DAAD TU Berlin Alumni Seminar

Energy Transition in Africa

Cooperations and Networks to Strengthen North-South and South-South Interventions

25-29 October 2021 | Report on Proceedings

The **DAAD TU Berlin Alumni Online Seminar, Energy Transition in Africa - Cooperations and Networks to Strengthen North-South and South-South Interventions,** was organized by the TU Berlin Alumni Program, in cooperation with TUB Institute for Energy Engineering and HEDERA Sustainable Solutions, and in partnership with the African Center of Excellence in Energy for Sustainable Development from the University of Rwanda and Institute for Advanced Sustainability Studies in Potsdam (IASS). The seminar was held October 25-29, 2021. It aimed to explore the lessons learnt, challenges, and outlook for transdisciplinary and transnational cooperation in the energy sector in Africa, in view of the expected population growth, climatic and public health-related issues, and ongoing policies and initiatives to improve energy access.

The week after the event, from November 1 to 5, 2021, in the framework of the online seminar, a photo and video exhibition complementing the virtual event was organized. The exhibition, **Energy Transition in Africa - *Awakening the Senses***, was hosted at **The Embassy of Rwanda in Germany**, at its offices in Berlin. The event aimed to sensitize participants on energy access and the energy transition, along with the wide spectrum of work done by different stakeholders in Rwanda, to inspire TU Berlin alumni and others regarding the roles they can take to contribute to the energy sector in Africa.

This report of proceedings has been prepared by HEDERA Sustainable Solutions GmbH, led by Dr.-Ing. Natalia Realpe Carrillo, for the TU Berlin Alumni Program. Rosette Nagimesi drafted the session transcripts and summaries. Angelica Lozano, Olivia Nanfuka, Cecilia Scott, and Catalina Huertas Mateus from HEDERA have contributed with the coordination, technical revision, proofreading, and design, respectively. Artist and environmentalist Artur Sgambatti Monteiro has drawn the illustrations. Photos of the exhibition can be viewed here: https://hedera.online/daad-tu-alumni-seminar/exhibition.html, taken by Rwandan photographer Pacifique Himbaza.

This report should be cited as:

DAAD TU Berlin Online Seminar, Energy Transition in Africa – Cooperations and Networks to Strengthen North-South and South-South Interventions. Report on Proceedings. 2021.

Table of Contents

List of Acronyms & Abbreviations

AC	Alternating Current
ACE	African Centre for Excellence
ACE II	Eastern and Southern African Higher Education Centres of Excellence
ACE-ESD	African Centre of Excellence in Energy for Sustainable Development
ACERA	African Clean Energy Research Alliance
ADEME	Agence de La Transition Ecologique
AFD	Agence Française de Développement
AfDB	African Development Bank
AHP	African Hydrogen Partnership
AI	Artificial Intelligence
AMR	Automatic Meter Reading
AU	African Union
B2B	Business-to-Business
BFZ	Berufliche Fortbildungszentren der Bayerischen Wirtschaft
BGFZ	Beyond the Grid Fund for Zambia
BMBF	German Federal Ministry of Education and Research
BRD	Development Bank of Rwanda
CIDA	Canadian International Development Agency
CO_2	Carbon Dioxide

COMESA	Common Market for Eastern and Southern Africa
COP 26	2021 United Nations Climate Change Conference
COVID-19	Coronavirus Disease 2019
CREEC	Centre for Research in Energy and Energy Conservation
CRM	Customer Relations Management
CSO	Civil Society Organisation
CSP	Concentrated Solar Power
CSR	Corporate Social Responsibility
CST	Concentrated Solar Thermal
DAAD	German Academic Exchange Service
DFID	Department for International Development (former)
DRC	Democratic Republic of the Congo
e-mobility	Electric Mobility
EAP	East African Power
ECOWAS	Economic Community of West African States
ECREEE	ECOWAS Centre for Renewable Energy and Energy Efficiency
EDCL	Energy Development Corporation Limited (Rwanda)
EDPRS II	Economic Development and Poverty Reduction Strategy
EEA	ENGIE Energy Access
EIB	European Investment Bank
EnDev	Energising Development

