off for effective participation in economic development to enhance gender role in National growth. At the heart of this lies in preparing healthy yet affordable foods and managing the homes to be safe and a healthy environment for co-existence and food production. It is within this context that Lorna Has spent over 10 Years in mastering to become an expert in African Bio-energy systems, earth regeneration and land restoration which led to founding E-Moto Limited, a company that became a winner of World Resource Institute (WRI)**Land Accelerator programme 2019**. She is the holder of title of **African Queen of Energy Award Winner 2020 (innovation prize)** She has taken the task of championing for household cooking fuel-energy as an area of sustainable development for women of E.Africa Region. She promotes Circular Economy concepts in Ethanol production loop system.
It has developed a strong legal and regulatory structures and created several related streams of standardized products that are safe clean and sustainable yet Zero emission and deliver high economic and environmental benefits and generate solutions that generate fuels and complete non food- based value-chains. The solutions are simple adoptable transformative and efficient.

Its time up for smoky polluted homes and damping marginal agricultural lands.

Here at E-Moto, "No need to cut tree in order to put food on the table"

We are Bottling Hope and Bottling Fuel.

48. « Étude de la dynamique de conversion thermo-électrique d'un groupe électrogène à base de moteur Stirling pour la production d'énergie électrique en milieu rural », V. Zogbochi [1], P.K Chetangny [1],, D. Chamagne [2], S. Houndedako [1], G. Barbier [3], A. Vianou [1] (updated 24/7/2021)

(1) Polytechnic School of Abomey-Calavi University, Benin
(2)FEMTO-ST - UMR CNRS 6174, University of Bourgogne Belfort, Franche-Comté, France
(3)Laboratoire de Physique et Mécanique Textiles (LPMT), Université de Haute Alsace, Mulhouse, France

Abstract

In 2020, Benin has an electricity access rate of 33.42% distributed as follows: 60.35% in urban areas against 8.78% in rural areas. Faced with this disparity, several projects aimed at extending the electricity network or setting up off-grid electrification systems (OGES) are underway. Most OGES projects are based on solar photovoltaic (without storage) which remains unavailable in the evenings when it is most in demand or if it must overcome this constraint and include storage, its cost exceeds the stock market of the target populations. At the same time, final energy consumption in Benin is dominated by biomass in the form of fuelwood up to 46.1% and its transformation into charcoal has a yield of less than 15% efficiency. This implies a huge thermal rejection both during processing and during the use of coal in households. Among the processes allowing the transformation of heat into electricity, the Stirling engine is among the best choices since it is adaptable to almost all thermal sources. This is because the Stirling engine is an external combustion and closed-cycle working fluid engine that receives heat to produce mechanical movement. The fluid is a gas (air, hydrogen, helium or nitrogen) subjected to a cycle comprising four phases: isochoric heating, isothermal expansion, isochoric cooling, and isothermal compression. This engine can use multiple hot sources coming either from the sun, underground, household or agricultural waste, industrial thermal waste, etc. The heat coming from outside, it is possible, by using non-fossil fuels, to supply it in a less polluting way than in many thermal engines where combustion is imperfect. Noise pollution is very low due to the absence of explosion systems such as in internal combustion engines. The lack of internal chemical reaction in the machine and the lack of material exchange with the environment make the Stirling engine an easy to maintain engine that lasts a long time. In addition, the Stirling cycle is reversible. It can work just as well as a motor when supplied with heat or as a refrigerator or heat pump when operated mechanically.
Our goal is to study a Stirling engine-electric generator assembly to make a compact group that can be moved like a handbag and can be used anywhere. The combination of kinetic and thermodynamic methods for a light group of 34 kg shows us that by adjusting certain heat exchange parameters, we can obtain a maximum electric power of 2500W with an overall efficiency of 38%.

Short bio

Victor ZOGBOCHI is an Aircraft Engineer in Benin. Holder of a Masters in Physical Science and a Master of research in Electrical Engineering, he is currently a PhD candidate at the Doctoral School of Engineering Sciences at the University of Abomey-Calavi. His research focuses on the "Design of a Stirling engine and an electric generator for a generator set using renewable energies". His works are done in the electrical engineering, telecommunications and applied computing laboratory.
The objective of his research work is to contribute to the off-grid electrification of Benin by setting up a device at reasonable cost and usable anywhere and anytime to convert all the thermal wastes obtained in homes, fields and industries into electric energy. His research area focuses on the production of electrical energy and the optimization of the production processes of this energy. He teaches at Abomey-Calavi Polytechnic and is an aircraft repairer.
Victor is the author or co-author of several studies, publications and scientific communications in Benin and internationally as part of his thesis.

49. « Design study of a gasification reactor for manufacturing and experimentation in West Africa », Laetitia Zoungrana

Abstract

West Africa has a large potential of biomass as a source of renewable energy. One of the promising ways to valorise biomass is through gasification that allows the production of heat and electricity. This study introduces the design and the experimentation of a gasification reactor. A design methodology based on the conceptual approach proposed by Cross was adopted. This approach leads in several steps to a rational design choice based on the evaluation of different solutions. In this study, nine reactors types have been compared to select the design that best suits the defined objectives such as a local manufacturing, a safe operation and a correct gas quality. The reactor types are distinguished by the different modes of fuel supply, the methods to introduce the gasification agent and the type of bed. From this design study, a semi-batch, fixed bed reactor with air aspiration appears the most suitable to achieve the objectives. To refine the design, some technological options such as the heat recovery from the reactor walls have been studied by simulation with the Ansys Fluent software. Based on the final design, the gasifier has been dimensioned and manufactured in Burkina Faso with the help of local craftsmen. The gasifier characteristics were described for an optimal operation in a small scale industrial unit with a representative scenario that can be made of a gasifier. The average biomass consumption has been chosen at 20 kg/h and the specific gasification rate is 100 kg/m2/h while the average air flow is estimated at 30 kg/h. The usefulness of this gasifier has been defined for a small industrial rice husking unit. For an economic usability, the platform has an energy autonomy that makes it more competitive than a system powered by the electricity grid. Thus, the produced syngas is used as fuel in an engine coupled to an alternator in order to produce electricity. This electricity allows to run the huller that husks the paddy rice producing rice husk as residues and the rice husk is used in the gasifier to generate the syngas. The heat from the cooling system and the exhaust of the engine could be recovered to reduce the thermal energy needed to parboil the rice. The design study, the manufacture and the experimental results demonstrate the feasibility of a local technology for a safe and efficient gasification of biomass.

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Short bio

Laetitia Zoungrana is born in 1993 in Burkina Faso. After a high school diploma in 2010, she studied environmental engineering at the International Institute of Water and Environment Engineering (2iE) in Ouagadougou, Burkina Faso. Her graduation internship between the University of Montpellier and the European Institute of Membranes, gave her the desire for research. Two co-authored articles were published during this research internship. Then, after her engineer diploma,She started PhD studies. Her research subject is the valorisation of agricultural residues, like rice husk, through gasification with a focus on the development of a local technology.

Wednesday 10 November 2021
Infosec , Rue 913
Room Collines
Research, innovation & education in connection with the energy-intensive sectors

9:00-10:30 ***SESSION 9***

Chair: Marc Lobelle (Belgium, Benin)/ Jean Snoeck (Belgium)

THEME 5 - Optimisation of energy based services for big consumers
Keynote speakers: Philippe Schild (France), Emmanuel Ackom (Ghana), Edgard Gnansounou (Benin) , Arthur Minsat (France), Bruce Sithole (South Africa)

9:00-9:15	Philippe Schild (France) - *Electrification des miliieux ruraux par les microcentrales hydroélectriques en RD Congo*
9:15-9:30	Emmanuel Ackom (Ghana) - *Close-by yet inaccessible: Urban poor communities and modern energy conundrum in Africa*
9:30-9:45	Edgard Gnansounou (Benin) - *Sustainable Strategy for Transportation Fuels in West-Africa: A 2050 Prospective Assessment*
9:45-10:00	Arthur Minsat (France) - *How sustainable energy in intermediary cities will strengthen Africa's food value chain*
10:00-10:15	Bruce Sithole (South Africa)- *Extracting Maximum Value from trees*

50. « EU-Africa Science, Technology and Innovation Cooperation: Perspective », Philippe Schild,

European Commission, DG Research and Innovation, Directorate D Clean Planet

Abstract

Science, technology and innovation (STI) cooperation between the European Union (EU) and Africa has been enhanced a decade ago with the creation of the EU-Africa High Level Policy Dialogue (HLPD) on science, technology and innovation at the 2nd EU-Africa Summit in Tripoli in 2010.

The HLPD aims to establish long term jointly funded and co-owned research and innovation actions. It is implemented through the creation of partnerships formally agreed between its members.

The first one was on Food and Nutrition Security and Sustainable Agriculture (FNSSA), but the second was on energy and climate change. At the EU-Africa joint Summit of Abidjan in 2017, the Climate Change and Sustainable Energy (CCSE) partnership was established. The CCSE partnership is based on a jointly agreed roadmap covering actions on climate change, on renewable energy and on energy efficiency.

The EU initiated already an action on energy efficiency in urban areas in Africa and a second through a joint programme of activities in the field of renewable energy technologies. They are being implemented through Horizon 2020, the EU Research and Innovation framework programme.

The European Green Deal launched in November 2019 has set as one of its priority Africa cooperation. Research collaboration is an important element of the new European Commission communication “Towards a Comprehensive Strategy with Africa”.

The new EU Research and Innovation framework programme, Horizon Europe, is starting in January 2021 with its first work programmes being developed now. Those three new initiatives will offer new opportunities for collaboration.

BIO

Dr. Philippe Schild is a senior expert in the unit responsible of clean energy transition in the directorate general for research and innovation of the European Commission. He obtained his PhD, plasma physics, at the University Joseph Fourier in Grenoble (France) in 1989. He started his carrier as a scientist at the European fusion tokamak experiment, the Joint European Torus (JET). He joined the Directorate General Research and Innovation in 1998, when he started working in the areas of renewable energy technologies. He contributed to the development of the EU research work programme, to the selection of research projects and their monitoring. His expertise covers the areas of concentrated solar power, photovoltaics, ocean energy and bioenergy. He is now following emerging energy technologies such as solar conversion from artificial photosynthesis.

He has been involved in international cooperation from the early time of his carrier. He represented the European Commission in different Technology Collaboration Programmes (TCP) of the International Energy Agency (IEA). He is a co-lead in the Mission Innovation Challenge "Converting Sunlight". Mission Innovation is a partnership of 23 countries including the European Commission created in 2015 at the COP21 aiming at accelerating research and innovation in the field of clean energy technologies. He is also leading the activities to develop a joint programme of activities in the area of renewable energy under the framework of Climate Change and Sustainable Energy (CCSE) partnership created under the EU-AU High Level Policy Dialogue.