EPD	Energy Private Developers Association (Rwanda)
ERA	Electricity Regulatory Authority
ERP	Enterprise Resource Planning
ESCO	Energy Service Company
ESIA	Environmental and Social Impact Assessment
ESMAP	Energy Sector Management Assistance Programme
ESMMP	Environmental and Social Management and Monitoring Plan
ESSP	Energy Sector Strategic Plan
EU	European Union
EUCL	Energy Utility Corporation Limited (Rwanda)
FDI	Foreign Direct Investment
FGD	Focus Group Discussion
GHG	Greenhouse Gas
GIS	Geographic Information System
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GPS	Global Positioning System
GW	Gigawatt
H_2	Hydrogen
HEDERA	HEDERA Sustainable Solutions GmbH
HIT	HEDERA Impact Toolkit
hr	Hour
HySA	National Hydrogen Strategy

IASS	Institute for Advanced Sustainability Studies, Germany
ICE	Internal Combustion Engine
ICS	Improved Cookstoves
ICT	Information and Communication Technologies
IEA	International Energy Agency
IMPACT-R	Impact-Driven & Action-Based Research
IPP	Independent Power Producer
IPR	Inevitable Policy Response
IRENA	International Renewable Energy Agency
IT	Information Technology
ITF	EU-Africa Infrastructure Trust Fund
JICA	Japan International Cooperation Agency
JMP	Joint Monitoring Programme for Water Supply, Sanitation, and Hygiene
kg	Kilogramme
km^2	Square Kilometre
KOICA	Korea International Cooperation Agency
kWh	Kilowatt-Hour

L	Litre
LCOH	Levelised Cost of Hydrogen
LEAP-RE	Long-Term Joint EU-AU Research and Innovation Partnership on Renewable Energy
LED	Light-Emitting Diode
LG	Local Government
LPG	Liquefied Petrol Gas
LRP	Livelihood Restoration Plan
m^3	Cubic Metre
MEMD	Ministry of Energy and Mineral Development
MENA	Middle East and North Africa
MFI	Microfinance Institution
MOU	Memorandum of Understanding
MSMEs	Micro-, Small, and Medium-Sized Enterprises
MTF	Multi-Tier Framework
MTN	MTN Telecom Company
NEP	National Electrification Plan
NGO	Non-Governmental Organisation
NST1	National Strategy for Transformation

PACET	Pan Africa Cooperation on Education and Technologies
PAU	Pan African University
PAUWES	Pan African University - Institute of Water and Energy Sciences, Algeria
PAYGO	Pay-As-You-Go
PESTEL	Political, Environmental, Social, Technological, Economic, Legal
POLIMI	Polytechnic University of Milan, Italy
PPA	Power Purchase Agreement
PPI	Poverty Probability Index
PPP	Public-Private Partnership
PSF	Private Sector Federation
PV	Photovoltaic
PWh	Petawatt-Hour
R&I	Research and Innovation
RAP	Resettlement Action Plan
RDB	Rwanda Development Board
RE	Renewable Energy
REA	Rural Electrification Agency
REEEP	Renewable Energy and Energy Efficiency Programme
REG	Rwanda Energy Group
REI4PPP	South Africa's Renewable Energy Independent Power Producer Programme
REMA	Rwanda Environment Management Authority

RLI	Reiner Lemoine Institute
RRA	Renewable Readiness Assessment
RWF	Rwandan Franc
SACCO	Savings and Credit Cooperative Organisation
SACREEE	SADC Centre for Renewable Energy and Energy Efficiency
SADC	South African Development Community
SASSCAL	Southern African Science Centre for Climate change and Adaptive Land Management
SDGCA	Sustainable Development Goals Center for Africa
SDGs	Sustainable Development Goals
SEFA	Sustainable Energy Fund for Africa
SHS	Solar Home Systems
SMEs	Small and Medium-Sized Enterprises
SSA	Sub-Saharan Africa
SVF	Sustainable Villages Foundation
TUB	Technische Universität Berlin
UECCC	Uganda Energy Credit Capitalisation Company
UEGCL	Uganda Electricity Generation Company Limited
UETCL	Uganda Electricity Transmission Company Limited
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Programme

UNEP	United Nations Environment Programme
UNICEF	United Nations Children's Fund
UNU - EHS	United Nations University - Institute for Environment and Human Security
UNU - ViE	United Nations University - Vice Rectorate in Europe
UR	University of Rwanda
USA	United States of America
USAID	United States Agency for International Development
USD	United States Dollar
USEA	Uganda Solar Energy Association
W	Watt
WA	West Africa
WASH	Water, Sanitation, and Hygiene
WES	Institute of Water and Energy Sciences
WHO	World Health Organisation
WIRE	Women In Renewable Energy (Rwanda)

Introduction to stakeholders & key challenges

Monday, 25 October 2021

Programme

Report on Proceedings

Day 1: Introduction to the stakeholders & key challenges - Monday, 25 October 2021

Moderator: Dr. Natalia Realpe Carrillo, HEDERA Sustainable Solutions, Institute for Advanced Sustainability Studies (IASS)

Opening remarks

The DAAD TU Berlin Alumni Online Seminar: Energy Transitions in Africa - Cooperation and Networks to Strengthen North-South and South-South Interventions - was organised by the Technische Universität (TU) Berlin Alumni Programme, in cooperation with the Energy Engineering Institute, African Centre for Excellence in Energy for Sustainable Development (ACE-ESD) - University of Rwanda (UR), HEDERA Sustainable Solutions GmbH, and IASS. The event was sponsored by the German Academic Excellence Service (DAAD).

As a complement to the seminar, from 1 to 5 November 2021, there was a photo and media exhibition titled "**Awakening the Senses**" featuring the work of the Rwandan photographer, Pacifique Himbaza. The exhibition included pictures, and video recordings of Rwandan experiences regarding energy access, the energy transition, and different solutions being implemented in the field. The exhibition was set up in partnership with the Embassy of the Republic of Rwanda in Germany.

TU Berlin Alumni Program - Ms. Bettina Klotz & Ms. Juliane Wilhelm,

The TU Berlin Alumni Programme works to support the strategic aspirations of the university through alumni activities and meaningfully link the university's alumni to their alma mater. The program targets former students, junior researchers, employees, and guest researchers of the university. Program membership is free, and the member count currently stands at 35,000 members in 139 countries around the world.

Among the services rendered to members are international alumni training seminars and workshops, often held face-to-face in Berlin or abroad. These engagements aim to extend the skills of alumni, empower them to be multipliers for knowledge transfer, help them maintain their links with Germany, and foster cooperation and networking with higher education

institutions, research institutes, non-governmental organisations (NGOs), the public sector, and industry. In 2021, besides the seminar "Energy Transition in Africa", these other seminars were organised:

- SPURT- Sustainable Processes of Urban-Rural Transformations
- Tearing down walls on entrepreneurial ecosystems in the Global South
- Innovative vocational education and training for companies and society
- "COLLOC - Collaborative Production of Transformation Knowledge in Self-Organized Occupations"

The seminars and workshops are supported by DAAD and the Berlin Senate Department for Economics, Energy, and Public Enterprises. Due to the coronavirus disease 2019 (COVID-19) pandemic, all seminars and workshops in 2021 were moved online. To date, TU Berlin has established international alumni clubs with focal point persons, including one in Africa, the African Union TU Berlin Alumni Club.

Welcome Alumni Seminar - Mr. Christian Thomsen, President, TU Berlin

Mr. Thomsen expressed his gladness that the seminar was taking place despite the global pandemic. He also mentioned that he looked forward to activities resuming in a normal manner in the future and heartily welcomed alumni to the seminar.

Opening session - Introduction to the stakeholders & key challenges

Eastern and Southern African Higher Education Centres of Excellence (ACE II)

Dr. Charles Kabiri, African Centre of Excellence in Energy for Sustainable Development, University of Rwanda

The ACE-ESD project is a 5-year project funded by the World Bank. The project has been extended to 2023, after which it will be self-sustaining. Located in the UR College of Science and Technology, ACE-ESD is one of the regional priorities under the ACE II project.