51. « Close-by yet inaccessible: Urban poor communities and modern energy conundrum in Africa » Dr Emmanuel Kofi ACKOM

Abstract

In this paper, experience based on over 8 years of work on lack of modern energy for sustainable development especially focused on urban and peri-urban communities in Africa is presented. The paper will focus on the mechanisms employed by the researcher, the extent to which, and how, his work with collaborators in the continent has been able to influence change in climate-friendly energy policies and energy planning in cities in the participating African countries. This was achieved by working with key stakeholders, government departments, municipal authorities, scholars and facilitating a South-South knowledge network.

Over half of today's population, representing 4.3 billion people live in urban communities globally. Urbanization is increasing at an alarming rate, with 70% of the world's population projected to dwell in cities by 2030. The urban growth phenomenon in developing countries is driven in part by increased rural to urban migration. Due to a complex array of factors, over one billion urban dwellers are currently without adequate access to basic services, globally. This means approximately 1 in every 3 urban dwellers the world does not have access to modern energy services. Thus, energy poverty is no longer a challenge in rural communities alone, but it has also become a key urban problem in developing nations including many African countries. Several studies have underscored that access to modern energy services - Sustainable Development Goal (SDG) 7 - is an essential enabler of development and socio-economic empowerment of communities with a multiplier effect towards achieving key SDGs. This multi-country study was conducted globally including three African cities, namely in Dakar (Senegal), Nairobi (Kenya) and Cape Town (South Africa) over 8-year period. The objective of the study was:

- to understand the barriers (both supply and demand-side) hindering access to electrification in urban poor communities;
- an analysis of existing energy policy reforms and whether they sufficiently address the challenges facing urban poor;
- an assessment of how policy processes could be improved to promote better access to cleaner energy services for poverty alleviation and productive uses of energy.

Data collection using common indicators was undertaken across all the countries in the field study. Additionally, a policy dialogue Panel (PDP), which was a structured mechanism for engaging our researchers, policymakers, local representatives from the respective communities along the research value chain was established. Based on findings from the study across the countries; it was evident that the lack of tenure; policy conflicts; weak alignment between energy policies and urban planning; the high upfront cost of electricity connection and tariff structures; the high cost of energy-efficient appliances and the inability of the poor to benefit from subsidized tariff structures were common. An interesting observation was the increased uptake of the research findings in policy reformulations, due in part to the PDP we employed in this study. Possible recommendations include innovations in PDP, financing, social inclusion, policy reformulation, international cooperation and peer-to peer knowledge sharing among urban poor communities.

Bio of Dr. Emmanuel Kofi Ackom (Assistant Professor, Thompson Rivers University & Adjunct Professor, University of British Columbia, Canada).

Dr. Ackom is a Ghanaian citizen by birth and heritage and an African energy scholar. He is fluent in English Language and a great communicator.

For over 19 years, he has actively conducted research, engaged in capacity building activities and provided policy advisory on cleaner energy technologies, environmental sustainability and low carbon development strategies particularly on African countries. Currently, he remains actively engaged in teaching and research in Sustainable Energy and Climate Change. Upon the request by some African governments, Dr. Ackom has provided direct analytical contribution to the development of national policy documents.

For the past 11 years, he was a Senior Scientist at the UNEP DTU Partnership (UDP), Denmark where among his accomplishments; he led the Global Network on Energy for Sustainable Development (GNESD) for 5 years and implemented its Policy Dialogue Panel which in part has led to a number of policy reforms on energy for sustainable development in participating GNESD nations including African countries.

Dr. Ackom is a regular reviewer of the IEA World Energy Outlook publications including their special edition on Africa in 2014. He provided regular analytical support to the REN21 Global Status Report on Renewables. He is an active expert group member of the United Nations Economic Commission on Africa (UNECA) on energy and climate change tasks.

Dr. Ackom is invited to speak at key high level meetings on energy for development including the International Energy Agency (IEA) plenary during COP21 in Paris and the 6th Assembly of the International Renewable Energy Agency (IRENA) in Abu Dhabi.

Working with colleagues and other partners, Dr. Ackom is very passionate about helping to improve the energy access situation in sub Saharan Africa (SSA) where two-thirds of its populace are without access to modern energy services, however 66% of investments in energy supply are targeted for export rather than being utilized in the region for needed livelihood improvements and sustainable development. His penultimate goal is working towards attainment of universal energy access in SSA over time, in concert with colleagues and other key players.

52. « Sustainable Strategy for Transportation Fuels in West-Africa: A 2050 Prospective Assessment », Edgard Gnansounou

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Abstract :

West African countries depend on fossil fuels for the transportation of goods and passengers. While in the short to medium term, this situation cannot significantly change, it is worthwhile to develop a long term vision on wide scale introduction of renewables into the energy matrix of this subsector. Transportation sector is one of the biggest energy consumer worldwide and it is fueled almost exclusively by petroleum products. According to the World Energy Balances 2020, the share of the transportation sector in the total final oil consumption in 2018 was about 65% including 49% for road transportation.

Depending on the scenarios, the share of the transportation subsector in the world final energy consumption in 2040 would be in the range of 27.5 – 28.5%. Because of its energy profile, transportation subsector is one of the main CO_2 emitters in the energy sector and finding strategies aiming at improving its environmental performance is challenging. Due to lack of statistics, it is not easy to undertake a precise diagnostic in the case of West African countries. However, the weak development of electrified railways and modern renewable energy would suggest that dependency on oil is higher compared to the world case. Factors such as high demographic growth, potential of economic growth and free movement of goods and people within the Economic Community of the West Africa States (ECOWAS) can enhance the growth of Transportation subsector w in the next decades in West Africa. Hence, the concern regarding the non-diversity of energy in this subsector and its dependence on fossil fuels in West Africa is of utmost importance.

This prospective study focuses on the use of biomass to produce transportation fuels such as synthetic natural gas, second generation bioethanol and electricity under a sustainable scenario in West Africa in 2050. The aim of this work was to evaluate the feasibility of producing such biofuels using agricultural residues as feedstock in the studied area. The potential of biomass from ten agricultural residues was estimated in R environment using FAO data. Options were analyzed in order to generate portfolios of transportation fuels based on energy indicators, biomass availability taking into account the requirements to leave part of the residues for the regeneration of the soils. Scenarios of technological progress are considered as well. The optimal allocation among the technology options was found out for each country and the sub-region as a whole, based on a multi-objective objective optimization.

Short biographical notes

Dr. Gnansounou is Professor of modelling and planning of Energy Systems at the Ecole Polytechnique Fédérale de Lausanne EPFL (Switzerland) where he is Director of the Bioenergy and Energy Planning Research Group. His current research works comprise techno-economic and environmental assessment of bio-refinery schemes based on conversion of agricultural residues. He has led research projects in that field in several countries including China, Brazil, and South Africa.

Edgard Gnansounou is member of the editorial board of Bioresource Technology and Associate Editor of the Energy Strategy Reviews; both journals are published by Elsevier. Edgard is also fellow of International Society for Energy, Environment, and Sustainability (ISEES).

He graduated with a M.S. in Civil Engineering and Ph.D. in Energy Systems at the Ecole Polytrechnique Federale de Lausanne (EPFL). He was a visiting researcher at the U.S. Thayer College, Dartmouth School of Engineering, at Polytech of Clermont-Ferrand, University Blaise Pascal (France) and at the Center of Biofuels, the National Institute for Interdisciplinary Science and Technology (India). He was also a visiting Professor of the African University of Science of Technology (Abuja, Nigeria).

One of the methodological research of Professor Gnansounou is on allocation in Lifecycle assessment of biorefineries. He proposed two methods: the valued based method and the claiming based method.

In 2020, Edgard Gnansounou was also nominated as affiliated Professor of the University Mohammed VI Polytechnic in Morocco where he is developing inter alia a new vision of Global and Regional Energy Geopolitics and Governance and is also working on Regional Competitive Electrical Power Markets in Africa.

In 2020, Edgard Gnansounou was listed on the top 2% world scientists in the Ranking of the US Stanford University.

53. « How sustainable energy in intermediary cities will strengthen Africa's food value chain», Dr. Arthur J. Minsat

Senior Economist and Head of Unit – Africa, Europe & Middle-East, OECD development center

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Biography :

PhD, London School of Economics. Arthur heads the OECD Development Centre's Unit for Africa, Europe and Middle East, which produces Africa's Development Dynamics, Revenue Statistics in Africa, and Quality Infrastructure in 21st Century Africa. As lead economist, Arthur led the themes of the African Economic Outlooks (AEO). At UNDP, Arthur researched for the flagship Human Development Reports. In Abidjan, he volunteered for the United Nations Operations in Côte d'Ivoire (ONUCI). He taught at the LSE and Sciences-Po, after gaining private sector experience.

54. “Extracting Maximum Value from trees”, Bruce Sithole,

Prof. Chief Scientist and Director, Biorefinery Industry Development Facility,
Council for Scientific & Industrial Research, Durban, South Africa.

Abstract

Depletion of fossil fuels and the environmental concerns related to their use, together with increased energy demands and the need for cleaner production technologies across all industries is providing strong impetus in the search for alternative and renewable raw material resources. Our fossil driven economy has resulted in many challenges for the earth including increased greenhouse gas emissions, climate change and global warming. To promote sustainable growth with minimal environmental impact, alternate and renewable resources need to become an important part of the feedstock raw material for many of our industries. Currently the Forestry, Timber, Pulp and Paper (FTPP) sector is wasteful and has limited products. For example, the sector extracts only about 47% value from trees with the majority of trees being lost as waste. At the same time, there is ever-increasing pressure on the industry to make changes, improvements and/or adaptations to their processes in order to achieve cleaner production technologies that are more environmentally friendly. The disposal of their waste by-products in an economically and environmentally acceptable manner is another critical issue facing the industry. This is mainly due to challenges in locating disposal works and complying with environmental requirements imposed by waste management and disposal regulations. For example, sawmills produce large volumes of sawdust and other tree trimmings such as bark, leaves and branches. Pulp and paper mills, in addition to the aforementioned waste streams, also generate large quantities of process waste by-products in the form of sludge, dregs and fly ash. These by-products are traditionally stock-piled on site, landfilled, or burned. However, according to environmental regulations, these practices are being curtailed as they are environmental hazards that generate greenhouse gases and can lead to possible leaching of toxic chemicals into surrounding ground and water sources. In the case of landfilling as a means of waste disposal, significant costs are incurred by industry for transporting waste to landfill sites, maintaining landfill sites, and establishing new landfill sites once the previous ones are full. The problem is further compounded by the fact that suitable land for landfilling in relatively close proximity to where the waste is generated is limited. Opportunely, the waste streams generated by the forestry industry sectors are composed of potentially high value products and finding alternative and innovative uses for these industry waste streams and diverting them from landfill will transform the face of the industries, both economically and environmentally. This can be achieved via biorefinery technologies. The overall objective of biorefinery research and development is therefore to contribute to the evolution of FTPP mills into forest biorefineries through innovative biorefinery technologies, and in so doing, revitalise industrial development opportunities within this renewable biomass processing sector, whilst at the same time mitigating some of its environmental impacts. This will ensure that the industry stays abreast of new environmental and technological developments in order to remain internationally competitive and economically sustainable. Increased revenue streams from the production of new bio-materials and chemicals would ensure preservation of infrastructure, jobs, supply chains and permits, whilst at the same time helping countries minimise their energy problems and environmental impacts. The R&D on biorefinery technologies directly addresses some of the challenges associated with transitioning to a green economy and proper implementation of the technologies can result well over 90% tree utilisation.