The overall ACE II project aims to strengthen selected Eastern and Southern African higher education institutions to deliver quality postgraduate education and build collaborative

research capacity in selected regional priority areas (industry, agriculture, health, education, and applied statistics). ACE institutions currently exist in Rwanda (4), Kenya (3), Malawi (2), Tanzania (4), Ethiopia (4), Mozambique (1), Uganda (4), and Zambia (2), bringing the total number to 24.

The ACE-ESD at UR operates under the education regional priority area. In line with this, it focuses on implementing an education, economic development, research, and innovation matrix to achieve industrial and economic development. This approach seeks to develop capacities in the energy sector. The demand for applied areas like renewable energy (RE), energy economics, and electrical power systems is new and fast-growing, with the university already receiving master's and PhD students from around the region, many of whom already work in related industries. Key training areas include PhD and master's programmes and certificate courses in RE, electrical power systems, and energy economics. The UR Centre of Excellence also has an innovation hub that supports start-ups in Africa and links the university with the private sector and other stakeholders.

The Centre's achievements to date include projects with different partners like Sida, DAAD, and several universities in the United Kingdom, the establishment of a unique High E-Tech Smart Grid Laboratory, 2 patents received for developments at the innovation hub, over 30 academic exchanges for students, and the graduation of 43 master's students in August 2021, with 60 more expected to graduate in 2022; the university also recently had its first PhD student successfully defend his thesis.

Energy transition in Africa: Experience of TU Berlin, El Gouna, Egypt

Prof. Dr. Tetyana Morozyuk, Institute for Energy Engineering, TU Berlin and TU Berlin Campus El Gouna, Egypt

The energy transition in Africa is crucial and therefore frequently discussed in international energy and environment reports. It must happen to ensure the race for more electricity to power electric mobility (e-mobility) does not negatively impact the African climate and

economies. According to Prof. Dr. Morozyuk, the energy transition also entails knowledge transfer, in that if one country or continent finds a solution regarding demand-response management or how to fulfil e-mobility requirements more efficiently, this knowledge and experience should be shared all over the world.

TU Berlin Campus El Gouna

TU Berlin's El Gouna satellite campus was founded 10 years ago to foster country/continent transfer of engineering knowledge from Germany to, first, the Middle East and North Africa (MENA) region and, later, worldwide. In 2018, the campus had 150 master's graduates in the Energy Engineering Department. Their study experience was greatly enriched by the El Gouna Campus's collaboration with different Berlin universities and research centres, including the International Solar Energy Research Centre, Konstanz, German Aerospace Centre, Cologne, and Freie Universität, Berlin. These partnerships resulted in the creation of new modules, a steady supply of guest lecturers, and not only classwork, but also project work and experimental sessions.

Prof. Dr. Morozyuk pronounced that while the path to sustainability includes a variety of aspects, including reduced use of fuel and water, lower electricity costs, lower emissions, and lower capital cost, the energy transition is perhaps one of the most important aspects, as it significantly contributes to all seventeen Sustainable Development Goals (SDGs).

Research and dialogue for sustainable societies

Prof. Dr. Andreas Goldthau, Institute for Advanced Sustainability Studies in Potsdam (IASS)

"How do we grasp and address the challenge of the energy transition?" The following proposals were made:

- Africa needs more investment and accompanying capacity and technology transfer.
- In cases where African economies do not have access to sufficient technologies, e.g. because of no foreign direct investment, the alternative could be to get into manufacturing and expand from there, to achieve maximum value in the race.
- Africa needs to develop local energy innovation eco-systems to find ways to embrace opportunities in the energy domain as an area of economic growth and development.

Energy transition and the call on climate governance

Prof. Dr. Andreas Goldthau articulated calls to different stakeholders regarding the energy transition and climate governance, which include a call to the 2021 United Nations Climate Change Conference (COP 26) to focus on climate finance; a call to the 'rich world' to rethink technology access and ensure a fairer distribution of crucial technologies among countries and continents; and a call to African governments to foster conducive investment conditions in order to attract investors to invest in African economies.

Energy transition and the Global South

IASS works to find solutions to these challenges through a co-creative approach, collaborating with stakeholders on the ground to foster the energy transition. The Institute and its partners have also written many open-source empirical research papers.

HEDERA's impact assessment tools

Dr. Natalia Realpe Carrillo, HEDERA Sustainable Solutions, Klaus Töpfer Sustainability Fellow of the IASS

HEDERA Sustainable Solutions develops digital solutions for the microfinance and sustainable development sectors. These solutions enable organisations to assess their own impact from the perspective of end-customers and beneficiaries, in order to enhance the results of their work in the field.

HEDERA's client organisations use the HEDERA Impact Toolkit (HIT), which consists of a mobile application for data collection and a dashboard for data monitoring and digital report generation. The app enables, among other things, information filters and collection of Global Positioning System (GPS) coordinates, audio and video clips, and photos. No internet connection is needed for data collection in the field; once there is an internet connection, information is automatically uploaded to the cloud.

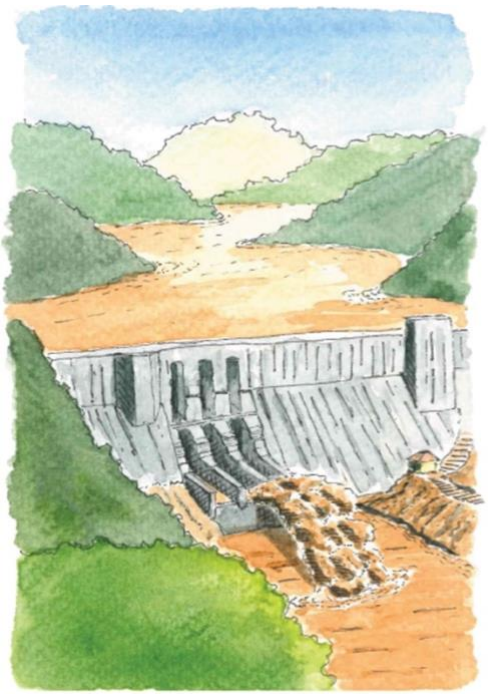
Regarding data processing and analysis, all surveys follow pre-existing international frameworks that have been officially established to track progress towards the SDGs. For example, for SDG 7: Access to Energy, HEDERA follows the World Bank Energy Sector

Management Assistance Programme (ESMAP) Multi-Tier Framework (MTF); for SDG 6: Water, Sanitation, and Hygiene (WASH), it uses the Joint Monitoring Programme for Water Supply, Sanitation, and Hygiene (JMP), the latest WASH assessment framework developed by the World Health Organisation (WHO) and United Nations Children's Fund (UNICEF); for SDG2: Food Insecurity Experience Scale (FIES) from the Food and Agriculture Organization (FAO), and for SDG 1: Progress Out of Poverty, HEDERA's data collection and monitoring tools include the Poverty Probability Index (PPI) questions and scorecards for several countries. The surveys are constantly updated based on the latest framework releases and upcoming frameworks to assess achievements towards the SDGs include Women Empowerment in Agriculture Index for SDG5.

HEDERA also has a COVID-19 toolkit app and dashboard to enable organisations to get feedback from their beneficiaries, e.g., households, small businesses, and communities, to facilitate inclusive data-driven decisions.

Panel discussion: Energy transition in Africa - What is the status quo and potential?

The energy transition in Africa: Case study: Rwanda



Mr. Gen Cesar, Chief Technical Advisor, Ministry of Infrastructure of Rwanda

Currently, 67% of Rwandan households have access to electricity—48.4% on-grid and 18.5% off-grid. 2010 figures showed extremely high dependence on biomass, i.e. around 90%, and the government has consequently been trying to reduce this figure. The percentage decreased to 79.9% in 2017 and is expected to further drop to 42% in 2024. This decline is attributed to the national biomass energy strategy, which has promoted the shift to clean cooking technologies such as gas, induction, and electric cookstoves. When

considering energy and cooking solution access, gender inclusion is a priority.