Short bio

Prof. Bruce Sithole is a Chief Scientist and Director, Biorefinery Industry Development Facility, Council for Scientific & Industrial Research, in Durban, South Africa. He came to South Africa in 2010 after a 20-year stint as a Principal Scientist and Group Leader at the Pulp and Paper Research Institute of Canada, Montreal, Canada. His educational credentials include: BSc (hons), Chemistry, University of Sierra Leone; MSc, Analytical Chemistry, University of Aberdeen, Scotland; and PhD, Industrial Chemistry, Dalhousie University, Halifax, Canada. He is also a Professor in Chemical Engineering at the University of KwaZulu-Natal, Durban, where he supervises MSc and PhD students working on biorefinery technologies. His main research focus is on development and implementation of biorefinery technologies, specifically those aimed at beneficiation of forestry wastes and waste chicken feathers. The purpose of the research is to contribute to the revitalization and resilience of the forestry industry by diversifying into biorefinery activities that will add more value to the bottom lines of the mills and avoid unsustainable disposal of their wastes.
He has published over 130 papers in peer-reviewed journals and 5 book chapters.

B. Bruce Sithole, PhD
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11:00 – 12:45 ***SESSION 10***

Chair: Marcellin Amoussou-Guénou (Benin)/Bernard Mairy(Belgium)

THEME 7 - Materials and sustainable development

Keynote speakers: Kenneth Ozoemena (South Africa), Hervé Jeanmart (Belgium), Thierry d'Almeida (Benin).

11:00 – 11:15	Kenneth Ozoemena (South Africa) **–** *Energy storage landscape in South Africa and the rest of Africa*
11:15 – 11:30	Hervé Jeanmart (Belgium) **–** *The Energy Return on Investment (EROI) and the accessibility of renewable energy*
11:30 – 11:45	Thierry d'Almeida (Benin) – *The X-TechLab initiative in Benin: a regional platform dedicated to capacity building in science education*
11:45 – 12:00	Fouzia Cherkaoui El Moursli (Morocco) - *Polyanions phosphate and phosphite materials for Li-Ion Batteries: Moroccan resources valorization*
12:00 – 12:15	Alina Iatan (Romania) - *EU CBRN Centres of Excellence- Strengthening preparedness on CBRN incidents in Africa.*
12:15 – 12:30	Thierry Duvaut (France) - *Quels peuvent être les impacts d'une recherche et d'un enseignement scientifiques pluridisciplinaires sur la problématique générale liée à un système urbain durable (cas d'un campus universitaire par exemple), et sur le quotidien des citoyens ?*

55. “Energy storage landscape in South Africa and the rest of Africa”, Kenneth I. Ozoemena,

Professor , School of Chemistry, University of the Witwatersrand, Johannesburg, South Africa

Abstract

As the 4th Industrial Revolution falls upon us, the main challenge to the widespread deployment of the ever-increasing technological advances (consumer electronics, autonomous vehicles, electric vehicles, etc) will be energy storage and conversion systems that will power them. Also, electrochemical energy technologies (EETs) such as advanced batteries, supercapacitors and fuel cells, are critical to unlocking the potential of green transport such as electric vehicles, and the utilization of renewable energy sources (solar and wind) as well as the realization of energy efficiency technologies.

Africa is richly endowed with all the energy resources to harness and store its abundant renewables (solar and wind) yet suffers from energy poverty. Off-grid storage is most critical (e.g., solar-plus-battery systems in rural Sub-Saharan Africa) if one considers that more than 70% of the 1.2 billion of Africans (> 840 million people) do not have access to electricity.

There are different energy storage opportunities available to Africa: 1) Electrochemical (e.g., secondary batteries, flow batteries); (2) Chemical (e.g., hydrogen); (3) Electrical (e.g., supercapacitors); (4) Thermal (e.g., heat storage); (5) Thermochemical (e.g., solar hydrogen); and (6) Mechanical (e.g., pumped hydro storage). African is described as the “sun continent” due to its huge available solar energy (~ 60,000,000 TWh/year) which is about 40% of the global total. Africa’s huge wealth in solar energy and the global quest to curb the disastrous climate change makes it necessary for the continent to lead in sustainable energy technologies.

This presentation will discuss some of the research activities in Africa that explore some African’s abundant solar energy and solid minerals for the development of affordable and safe-to-use EETs such as lithium-ion batteries (LiBs), sodium-ion batteries (SIBs), supercapacitors and fuel cells for the realization of SPB technologies.

Short biography

Kenneth Ikechukwu Ozoemena is Research Professor and South African Research Chair Initiative (SARChI) Chair (Tier 1) in Materials Electrochemistry and Energy Technologies (MEET) at the University of the Witwatersrand, South Africa. Prior to joining Wits University in 2017, he had worked at the Council for Scientific and Industrial Research (CSIR) as Chief Research Scientist and Research Group Leader of the CSIR Electrochemical Energy Technologies (2009 - 2017). His current research interests are focussed on energy storage and conversion systems (such as lithium-ion batteries, electrochemical capacitors, and fuel cells). He holds a PhD degree (Rhodes University, 2003) in Chemistry. He is a Certified Renewable Energy Professional (CREP, Association of Energy Engineers, USA), member of the Academy of Science of South Africa (MASSAf), Fellow of the African Academy of Science (FAAS), and Fellow of the Royal Society of Chemistry (FRSC). He serves on the editorial Boards of some science journals, including Electrochemistry Communications (Elsevier), Current Opinion in Electrochemistry (Elsevier), and Scientific Reports (Nature Publishing), Catalysis (MPDI Publishing) and Chief Editor, International Journal of Electrochemistry (Hindawi / Wiley Publishing).

56. “The Energy Return on Investment (EROI) and the accessibility of renewable energy”, Hervé Jeanmart & Elise Dupont,

Université catholique de Louvain, Institute of Mechanics, Materials, and Civil engineering, Louvain-la-Neuve, Belgium

Energy is a main driver of all human activities. Its use is well correlated with the economic activity measured by the world gross domestic product. Energy consumption is ever growing due to population and economic affluence increases. This energy being mainly fossil, it induces climate change. To reduce its impact, the world must switch from a fossil fuel-based to a low-carbon economy. The transition is complex and involves many dimensions and challenges, including energy efficiency, electrification and storage, green growth vs degrowth, etc. One important dimension is the availability of renewable energy, i.e. the amount of renewable energy that can be harvested worldwide. Studies show that solar and wind energy have the highest potentials, followed by biomass [1,2]. Moreover, these potentials are much higher than the actual needs. However, to be useful for the human beings, renewable energy must be effectively harvested and delivered in consumption centres. Taking physical limits into account largely reduces these potentials and leads to the definition of the accessibility of the energy, i.e. the amount of energy that can be effectively, in other words economically, harvested by our societies.

To assess the accessibility, a metric, measuring the cost, must be used. Usually, the economic cost is considered, but it might be biased and distorted. In this paper, the Energy Return on Investment (EROI) is preferred to study the accessibility of both wind and solar energy [3,4]. The EROI is defined as the ratio between the energy produced during the lifetime of a facility and all the energy required to build, operate, maintain and decommission it. It has been shown that the EROI is a decreasing function of the installed capacity. It is also shown that while solar energy has a lower EROI, it has a much larger potential than wind energy. Linking renewable energy and the EROI is critical for affluent societies that are used to consume fossil energy with a high EROI. Indeed, renewable energies have lower EROIs that fossil fuels due to their higher capital intensity. On the contrary, it is an opportunity for less affluent societies that could benefit greatly from an energy system based on modern renewables. This is addressed by linking the EROI of the energy system and the growth in the economy.

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BIO

Hervé Jeanmart is professor at the Université catholique de Louvain in Belgium. He is member of the Ecole Polytechnique de Louvain (EPL) where he teaches to the engineering students basic and applied thermodynamics, IC engines, renewable energy, and biomass conversion. He is also a member of the Institute of Mechanics, Materials, and Civil engineering. His main research topics are biomass conversion, internal combustion engines, and combustion kinetics.

His research combines experimental and numerical approaches. In biomass conversion, his research activities are focused on thermochemical conversion of biomass through gasification, more particularly, the small-scale, fixed bed technologies for electricity and heat production. This includes the two-stage, low tar, technology and more specifically the study of the pyrolysis step. His second topic is the combustion of gases, including syngas, in internal combustion engines for stationary applications. The Homogeneous Charge Compression Ignition (HCCI) and its derivatives are at the centre of the development. Combustion kinetics of alternative oxygenated fuels produced from biomass, like ethyl pentanoate, is studied experimentally via measurements on low pressure flat flames.

More recently, he has developed a growing interest for the link between energy and economy. He is studying the availability and accessibility of renewable energy in order to predict an upper bound for the economy.

57. “The X-techLab initiative in Benin: a regional platform dedicated to capacity building in science education” Thierry d’almeida

Abstract

bio thierry d'almeida

58. ”Polyanions phosphate and phosphite materials for Li-Ion Batteries: Moroccan resources valorization”, Fouzia Cherkaoui El Moursli

Abstract

Batteries with higher energy density, longer life and higher safety have led to identify and develop alternative materials and technologies that can meet increasingly stringent requirements. Among interesting materials, polyanion compounds such as silicates (SiO_4^{4-}), borates (BO_3^{3-}), phosphates (PO_4^{3-}) and pyrophosphates ($P_2O_7^{4-}$) are being actively investigated. They have the advantage of being very stable thanks to their open frameworks that provide long-term structural stability and higher safety when used as cathodes, compared to layered oxide compounds known to dissolve easily in organic electrolytes. Polyanion compounds of metals also allow, obtaining higher voltages vs. Li^+/Li resulting in high energy densities. Finally, due to their chemical nature various structures and compositions can be built offering a large spectrum of applications within the battery. Indeed, polyanion compounds cannot only be used as cathodes but also as anodes or solid electrolytes. Phosphates and their derivatives attract particularly our attention because they present the most important natural resource of Morocco to be valorized. As example phosphite $(HP^{III}O_3)^{2-}$ based compounds received little or no attention. Replacing metal phosphates $M_x[PO_4]_y$ by metal phosphites $M_x[HPO_3]_z$ can be of big interest, thanks to the various new structures that can be obtained. In metal phosphate structures, phosphate tetrahedral $[PO_4]^{3-}$ have four connections with the metal where, phosphite pseudo pyramids $[HPO_3]^{2-}$ have only three connections making a greater open framework and large tunnel structures allowing a better cation conduction. Finally, phosphites polyanions have also shown their ability to electrochemically stabilize electrolytes. In this presentation, our last findings (phosphites synthesized for the first time) at MANAPSE laboratory (MAtériaux et Nanomatériaux pour le Photovoltaïque et le Stockage de l’Énergie) and applications of phosphites (anodes, interface layers…) will be presented.