Challenges in implementing the transition include the fact that reaching all targets is costly and affects the national economy. There are also unforeseen/natural challenges with renewable energies, e.g. when there is low solar radiation, less solar photovoltaic (PV) power is generated, and during the dry season less hydropower is generated. Additionally, with climate change predicted to heavily impact Eastern Africa, there is the worry that it may disrupt current energy generation plans. To mitigate this, a climate adaptation plan has been put in place. The government has also implemented extra measures to mitigate climate change such as the deployment of hydro and solar energy, improving energy efficiency in industrial processes, rolling out electric vehicles, introducing vehicle emission standard, and promoting on-farm biogas use.

An energy transition in Africa cannot be one-size-fits-all, as there are many differences between African countries. One such difference is that East African countries are more mountainous, making hydropower generation favourable and more preferred, while Western African countries have flat terrain and resources that orient them more towards diesel and gas generation. Moreover, some countries have energy-intensive outputs based on their industries, e.g. mining. At the same time, global energy indices use energy consumption per capita, which makes some countries seem better than Rwanda, but there are other unconsidered variables that need to be considered.

Regarding transnational cooperation, Rwanda is connected to all the neighbouring countries through transmission lines; there are also regional power generation projects like the Rusumo hydropower plant shared between Tanzania, Burundi, and Rwanda, and Rusizi II and III, shared between the Democratic Republic of the Congo (DRC), Burundi, and Rwanda.

Cooperation between countries is quite feasible, as Africa is divided into electricity blocks (East Africa, West Africa, Central Africa, and Southern Africa), and there is regular bilateral energy cooperation between countries. Among the stakeholders involved in Rwanda's energy transition are international development partners, the private sector, development banks, and different funds.

Strategic issues on the just transition for sub-Saharan Africa

Ms. Tendai Makanza, IndustriALL Union

This seminar focused on the social issues surrounding the energy transition in sub-Saharan Africa (SSA) and the work IndustriALL is doing as a global trade union. Key issues discussed included how to define transition in the context of IndustriALL's work, incorporating due diligence issues, social solidarity frameworks among national and sub-national stakeholders, re-examining the duality of Sub-Saharan Africa, and addressing challenges around research, green capitalism, and transitioning from energy and mining sectors with poor human rights track records.

While the initial term was simply 'energy transition', social stakeholders have emphasised the need to have not only a transition, but rather a just/fair energy transition in SSA. Effort has therefore gone into defining the term 'just' inclusively, resulting in the agreement that a just transition should be transformative, meeting the needs of all social stakeholders, addressing existing inequalities, and showing how social and economic structures could be changed and improved through this transition.

Pathways/elements that may enable social partners to play a role in the just energy transition include the following:

- Relevant due diligence - The multiple existing approaches, instruments, and guidelines need to be reviewed to ensure they are adequate, applicable, and enforceable. Civil society organisations (CSOs) need to define and develop a transformative agenda for the energy sector, highlighting how they aim to support the energy transition process.
- Engaging in social dialogue instead of collective bargaining - The roles of trade unions at enterprises and on a sectoral and national level should be expanded to enhance their impact on policy. CSOs should also build the capacities and competencies of social partners to understand and articulate the issues.
- Establishing a social solidarity network for the energy transition – The cost of the energy transition is rising due to the global race for minerals to power the transition. The race, unfortunately, seems to clash with the global interest in greening the energy industry. It is also exacerbating human rights abuse and violations, especially when one considers the impact of the mining sector, e.g. in Zambia (copper mining) and the

DRC (cobalt mining). Governments should therefore also integrate due diligence into plans for this sector.

There is a lack of engagement between non-state stakeholders and the government, yet consultation processes are key for sustainability. The involved actors need to build these platforms to inform the direction of the energy transition and ensure there is gender inclusion and no one gets left behind, including minorities and youth. There is a need to not only write participatory and inclusive documents, but also use them to implement a collaborative approach.

Furthermore, there is a need to build technical capacities to enhance the engagement and competencies of CSO actors. This can be done through more digitisation, changes to non-state actors' organisational frameworks, and improvements in democracy and participation, among other things.