Short biography

Professor Fouzia Cherkaoui EL Moursli
MANAPSE, Mohammed Vth University in Rabat
Morocco
E-mail: f.elmoursli@um5r.ac.ma

After a master's degree in Chemistry at the Joseph Fourier University of Grenoble-France, Fouzia Cherkaoui El Moursli obtained two doctorates: a postgraduate doctorate on conductive polymers for lithium generators at the National Polytechnic Institute of Grenoble-France (1982) and a Doctorate on fuel cells issued by the Mohammed Vth University of Rabat-Morocco (1990). From 1986 to 1988 she worked as associate lecturer at the Joseph Fourier University of Grenoble-France. Since 1988, she has been a professor at the Faculty of Sciences-Mohammed Vth University of Rabat and works in the LMNE laboratory in the chemistry department. Today Fouzia has joined MANAPSE laboratory.
The main research interests are in nanomaterials as electrodes for lithium-ion batteries and in thin films for solar cells. She has several patents and several publications in international peer-reviewed journals. The first patents (ANVAR patents) were obtained in 1985 on lithium-ion batteries. Currently, her research work concerns phosphate and phosphite materials for Li-ion batteries. She is a member in several national and international research projects. Currently she is coordinator of the APHOS and PPR projects. Ms. Cherkaoui published 2 educational university books in General Chemistry published by ISESCO in 2009.

59. “EU CBRN Centres of Excellence- Strengthening preparedness on CBRN incidents in Africa” Alina Iatan

Abstract
The European Union Chemical Biological Radiological and Nuclear Risk Mitigation Centres of Excellence Initiative (or EU CBRN CoE) was launched in 2010 in response to the need to strengthen the institutional capacity of countries outside the European Union to mitigate CBRN risks (intentionally, accidentally or naturally created). Through the EU Neighbourhood, Development and International Cooperation Instrument (NDICI), the initiative funds regional projects in the area of CBRN risk prevention, preparedness and response. The European Commission works directly with 62 Partner countries that voluntarily joined the initiative to develop a deeper understanding of individual country needs and conduct a regional analysis in the field of CBRN.
The Joint Research Centre (JRC) contributes to the implementation of the CoE Initiative by providing scientific and technical assistance for the assessment of the needs of partner countries in terms of capabilities in CBRN emergency preparedness and response through the evaluation of projects' implementation and outcome.
The COE initiative encompasses on a worldwide network of local experts and collaborating regional and international partners such as UN Agencies (UNICRI, WHO). The activities are developed in partnership with partner countries in view of encouraging local ownership of CBRN action plans and strengthening national legal frameworks on CBRN risk mitigation. The analysis of the capacities and gaps identified helps defining the CoE projects that bring an added value to the individual countries or the eight regions. Proof to it, 27 Partner countries have prepared a National Action Plan on CBRN risk mitigation which is subsequently endorsed by national authorities as part of their national law.
Through this programme, the EU has been supporting the countries to enhance their CBRN capabilities though the provision of CBRN equipment and transfer of CBRN knowledge and skills. This is done through the implementation of EU funded projects that include training of first responders, addressing gaps in national legislative frameworks on CBRN, tackling the illicit trafficking of CBRN materials and the planning of post incident recovery measures, among many other topics. Some of the reference projects in Africa:
P60 – Support to the Eastern and Central Africa in Nuclear Security focuses on nuclear security. The overall long-term objective of this project is to strengthen and harmonize the nuclear regulatory frameworks in the participating countries, to enhance their national nuclear safety and nuclear security regimes in support of the fulfilment of national obligations under international instruments (IAEA NSSC, in particular).
P69- High risk chemical facilities and risk mitigation in the African Atlantic Façade Region (INSTASUR) which aims at developing capacities for the efficient management of chemical risks in the AAF region to ensure the prevention of major risks (accidents and/or pollution) in and outside plants containing chemicals and to respond quickly and adequately in the event of incidents.
P71-Safer and more secure transportation of dangerous goods by road and rail (SECTRANS AAF). Transportation of dangerous goods (TDG) covers three product families: liquid petroleum products (75%), miscellaneous chemicals (20%) and gases (5%). While this type of transportation is essential, it is critical to manage associated risks. Project

71, implemented by EU and international experts with sound knowledge in dangerous goods and the implementation of relevant SoPs, addresses the entire chain of safety, from regulation to intervention, and covers in particular driving and other safety issues during transportation, loading/unloading operations, as well as operational procedures in case of accident.

Short Bio

ALINA IATAN- Scientific and Technical Project Manager at the European Commission (Joint Research Centre, EURATOM)

Alina Iatan is Scientific and Technical Project Manager at the EU Joint Research Centre Unit A7 which is in charge of the coordination of the implementation of the Euratom Treaty. Alina joined the unit in February 2020 and she is in charge of the coordination of the JRC's activities under the CBRN Centres of excellence initiative which entails the roll out of CBRN exercises with local experts and collaborating with international partners to enhance capabilities in CBRN emergency preparedness and response. Prior to that, Alina acquired over 10 years of experience in standardisation and implementation of EU-funded projects. In particular, she held various positions at the European Committee for Standardisation (CEN) where she coordinated the implementation of standardisation work programmes on security, cybersecurity, energy and consumer goods.

As educational background, Alina studied international relations and EU law in Romania and Italy; she concluded her studies by a master in Risk Management and Civil Protection from Ecole Nationale d'Administration (Paris, France).

60. « Quels peuvent être les impacts d'une recherche et d'un enseignement scientifiques pluridisciplinaires sur la problématique générale liée à un système urbain durable (cas d'un campus universitaire par exemple), et sur le quotidien des citoyens ? », Duvaut Thierry,

ItheMM Université de Reims Champagne Ardenne

Abstract

L'objectif de cette conférence est de montrer comment une recherche et un enseignement pluridisciplinaire (dans les domaines de l'énergétique, des sciences de l'ingénieur, de l'environnemental, des sciences de l'homme, et de la socio-économie) et multiéchelles (du bâtiment, de l'ilot, pour aller vers le quartier, la ville et l'agglomération) peuvent apporter des réponses sur la capacité d'un système urbain, par exemple un campus universitaire, à s'engager dans la voie du développement durable, et quels sont les impacts urbanistiques notamment en matière de constructions et d'usages ?

Il s'agit donc d'analyser nos connaissances sur l'efficacité énergétique, les impacts environnementaux, la qualité de vie professionnelle (ici des étudiants et des personnels), et l'interaction avec le monde environnant. Ces enjeux d'habitat, de mobilité, du bien vivre ensemble, et des interactions entre les différents acteurs du campus et du quartier viennent aussi interpeller des problématiques relevant de la performance des bâtiments, des modes et des plans de circulation, de l'organisation intrinsèque du quartier et de la ville, de l'accès fluide et efficace aux ressources et aux services (économie circulaire), et de l'adaptation des réseaux et des infrastructures (notamment électrique) à de nouveaux besoins émergents (gestion urbaine plus intelligente et numérique). Nous tenterons d'effectuer une analyse africaine de ces questions en prenant principalement l'exemple du Bénin.

Short biographical notes :

Thierry Duvaut est professeur des universités en 62ème section (Energétique et Génie des Procédés) à l'Université de Reims Champagne Ardenne. Il est actuellement directeur l'Institut de Thermique, Mécanique, Matériaux spécialisé dans les domaines de l'énergétique, de la mécanique appliquée, du génie civil, de la caractérisation thermique et mécanique des matériaux, et des nouveaux procédés (fabrication additive). Il a été Vice-Président de l'Université de Reims Champagne Ardenne en charge du patrimoine et plus particulièrement de l'élaboration d'un éco-campus durable. Membre de l'X-TechLab International Scientific and Advisory Board (Bénin), il participe depuis maintenant 2 ans à un programme de formation en ingénierie thermique et développement durable pour des étudiants de master 2, de doctorants, et de chercheurs principalement issus du Bénin et des pays limitrophes.

1* ITheMM Université de Reims Champagne Ardenne, UFR Sciences Exactes et Naturelles, Moulin de la Housse BP1039 51687 Reims Cedex 2 ; thierry.duvaut@univ-reims.fr

13:30-15:00 ***SESSION 11***

Chair: Rajaâ Cherkaoui El Moursli (Morocco)/ Antoine Vianou (Benin)

THEME 8 - Reinforcement of education and research capacities and valuation of scientific expertise in Africa

Keynote speakers: Léonard Lévêque (France), Hamid Aït Abderrahim (Algeria).

13:30-13:45	Léonard Lévêque (France) - *Long-Term Joint European Union - African Union Research and Innovation Partnership on Renewable Energy*
13:45-14:00	Hamid Aït Abderrahim (Algeria/Belgium) - *Energie nucléaire pour l'Afrique et par l'Afrique : rêve ou réalité - The development of Small Modular Reactor (SMRs) for emerging nuclear countries in Africa*
14:00-14:15	Glory Oguegbu (Nigeria) - *How Innovation and Capacity Building will Disrupt the Sustainable Energy Space and Aid Climate Action*
14:15-14:30	Sandra Soares-Frazao (Belgium) - *Distance learning in hydraulics*
14:30-14:45	Tsopgni Vadel Eneckdem (Cameroon) - *Contribution of mapping to wind power, solar photovoltaic and hydroelectric energies potential assessment from the highlands of Bitchoua (West Cameroon)*

61. “Long-Term Joint European Union - African Union Research and Inovation Partership on Renewable Energy” BUKASA KAMPATA Niclette & LEVEQUE Léonard[2], NTSHONGWANA Tinyiko[3], PLATH Melissa[4], COLOMBO Emanuela[5], WAMBUGU Anne[6]

KEYWORDS: — Renewable Energy ; Smart stand-alone systems ; Smart grids; “Produse” ; Clean cooking ; Long-term perspective.

ABSTRACT:

The ambition of LEAP-RE is to establish a long-lasting EU-AU research and innovation partnership on renewable energy. One of the most effective ways to support the transformative path toward sustainable, affordable and accessible energy is the promotion of joint research and innovation efforts. Impact will be sought by creating a framework, methodology, and cooperation model. The aim is to reduce fragmentation by aligning existing bilateral and multilateral frameworks. LEAP-RE establishes and jointly implements research, innovation, and capacity-building activities that respond to Multi-Annual Roadmaps (MARs), representing the main topics related to renewable energies development and described in terms of social challenges, research scope, and expected output, outcome, and impact. These six MARs serve as the basis for the LEAP-RE Joint Call 2021 and for the 8 projects undertaken in Pillar 2:

- Mapping joint research and innovation actions for future RES development
- End-of-life and second-life management and environmental impact of RE components
- Smart stand-alone systems (SAS)
- Smart grid (different scale) for off grid application
- Processes and appliances for productive uses (PRODUSE)
- Innovative solutions for priority domestic uses (clean cooking and cold chain)

To match its ambitious objectives defined above, LEAP-RE is conceived as a programme, rather than an individual project. This programme is built on three pillars with their own conceptual approach:

Pillar 1: Organise and demonstrate joint programming and joint funding, by pooling national and regional agencies along with top-up EC funding from this grant. This first pillar relies on the implementation of open calls for R&I and capacity-building proposals, funded by national / regional agencies, and monitoring of execution and impact ;

Pillar 2: Coordinate, cluster and monitor impact of individual projects chosen to address MAR objectives and capacity-building projects with substantial co-funding from the research institutions, implemented by consortium members ;

Pillar 3: Build a community, strategy, organisation, methodological assets and tools to set the foundations of a long-lasting AU-EU partnership to address the post-2025 challenges and policy priorities. It mainly consists in programme management and all strategic activities to strengthen the community, maximise impact and build the future long-term AU-EU partnership.

LEAP-RE opted for a large-scale, inclusive consortium of 83 partners from 33 countries to ensure a broad thematic, geographical and stakeholder coverage, and to demonstrate the feasibility of the collaboration and build trust in view of a long-term partnership addressing the post-2025 period.

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[3]Finnish University Partnership for International Development (UniPID), Helsinki, Finland
[4] Politecnico di Milano, Department of Energy, Via Lambruschini 4, 20156 Milano, Italy
[5] Strathmore University, Strathmore Energy Research Centre, Kenya

Léonard LEVEQUE

Léonard is in charge of coordinating the Long-Term Joint European Union – African Union Research and Innovation Partnership on Renewable Energy (LEAP-RE) and developing sustainable innovation projects. Before joining LGI, Léonard worked for the French Agency for sustainable Mediterranean cities and territories (AVITEM) on projects related to energy efficiency and air quality management, and for an international network (ANIMA Investment Network) which aimed at fostering investment and business ecosystems in Northern Africa and Middle East. He holds a Master's degree in Public Policies from Sciences-Po Grenoble and is a university lecturer at Sciences-Po Aix. Léonard is based in Marseille.

62. « Energie nucléaire pour l'Afrique et par l'Afrique : rêve ou réalité - The development of Small Modular Reactor (SMRs) for emerging nuclear countries in Africa", Prof. Hamid Aït Abderrahim,

Deputy Director-General International Affairs SCK•CEN & UCL
and Prof. Peter Baeten, SCK•CEN & VUB Kernenergie

ABSTRACT

The renewed interest in nuclear power in Africa driven by a rapidly growing energy demand, persistent concerns over climate change and dependence on overseas supplies of fossil fuels has increased the prospects of considering this option in national energy strategies to ensure access to affordable energy for sustainable development. Many African countries have begun revisiting the nuclear option over recent years with a view to establishing long-term sustainable energy supplies.
A first prerequisite is the development of national and regional planning for nuclear power development. Secondly, adequate legal and nuclear safety and security measures and infrastructures need to be installed. Thirdly, government leadership is necessary for the initial programme development, while continued government support is required throughout the life of the programme. In addition, funding and financing during the initial programme development are necessary and critical. Moreover, in Africa the compatibility and integration in the electrical grid should also be considered as an important infrastructure consideration. Last, but not least, one needs to address the human resource requirements of a nuclear power program.
Based on the previous considerations it is clear that large NPP's of 1000 MWe and beyond are not that well suited to respond to the demand. Small Modular Reactors with a typical power of maximum 300 MWe show the following benefits. First of all, from the point of view of grid considerations, SMR's are better suited to respond to: (1) electrical grids with limited capacity; (2) remote areas requiring smaller localized power plants to avoid long and expensive transmission lines; (3) geographically dispersed small- and mid- size urban plants; (4) incremental production capacity.
Secondly, SMR's require a smaller capital investment cost and have the potential to reduce the cost uncertainties and construction timeframes associated with conventional NPPs. Because of the smaller size, they could even be used in remote African locations.
Large NPP's as well as SMR's require decay heat removal after shutdown. This represents 6% of the nominal power; SMR's with lower power can be designed more easily for passive decay heat removal.
Besides electricity production, SMR's could also address the need for water desalinisation and industrial heat cogeneration.
Today, several concepts based on the current Light Water Reactor technology are becoming ready for industrial deployment. However, these concepts based on water as a coolant will generate the same type of long-lived spent fuel as we encounter today in the Western world. To go also for a more sustainable solution of nuclear energy production with SMR's in Africa, a shift towards so-called fast neutron SMR's, not based on water as a coolant, is recommended. This offer to have very long refuelling times up to 10 to 15 years, resulting in only 2 or 3 reloads over its lifetime. All these aspects and corresponding technologies will be covered.

BIO

Prof. Dr. Hamid Aït Abderrahim is the Deputy Director General of SCK•CEN, the Belgian nuclear research centre. He is also professor of reactor physics and nuclear engineering at the "Université Catholique de Louvain" (UCL) at the mechanical engineering department of the "Ecole Polytechnique de Louvain (EPL)".

His fields of specialisation are Reactor Physics, Reactor Dosimetry, Nuclear Fuel Cycle, Partitioning and transmutation of high level nuclear waste and Nuclear Reactor Technology.
Since 1998 he is the director of the MYRRHA project: an accelerator driven system coupling a sub-critical Pb-Bi cooled reactor and a high power proton accelerator through a spallation target.

He is partner and/or coordinator of various projects of the European Commission framework programme related to advanced nuclear systems or to partitioning and transmutation of high level nuclear waste management. He chaired the Strategic Research Agenda (SRA) working group of the European Sustainable Nuclear Energy Technology Platform (SNETP) from September 2007 to December 2011. Since 2015 he is the chairman of the Governing Board of SNETP.

He is the representative of Belgium in the Governing Board of the project JHR (Jules Horowitz Reactor, a MTR under construction in Cadarache, France).

He is author of more than 100 scientific publications in publications in peer review journals and international conferences.

He directed many PhD and masters theses in the various fields of nuclear technology.

Last but not least in April 2014, he has been honoured by the King of Belgium by nominating him as “Grand Officer in the Crown Order” for his contributions in progressing science and knowledge in the field of nuclear engineering of innovative systems for High Level Waste management.

On February 15, 2016 he received the title of Doctor Honoris Causa to the Kaunas University of Technology for his personal achievements and long term collaboration with Kaunas University, especially with the Baršauskas Ultrasound Research Institute.

63. “How Innovation and Capacity Building will Disrupt the Sustainable Energy Space and Aid Climate Action”, Glory Oguegbu

– (submitted 01/02/2021 and 26/05/2021)

Founder/Executive Director; Glow Initiative for Economic Empowerment (Pioneers of Climate Smart Nigeria), Founder/CEO - Renewable Energy Technology Training Institute (RETTI) - Website: www.glowinitiative.org and www.retti.com.ng

ABSTRACT

Lack of electricity and constant power outages in Africa has hindered economic growth and development especially through the death of small businesses. Climate change impacts on the other hand had affected crop yield, lead to diseases in northern Nigeria and flooding has swallowed arable lands in the south.

According to the international energy agency 93 million Nigerians lack access to electricity. But investments into the sector especially in Africa has seen positive light as global investment for the development of solar power increased significantly and hit a peak of 330 billion dollars in 2015 (IRENA). However, this investment have revealed a new problem - the lack of competent and skilled workforce or entrepreneurs to leverage the investment and promote clean electricity to communities that are off the grid and reduce carbon emission through the process.

Human capacity training, with content made possible through scientific resource, is therefore paramount if we must promote renewable electricity, conserve energy, build bridges that will lead to energy sustainability in transport, residential and businesses sectors, combat climate change, and create the policies that will enable this transition. Most importantly renewable energy for electricity is an area of knowledge that is somewhat new to people, therefore it must be taught across all spheres helping everyone understand how it works, its structure, the applications, opportunities and everyone's role.

This section will present the answer to the question - how do we support innovation for the clean and renewable energy sector to promote energy sustainability and combat climate change? In addition to that, the presentation will share an overview of the problem in the Nigerian context and show how human capital development can promote sustainable and clean energy, aid the development of energy systems, policies and ultimately contribute to economic growth and development.

The section will share the case study of how - The Renewable Energy Technology Training Institute (RETTI) has supported research, innovation and education for the renewable energy sector taking a closer look how training young people from the slum community of Makoko without access to electricity enabled up to 757 households access to renewable clean electricity.

Short bio

Glory's goal is to be a positive part of people's lives and make good impact. She's passionate about the economic development of Nigeria and work in the field of renewable energy and environmental sustainability to promote Nigeria's economic growth through job creation and education. She's the founder of Glow Initiative for Economic Empowerment under which their environmental arm – Climate Smart Nigeria - is promoting Climate Change Education in Nigerian institutions and provide capacity building on renewable energy technologies. Noticing an increase in investments into Africa's renewable energy sector, she established the Renewable Energy Technology Training Institute (RETTI) to train the next generation of efficient installers and entrepreneurs who will serve as a competent workforce pool for the renewable energy industry and provide solutions to Nigeria's prevalent energy problems as entrepreneurs. In eighteen months, RETTI has trained 154 individuals including women who then receive after training support to enable them set up own businesses. To ensure that trainees hone their acquired skill, RETTI launched the Growth Support Plan (GSP) - an after-support platform for the alumni at no extra cost. Fourty-five members of the alumni have started their own viable renewable energy businesses or have been recruited in solar jobsand have employed 70 new employees. They have collectively provided more than 90, 000 KVA of renewable electricity to over 1053 homes and businesses and offset 940,000 T of C02. Under her leadership, RETTI created a tech platform – REEN Connect (Renewable- energy Engineers and Entrepreneurs Connect) to provide mentorship, business advisory, webinars, hands-on installation engagement for budding renewable energy entrepreneurs. At this time, REEN Connect has membership strength of 450 solar engineers and entrepreneurs.

In April 2019, Glory was selected and sponsored by the US Mission to the African Union (USAU) as one of fifteen African female business leaders to speak during the United States Government's launch of the OPIC 2X Africa and meet with advisor to President of USA - Ms. Ivanka Trump and the Ethiopian President - Ms Sahle-Work Zewde. In June 2019, she received a sponsored invitation by the IEA and USAU to contribute during the IEA and African Union Ministerial on the future of Africa's Energy. In august 2019, she received a special invitation from the IEA to contribute to the World Energy Outlook Special Report – The Africa Energy Outlook. In December 2019, she received a sponsored invitation to Paris by the IEA to contribute during the roundtable ministerial on Energy for a Continent of 2 Billion. In November 2019, She was nominated as one of four high achieving youths by the Nigerian Government to participate as a delegate in the United Nations COP 25 in Spain . Glory recently received the Lights on Women Global award by the Florence School of Regulation as one of four women doing outstanding work in the energy sector. The award offered her a scholarship to study a Master Level Course – Electric Vehicles.

Glory has authored four books to promote climate change and renewable energy literacy for children in primary and secondary schools and tertiary institutions - (Bit.ly/rettiM) and sold 2000 copies. She is the recipient of the following awards; (a) Nigerian Star from the US Mission in Nigeria (2019), (b) The Nigerian Energy Champion Prize,(2015), (c) Mandela Washington Fellowship Award (2015), (d) The Young Energy Professional of the Year Award by Nigeria Energy Awards (2018), (e) A Foremost Woman in Renewable Energy award recipient (2017) Leader &Mentor Award by US Consular General (2017) Enel Foundation Recognition as outstanding Young African in Energy (2020). In the course of her work she has met with the following global leaders; President Barack Obama, US Senator Chris Coons, Ms Ivanka Trump, US Undersecretary for Energy - Mr Mark Menezes, Ethiopian President – Ms Sahle-Work Zewd

64. « Distance learning in hydraulics : MOOCs and beyond », Sandra Soares-Frazão[a], Yves Zech[a], Adermus Joseph[b], Stephen Louis[b], Nyankona Gonomy[b] (30/6/21)

[a] Institute of Mechanics, Materials and Civil Engineering, Université catholique de Louvain, Belgique

[b] Faculté d'Agronomie et de Médecine Vétérinaire, Université d'Etat d'Haïti, Haïti

Abstract

Within the framework of the RESCIF network (www.rescif.net), several MOOCs have emerged since the initial impulse given by EPFL in 2012 who was leading the network at that time. Among these, the "Hydraulique Fluviale" MOOC (course about fluvial hydraulics, in French) was developed on the EdX platform in a collaborative way by teachers from UCLouvain (Belgium), the State University of Haiti (UEH) and EPFL (Switzerland). This MOOC is divided into two parts lasting four weeks each. The first part "Hydraulique Fluviale 11" focuses on free surface flows in canals and natural rivers, including some elements of bathymetric measurements essential for the flow calculations, and gives an introduction to the use of numerical simulation software. The second part "Hydraulique Fluviale 22" concerns the transport of sediments in natural rivers and irrigation canals. These courses include many examples issued from the author's experience, including several Haitian sites.

During the first editions of these courses, the formula for learners consisted of a registration to follow the course at fixed dates, while teachers were available online to answer questions, lead debates, and remind the learners of the different deadlines. In addition to these entirely remote editions, a one-week face-to-face course experience based on the MOOC was conducted with the Haitian partners. The students had all followed the four-week MOOC course (part 1), and the one-week face-to-face course at UEH was organized just before taking the final MOOC exam. It was an opportunity for the students to go deeper into the course, to ask questions, and to review various aspects that were less understood. At the end of this week, the students took the final exam of the MOOC in class. One conclusion from this experience was that the students preparation by watching videos of the different lessons had been really effective and had significantly increased their motivation.

At present, after a few years of experience with the MOOCs, we are observing an evolution in the way in which learners consider the courses. This evolution has been further accelerated by the COVID crisis which has changed traditional education for many students, learners and teachers into distance education, using MOOCs or lesson podcasts. It appears that the initial MOOC formula open as a regular course over a fixed period of time no longer meets the expectations of learners who each have their own schedule. Significant video registrations and viewing rates were observed even outside of official opening times. Learners, from very diverse origins and backgrounds, seem more in search of tailor-made learning paths.
In this communication, we will briefly recall the evolution of the MOOCs that we have led in the field of hydraulics, and we will look at some perspectives that we believe are relevant for the future, to go beyond classical MOOCs and propose the best possible distance learning experience.

Short bio of Sandra Soares-Frazão

Sandra Soares-Frazão obtained her PhD in Hydraulics in 2002 from the Université catholique de Louvain (UCLouvain) in Belgium. After a post-doc period during which she visited the University of Montpellier (France) and the University of Illinois at Urbana-Champaign (USA), she was appointed as Research Associate from the FNRS (Belgian National Fund for Scientific Research) and then became Professor at UCLouvain where she is leading the Hydraulics research group since 2011.

She is teaching several courses both at Bachelor and Master level, such as basic hydraulics for Bachelor students in civil engineering, then open-channel flows, fluvial hydraulics, numerical simulations of transient flows, and hydropower plants at Master level. The Covid pandemic was the opportunity to develop online courses (hydraulics, in French, and open-channel flows, in English) for UCLouvain students, that are also publicly available on YouTube (https://www.youtube.com/c/SandraSoaresFrazao_Teaching).

Her research activities focus on fluvial hydraulics and transient flows, considering both numerical simulations and laboratory experiments. She has conducted several experimental campaigns focusing on idealised problems with the aim of providing the scientific community with reliable data sets to validate numerical simulation tools for free-surface flows, in pure hydrodynamic conditions or with movable beds. Using these data, she has organized benchmarking events where different modellers could test their simulation tools in a blind way and then discuss the observed discrepancies with the aim of better understanding the physical processes and their modelling.

Besides this fundamental research, she has also developed strong collaborations with developing countries. She is currently leading a research project with the State University of Haiti to develop an adapted methodology to characterize floods and their consequences to allow for better prediction and design of protection measures. Within this project, she is also developing UAV-based photogrammetric measurements for the topography, water levels and flow discharge.

Sandra Soares-Frazão has authored numerous journal and conference papers, and has supervised or co-supervised 11 completed PhD theses until now. Besides her research and teaching activities, she is currently vice-dean of the Louvain School of Engineering (Ecole Polytechnique de Louvain), she is also serving as chair of the IAHR Fluvial Hydraulics committee and as UCLouvain delegate for the RESCIF (Réseau d'Excellence des Sciences de l'Ingénieur de la Francophonie), a North-South cooperation network.

65. ”Contribution of mapping to wind power, solar photovoltaic and hydroelectric energies potential assessment from the highlands of Bitchoua (West Cameroon)”, Eneckdem Tsopgni Vadel[1*], Tchindjang Mesmin[1], Étongué Mayer Raoul[2]

1-Department of Geography, University of Yaounde I, Yaounde, BP. 755, Cameroun

2-Geography Department, Laurentian University, Sudbury, L-330A, R.D. Parker Building, Canada

Keywords: Mapping, wind energy, photovoltaic solar energy, hydroelectric energy, Bitchoua..

Abstract

Valuing renewable energies requires the availability of data on the exploitable potential at the finest spatial scales (Denfe et al. 2011). Moreover, in underdeveloped countries like Cameroon, atlases and data on renewable energy potential are not always available (Ould Bilal et al. 2010). Thus, and wrongly, it envisages the promotion of these energies according to a postulate of spatial homogeneity, without however invoking the geographical determinants of their production (Pinker & Laszlo, 1992). It is with a view to providing support for optimal decision-making that this study aims to evaluate by showing the relevance of mapping in the analysis of renewable energy potential at the scale of the rural locality of Bitchoua. The work is based both on Geographic Information Systems (GIS), climate data from NASA Surface Meteorology and Solar Energy (SSE) from 1985 to 2018, hydrological data from the Invest-Elec project and data from field surveys in 2020. The spatial analysis, coupled with the quantitative and qualitative processing of these data, made it possible to obtain information on the direction of the winds, the distribution of wind speed frequencies (by the Weibull method), the modeling of the relief, of the slopes. , and the hydrographic network. From this arises the numerical simulation of the data in order to provide predictions of the electrical energy that may be generated. The study shows that with an average speed of 2.56m / s, the winds from Bitchoua would generate an electrical power of 974.17 W / s with a wind generator 50 m in diameter. Also, the North-North East of the locality appears to be the most suitable area for the installation of wind turbines. The analysis of the potential in photovoltaic solar energy shows that with a daily irradiation rate of approximately 5.81 kWh / m2, for an optimal daily average sunshine duration of 7 hours, it would be possible to theoretically produce over any the surface of the locality approximately 353 GWh per day. For the Small Hydroelectricity (PHE), although having only modest rivers (coveted for agro-pastoral and domestic activities), Bitchoua would have in its East-North-East part on the Mondoui river a rather significant potential. Also not far from Bitchoua, the Invest-Elect project revealed two sites on the Képéte river with hydroelectric potential. These two sites would have installed capacities of 0.22 and 5.29 MW, for approximately 0.50 and 12.76 GWh of guaranteed annual production. Thus, by mobilizing GIS in the assessment of renewable energy potential, the study proposes a decisional mapping allowing the planning and implementation of wind, solar photovoltaic and hydroelectric projects in the studied area.

Short Bio of Eneckdem Tsopgni Vadel

Eneckdem Tsopgni Vadel is an environmental geographer specializing in Climate Change, Renewable Energy, Environmental Dynamics and Risks. He is a PhD student in Physical Geography, Option: Climate Change and Environment at the University of Yaoundé I (Cameroon). He specializes in renewable energy issues, impacts, mitigation and adaptation to climate change in the fields of agriculture and energy. He is a consultant in geomatics, renewable energies and the environment with various structures and organizations involved in environmental protection. Also, is author of several communications (such as: The issue of waste management and energy perspectives in Dschang (Cameroon), presented at FES Green Conference in 2019), publications of scientific articles (such as: Contribution of cartography to the optimization of the evaluation of wind energy potential in the republic of Cameroon: case of Bitchoua Highlands, in Journal of Geography, Environment and Earth Science International, 68118, 2021) and a book (Analysis of the current state of knowledge on impacts of climate change on agriculture in the Adamawa and North Cameroon regions, Federal Institute for Geosciences and Natural Resources (BGR), 2021). He teaches high school geography and preparatory classes for the entrance examination to the Higher Teacher Training College (HTTC) in the "Intelligentsia Corporation" group. Also, he gives the TD of the course of MET 305 (General physical geography) at the meteorology branch of the National Advanced School of Engineering of Yaounde (University of Yaoundé I). At the associative level, he is Co-founder and vice-president of the Youth Initiative for Nature and Development (YIND) association and member of various think tanks and NGOs such as: Independent Observers of Climate, Environmental and Social Changes in Cameroon (OICC), Enviro-Protect.

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15:30-17:15 ***SESSION 12***

Chair: Phillipe De Maeyer (Belgium)/Michel Boko (Benin)

THEME 9 - Multidisciplinary approach for a sustainable access to energy
Keynote speakers: Monique Ouassa-Kouaro (Benin), Bob van der Zwaan (The Netherlands).

15:30-15:45	Monique Ouassa-Kouaro (Benin) - *L'accès à des services énergétiques fiables et de qualité au Bénin : un défi au développement durable du Bénin ?*
15:45-16:00	Bob van der Zwaan (The Netherlands) - *An Integrated Assessment of Pathways for Low-Carbon Development in Africa*
16:00-16:15	Satyanarayana Narra (Germany) - *Flexibilization of the sustainable energy supply in Ghana: a contribution by waste to electricity conversion*
16:15-16:30	Dimitrios Mentis (USA) - *Energy Access Explorer, a dynamic geospatial information system to connect SDG 7 and sustainable development outcomes*
16:30-16:45	*Monica Gullberg – African energy demand – the key to innovation*
16:45-17:00	Léonard Kabeya (RDC) - *Modèle simple d'accès à l'énergie verte consommable par les femmes en milieu rural face à la résilience au changement climatique en Afrique*
17:00-17:15	Bonaventure Banza Wa Banza (DRC) - *Electrification des quartiers périphériques de Lubumbashi (RD Congo) par le biais des miniréseaux hybrides PV-Diesel*

66. « L'accès à des services énergétiques fiables et de qualité au Bénin : un défi au développement durable du Bénin ? », OUASSA KOUARO Monique,

Laboratoire d'Anthropologie Appliquée et d'Education au Développement Durable, Université d'Abomey-Calavi, Bénin

Résumé

Le Bénin est confronté à un déficit énergétique qui compromet la possibilité de réduire la pauvreté et d'atteindre les objectifs du développement durable à l'horizon 2030. A partir d'un état des lieux de la situation énergétique du Bénin, cette recherche analyse l'accessibilité à un système énergétique fiable et de qualité comme un moteur du développement durable du Bénin.

La démarche méthodologique adoptée est résolument qualitative. Elle s'appuie sur un échantillon raisonné de 30 personnes sélectionnées à partir de la méthode des itinéraires dans les Communes de Cotonou, Porto-Novo, Bohicon, Djougou, Natitingou et Parakou au Bénin. Les entretiens individuels approfondis, l'observation directe et la recherche documentaire sont les techniques mobilisées pour le recueil des données.

La triangulation du corpus empirique révèle que le système actuel de production et de distribution de l'énergie électrique au Bénin ne permet pas de garantir des services énergétiques de qualité, en quantité suffisante, dans des conditions optimales de coût et de sécurité d'approvisionnement. La dépendance énergétique conjuguée à l'inexistence d'une infrastructure de réseau électrique appropriée et à l'inexploitation du potentiel énergétique soutenable (solaire, hydroélectrique, biomassique) limitent l'accès des populations notamment celles rurales à un système énergétique fiable et de qualité capables d'impulser la création de richesses et l'amélioration des conditions de travail, l'alimentation, la santé, l'éducation et l'accès à l'eau potable. Cette dépendance énergétique ne permet pas l'atteinte des objectifs du développement durable au Bénin.

Mots clés : services énergétiques, accès, créations de richesses, développement durable, Bénin

Biographie

Monique OUASSA KOUARO est sociologue–anthropologue et Maître de Conférences à l'Université d'Abomey-Calavi. Elle est enseignante–chercheure et dirige le Laboratoire d'Anthropologie Appliquée et d'Education au Développement Durable depuis trois ans. Elle mène des recherches sur les questions de Culture, genre et éducation des filles. Elle est directrice de l'ONG « Femme durable » qu'elle a cofondée. Ces recherches actuelles portent sur culture, Tourisme et gestion du patrimoine pour un développement durable, sur l'énergie durable et l'éducation au développement Durable des communautés pour l'atteinte des ODD. Elle a coordonné une étude sur l'évaluation du projet de production et de distribution de l'électricité au Bénin commanditée par le Millénium Challenge Account (MCA) Bénin 2 en partenariat avec le Bureau d'Etudes américain « MATHEMATICA » dans la période d'Août à octobre 2019. Elle a en outre organisé récemment un colloque sur « Leadership féminin et promotion des Objectifs du Développement Durable en Afrique Francophone ».

Elle a à son actif une cinquantaine d'articles scientifiques dont les deux derniers portent sur

-Représentations, pratiques et enjeux sociaux autour des fitness à Cotonou dans le contexte de développement durable.

- Femmes maraîchères et stratégies de résilience aux changements climatiques dans le nord du Bénin.

67. “An Integrated Assessment of Pathways for Low-Carbon Development in Africa”, Bob van der Zwaan

Prof. Dr., TNO Energy Transition, University of Amsterdam, Faculty of Science –
Abstract

In this paper we investigate the prospects for the large-scale use of low-emission energy technologies in Africa.

Many African countries have recently experienced substantial economic growth and aim at fulfilling much of the energy needs associated with continuing along paths of economic expansion by exploiting their large domestic potentials of renewable forms of energy. Important benefits of the abundant renewable energy resources in Africa are that they allow for stimulating economic development, increasing energy access and alleviating poverty, while simultaneously avoiding emissions of greenhouse gases.

In this study we analyse what the likely energy demand in Africa could be until 2050, and inspect multiple scenarios for the concomitant levels of greenhouse gas emissions and emission intensities.

We use the TIAM-ECN model for our study, which enables detailed energy systems research through a technology-rich cost-minimisation procedure. The results from our analysis fully support an Africa-led effort to substantially enhance the use of the continent's renewable energy potential. But they suggest that the current aim of achieving 300GW of additional renewable electricity generation capacity by 2030 is perhaps unrealistic, even given high GDP and population growth: we find figures that are close to half this level.

On the other hand, we find evidence for leap-frogging opportunities, by which renewable energy options rather than fossil fuels could constitute the cost-optimal solution to fulfil most of Africa's growing energy requirements. An important benefit of leap-frogging is that it avoids an ultimately expensive fossil fuels lock-in that would fix the carbon footprint of the continent until at least the middle of the century.

Short bio

Bob van der Zwaan is principal scientist at the Energy Transition department of TNO (Netherlands), Professor of Sustainable Energy Technology at the Faculty of Science of the University of Amsterdam (HIMS and IAS), and Adjunct Professor of International Relations at Johns Hopkins University's School of Advanced International Studies (SAIS) in Bologna. From 2007 to 2013 he was visiting senior research scientist at Columbia University's Lenfest Center for Sustainable Energy (Earth Institute) in New York.

He is co-director of the International Energy Workshop (IEW), member of the Council of the Pugwash Conferences on Science and World Affairs, and lead author for Working Group III of the Intergovernmental Panel on Climate Change (IPCC, 4th and 5th Assessment Reports).

He held several visiting professorships, most recently at the Royal Institute of Technology (KTH, Stockholm, 2010) and the Kiel Institute for the World Economy (IFW, 2008), and held research positions at Harvard University (Cambridge, 2002-2005), the *Vrije Universiteit Amsterdam* (1999-2001), Stanford University (Paolo Alto, 1999-2000), the *Institut Français des Relations Internationales* (IFRI, Paris, 1997-1999) and the European Organization for Nuclear Research (CERN, Geneva, 1992-1995).

He was trained in economics (MPhil, 1995-1997, University of Cambridge, King's College), physics (PhD, 1991-1995, CERN/NIKHEF, University of Nijmegen; MSc, 1987-1991, University of Utrecht) and international relations (Certificate, 1993-1994, IUHEI, University of Geneva).

His research includes the fields of energy and climate change, integrated assessment modelling, environmental economics, and technological innovation. He is (co-)author of 140 peer-reviewed scientific articles (4300 citations, h-index=38), and contributor to about a dozen books.

68. ”Flexibilization of the sustainable energy supply in Ghana: a contribution by waste to energy conversion”, Satyanarayana Narra1*, Edward Antwi1, Vicky Shettigondahalli Ekanthalu1, Mona-Maria Narra1, Alberta Aryee2, Daouda Kone2, Moumini Savadogo2

Keywords: Sustainable energy; biogas; solar PV; pyrolysis, hybridization, waste management, organic waste, plastic waste.

Abstract

Ghana has one of the highest access to electricity in Sub-Sahara Africa; its general energy scenario is not much different from the neighbouring West-African countries though. According to the World Bank about a third of Ghana’s rural communities are without access to power, while only 20% have access to modern cooking fuels. Apart from this, the economy is heavily reliant on fossil fuel to meet its electrical energy demand. Renewable energy alternatives play a very marginal role despite the availability of abundant renewable energy sources [1].

Even though the integration of renewable energy has been prioritized by way of policy, its current role in the electricity generation mix is marginal (<1%)[2].

Ghana’s energy supply has to be matched to the demand and has to be modernized with flexible demand driven systems. To investigate and demonstrate the flexible systems, a pilot demonstration plant is currently being built under the hybrid waste to energy as a sustainable solution project. The plant highlights hybrid energy production combinations that are flexible in operations due to start-stop as well as plug and play functionality of the individual energy producing technologies applied. The energy producing pathways chosen are biogas from organic wastes, pyrolysis from plastic wastes and solar-PV having a total guaranteed output capacity of 400 kW electricity and about 300 kW heat. The pilot plant contributes to Ghana’s renewable energy plan and will be demonstrated in the Atwima Nwabiagya Municipality in the Ashanti Region. The pilot plant with its hybridization and flexibilization approach is new to Ghana and Africa and will be a one of its kind project to be a one-stop research based implementable solutions developer. Further, the flexible operations will increase the number of business cases such as sale of oil, sale of biogas, lease or rent of batteries, etc. enhancing the economy and creation of qualified jobs.

Through flexibilization, the raw materials used, in this case municipal solid waste, will increase in value as the project will produce demand-based electricity and heat. Side products from the energy production, such as compost, will be monetized as additional revenue stream. The usage of municipal solid waste as feedstock also plays a crucial role in the countries sanitation and environmental protection.

The pilot plant is currently under construction and will be inaugurated in early 2022 as a research facility. Capacity building plays a crucial role in the project, which is funded by the German Ministry of Education and Research and coordinated by University of Rostock and WASCAL (West African Science Service Centre on Climate Change and Adapted Land Use), such that the plant will be independent from public funding and run by Ghanaian engineers in 2024. The hybrid waste to energy plant is expected to be used as model to be implemented in other West African countries in the upcoming years.

Short Bio Satyanarayana Narra

Prof. Narra is an expert in waste and resource management with special focus on process management and optimization. Since 2017, he works as an adjunct professor and project coordinator at the Department of Waste and Resource Management at the University of Rostock. Prof. Narra is also working as an executive staff at the well renowned federal institute German Biomass Research Centre in Leipzig. He has more than 13 years of experience in the fields of: (i) process development and optimization, (ii) multi-purpose products, (iii) efficiency increase as well as (iv) circular economy and resource conservation, (v) waste management including energy recovery. He has lead more than 25 international and national funded projects as the coordinator and waste expert. Prof. Narra has been awarded with a BMBF (German Federal Ministry of Education and Research) R&D&D project in collaboration with the Ghanaian government in which he and his team develop, construct, operate and transfer hybrid waste-to-energy plants in Ghana. Along with the above stated projects he is also involved in many of suggesting boards as an international expert for circular economy in African countries such as Nigeria, Togo, Ghana, Burkina Faso, etc.

69.”Energy Access Explorer, a dynamic geospatial information system to connect SDG 7 and sustainable development outcomes”, Dimitrios Mentis

Abstract:

To effectively expand energy access, government planners need to understand and have access to data and analytical tools that capture key attributes of the unserved and under-served populations they are trying to reach. (Today about 840 million people lack access to electricity.) Medium- to long-term energy planning tools used by planners consider spatially aggregated regions to solve complex cost-optimization problems. Although recently developed energy planning tools based on geographic information systems (GIS) focus on identifying technology and investment needs to provide access to unserved areas, these tools currently integrate limited information on demand and affordability. We need a better understanding of the needs and constraints of these new customers if we are to supply electricity in an economically sustainable manner. This paper introduces the methods and data used in Energy Access Explorer. The latter is an online, open-source, interactive platform that analyzes spatial data related to energy supply and demand and a population’s unique attributes. Location specific resource availability and infrastructure data are used to indicate energy supply, and demographic data and data on the social and productive uses of electricity help visualize demand. Together, these supply and demand indicators enable more comprehensive and geographically targeted energy planning not only for energy planning institutions but also for clean energy entrepreneurs and development finance institutions and donors.

Bios:

Dimitrios Mentis holds a PhD in Energy and Environmental Systems (KTH) and is currently leading World Resource Institute's (WRI's) Energy Access Mapping efforts to help accelerate the expansion of energy access using a data driven approach. Dimitrios is the Project Lead of the Energy Access Explorer, an online, open source, interactive GIS platform which provides geospatial data and analysis necessary to create a future where all people and institutions have access to affordable, reliable and modern energy while ensuring socio-economic development. Previously, Dimitrios led the Sustainable Energy for All team at KTH Royal Institute of Technology where he founded and developed the innovative Open Source Spatial Electrification Toolkit (OnSSET) in collaboration with the International Energy Agency (IEA), United Nations Department of Economic and Social Affairs (UNDESA), World Bank, ESMAP, ABB and others. Dimitrios has also focused on mapping technical potential of renewable energy resources at national and regional level through a complex GIS assessment, in collaboration with the International Renewable Energy Agency (IRENA). Further, Dimitris has worked on assessing the climate land energy and water nexus at different scales; water desalination on island case studies in cooperation with the Hellenic Ministry of Energy, Environment and Climate Change and the National Technical University of Athens, and trans-boundary river basins in cooperation with United Nations Economic Commission of Europe (UNECE).

70. "African energy demand – the key to innovation", Monica Gullberg, Green Climate Fund (South Korea), Senior Portfolio Specialist

Abstract
The future sustainable energy systems in Africa need to stem from a sensible demand analysis, including efficient and well targeted energy services for health, food, housing and diversification of the economies. Focus on supply is secondary. ..Efficiency, storage and flexibility can be mastered through innovative planning of demand. Capturing demand through being open minded to un-conventional solutions, rather than copying established supply models and demand projections based on these…Supply targeting specified demand in optimized, smart energy services… Important demand sectors include housing, SME's, basic health care, agriculture, diversification of economy and trade.. Methods include catalytic procurement, design, architecture competitions, etc. Business models that will enable these investments are typically leasing, BOT, shared risk agreements, guaranteed service/saving agreements. For financial schemes, a challenge is to ring-fence investments, define services and create scale… examples from interventions funded by EU, Sida, UNIDO and GCF.

Short Bio

Monica Gullberg has since more than twenty-five years been working with strategic energy planning including demonstration projects, statistics and indicators, especially for energy efficiency, energy for development and energy and environmental impacts. She is currently a Senior Portfolio Specialist at GCF since 6 months, and before that worked 4 years as a senior energy advisor at the Swedish International Development Agency.

Her technical fields of knowledge include primarily major energy end-users such as buildings and transport but also energy supply systems.
She has been implementing sustainability policies in municipalities and at national level, specifically providing expertise in the rural electrification and building sectors. Project implementation strategies include also project appraisal, procurement, public information campaigns and methods for monitoring and evaluation of energy sector programmes.

Monica worked as consultant for 15 years and has lead and contributed to international projects regarding energy efficiency in buildings include **Energy Saving Initiative in the Building Sector in Eastern Europe and Central Asia (ESIB)** 2010-2012**, Support for implementation of the STIL2 methodology in the Indian building sector,** 2011-ongoing, **Capacity Building and Technical Support to the Energy Efficiency Agency in Moldova** 2011-ongoing, **a web-tool for Nordic Eco-labeling of hotels and restaurants (Nordic and Baltic countries)** 2010-2012**.**

Recent East African projects regarding energy infrastructure planning include **Capacity Development at the Rural Energy Agency in Tanzania,** 2010 -on-going**,** where Monica is the project team leader. The **TREESPA** project with Tanesco and SIDO aiming at enhanced energy access and energy effciency for SME's in Tanzania, 2006-2009, where Monica was project manager. Another large scale energy infrastructure planning and pre-feasibility study that Monica has managed is **the North European LNG Infrastructure project,** 2011-2012.

In Sweden, relevant projects with municipal energy efficiency programs include an **assessment of the building sector and appropriate measures, for the City of Stockholm,** 2011 and the **lecturing for building managers in a Swedish multiannual project "sustainable communes"** 2003-2004 run by the Swedish Energy Agency in five parallel municipalities,.

Monica has also extensive experience in energy statistics compilation and analyses as a means to develop reference values and monitoring indicators.

For example she has been the project manager for the multi-annual project on enhanced energy statistics in the Swedish official building sector (STIL2), 2003-2011, financed by the Swedish Energy Agency. This project comprises a considerable data collection, structuring and definition of key energy indicators.

71. ”Modèle simple d’accès à l’énergie verte consommable, par les femmes en milieu rural face à la résilience au changement climatique en Afrique ”, D. Kabeya Nahum[1], Shaloom Mbambu K.[2], C. Mbikayi Tchamba[2], Ruth Mutala K[3]., Leonard Kabeya Mukeba Yakasham[2,3]

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Keywords : Energies vertes, défis, femme, climat, Yakam matrix, simulation et optimisation, Etuveuse, capteur parabolique, photovoltaique, Village Bena Kayemba Bena Kalombo.

Abstract

Les auteurs se focalisent sur 3 défis mondiaux : l’énergie, l’inégalité des genres et le changement climatique à relever pour les milieux ruraux de l’Afrique Subsaharienne, à l’échelle d’un village pilote en RD Congo, au Kasaï Oriental, Bena Kayemba Bena Kalombo.

Les femmes en milieu rural demeurent responsables de la collecte et production de nourriture dont l’énergie consommée affecte la résilience au réchauffement climatique par déforestation inquiétante causée due à l’usage du bois et des charbons. La cuisson des aliments a fait l’objet d’intégration d’étuveuses écologiques à coût modique et de foyers améliorés qui utilisent des déchets recyclés ou des résidus des bois. L’approvisionnement en carburant pour l’éclairage, cuisiner, moudre les maïs et les maniocs est compensé par l’exploitation des panneaux solaires photovoltaïques et tentative de couplage de mazout et de l’huile de palme ethanolysé (HPE).

Les femmes présentent 70 % des pauvres du monde. Elles sont trop chargées par les tâches ménagères, les soins aux enfants, aux malades et aux personnes âgées. Les énergies renouvelables réduisent les fumées qui leur posent des problèmes de santé. Le rendement de la conversion des énergies propres est relativement faible. Nous simulons par les techniques simples d’usage actif des énergies solaires pour les séchoirs à convection naturelle, l’usage des capteurs locaux paraboliques pour la cuisson avec une large plage d’application et le module Hydro-chloropur. L'objectif est de mettre en évidence des technologies appropriées, aux interfaces de l’énergie et de l’environnement. Celles-ci réduisent la pénibilité de certaines tâches.

Outre l’introduction et la conclusion , l’ensemble porte sur : (i) « Yakam Matrix » aux interfaces ; (ii) Bilan exérgétique en chevaux attribués à l’oeuvre d’une mère de famille/jour/13 heures du travail ; avec répertoire des outils énergétiques simples ; (iii) Propositions d’hybridation et couplage optimal des systèmes d'énergies renouvelables pour les villages, avec l’insertion d’électronique de puissance.

Les jeunes et les autres groupes vulnérables sont associés à cette transition prometteuse en vue de leur donner des moyens énergétiques propres et les faire participer aux processus d’adaptation et d’atténuation du changement climatique.

Short bio

Léonard Kabeya Mukeba Yakasham est actuellement Professeur Ordinaire. Il dispense les cours des Génie Thermique et Climatique à l'Université de Kinshasa au Département des Energies Nouvelles et Environnement de la Faculté Pétrole Gaz et énergies Nouvelles. Ensuite Simulation et Modélisation en Mécanique Energétique de l'Institut Supérieur de Techniques Appliquées de Kinshasa.

Il est Docteur PhD de l'Université de Liège en Belgique. Saa thèse portait sur l'"Etude du piégeage de la ligne de contact lors de l'évaporation de gouttelettes" en Mécanique des fluides et Energétique.

72. « Electrification des quartiers périphériques de Lubumbashi (RD Congo) par le biais des mini-réseaux hybrides PV-Diesel », *Banza Wa Banza Bonaventure, Kiseya Tshikala Flory, Diambomba Hyacinthe Tungadio and Philippe Bouillard

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Résumé

L'électrification progressive des zones non encore raccordées au réseau électrique principal a principalement été réalisée via l'installation de groupes électrogènes diesel décentralisés, ainsi que, dans une moindre mesure, par le biais de systèmes PV autonomes. Cette étude présente dans sa première partie la distribution spatiale des sources alternatives d'électricité en identifiant les facteurs socioéconomiques des ménages expliquant cette distribution. Et dans sa deuxième partie l'étude présente, les résultats optimums d'un système hybride PV/Diesel avec stockage. Les données d'enquêtes socioéconomiques auprès 5270 ménages sur toute l'étendue de la ville de Lubumbashi ont révélé 163 mini-réseaux alimentés par des groupes diesel et desservant 1143 ménages, soit 21,6% de ménages interrogés. Ces enquêtes révèlent qu'il existe un lien positif et plus significatif entre l'accès aux mini-réseaux diesel et les variables socioéconomique telles que le niveau d'éducation secondaire et source de revenu autre (la combinaison de plusieurs sources de revenu identifiées). Les données prélevées sur ces mini-réseaux diesels ont permis d'élaborer le profil de consommation de la zone d'étude.

Après simulation, optimisation et analyse de sensibilité avec le logiciel HOMER l'étude a révélé que la solution optimale est obtenue lorsque la charge est alimentée par un système PV/diesel avec stockage sur 96 batteries de 1 kWh, cette configuration offre le coût de l'énergie le plus faible soit 0,385 $/kWh comparativement aux configurations diesel seul et PV/diesel. D'un point de vue environnemental, l'étude de cas faite ici montre que le recours au PV-diesel-batteries permet de réduire les émissions de plus de 34 % à comparer à une production d'électricité purement diesel. Cette étude recommande le remplacement des mini-réseaux diesel par des mini-réseaux hybrides PV-diesel comme une mesure efficace pour réduire la consommation de carburant diesel et les émissions de gaz à effet de serre, tout en assurant un service électrique 24 heures par jour dans les quartiers non électrifiés.

Mots-clés: Photovoltaique, HOMER, mini-réseau électrique, statut socioéconomique, Lubumbashi

Short bio

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