Context-specific issues - Governments should define policies and programmes that also address the ever-increasing size of the informal economy to avoid marginalising millions in the SSA region. As stakeholders create North-South global alliances, they should be aware that some policies/frameworks cannot be easily adapted to SSA economies due to their structural duality. Such frameworks/policies should be modified/replaced, but never imposed.

The energy transition should further address the inherent existing injustices, be they racism or neoliberal policies, so that real change can be seen. There should be effort made to integrate aspects like transparency, accountability, and inclusion into economic development processes. This will ensure a profitable and human-centred transition. If this is not done, SSA will continue to experience the same issues and inequalities it does now, such as energy poverty and climate change impacts, among others.

Due to the pandemic, African countries have been forced to develop, adapt, and adopt technology, but they still face many limitations, such as inadequate regulations and financing for an effective energy transition.

The transition also means something different for each country; some nations are talking about greening their economies even as others continue to discover more oil and gas resources. Certain countries like South Africa and Nigeria may face negative economic consequences if they make the transition as given, considering they need fossil fuel-based resources to develop, and their carbon footprint is much smaller than that of the North. Stakeholders, therefore, need to make realistic, detailed, and clear planning for this transition.

The Long-Term Joint Europe-Africa Research and Innovation Partnerships on Renewable Energy (LEAP-RE) Programme

Mr. Léonard Lévêque, LEAP-RE

LEAP-RE was launched at the end of 2020 as part of the European Union (EU)-African Union (AU) High-Level Policy Dialogue on Science, Technology, and Innovation. The programme is running from 2021 to 2025 and is funded by the EU's Horizon 2020 Research and Innovation (R&I) Program under Grant Agreement 963530.

The programme aims to use R&I to fight climate change by addressing key RE challenges. The partnership is coordinated by LGI, a French SME, and DSI, the South African Department of Science and Innovation in the South African Ministry for R&I. The programme's 83 partners (in 39 countries in Europe and Africa) comprise representatives from governments, research, academia, the private sector, and civil society. This partnership will contribute to the production of new knowledge and technologies, therefore accelerating the inclusive transition to reliable and affordable RE.

LEAP-RE comprises 3 pillars:

- **Pillar 1:** External research and capacity building implemented through calls for proposals on R&I projects. The call for proposals was launched this year, and proposals are currently being evaluated. 10-20 successful proposals will be selected soon, to be funded by the funding agencies themselves. This pillar is being implemented by a consortium of 16 African and European funding agencies and co-chaired by ANR-France and MESRS-Algeria.

- **Pillar 2:** Internal consortium R&I projects with capacity building activities. This pillar is being implemented through 8 funded R&I projects, each targeting specific aspects, such as a geothermal atlas for Africa, renewable energy for African agriculture, and a sustainable energy transition and digitisation for smart mini-grids for Africa. Projects are further pegged to 6 multi-annual roadmaps that seek to address African and European cooperation on RE priorities. The developed roadmaps cover the following:

    - Mapping joint R&I for the future of RE sources in Europe and Africa
    - End-of-life and second-life management and environmental impacts of RE components
    - Small stand-alone systems

- Smart grids (different scale) for off-grid application
- Processes and appliances for productive use
- Innovative solutions for priority household use (clean cooking and cold chain).

This pillar is co-coordinated by Strathmore University, Kenya, and Polytechnic University of Milan (POLIMI), Italy and includes 59 R&I operators from Africa and Europe. Partners co-fund this pillar at 50 percent. The focus is on the chain output-outcome impact.

LEAP-RE uses a comprehensive approach to research, innovation, and capacity building under this pillar. It entails technical development, a strong methodological approach that seeks to guarantee scientific replicability and learning, energy scenarios and policies to not only understand the contexts where technologies and solutions are developed but also avoid lock-in solutions and unforeseeable side-effects, and strategies to maximise long term socioeconomic impact. Activities under this pillar further seek to ensure the sustainability of energy technologies and solutions.

- **Pillar 3:** Management, coordination, monitoring, evaluation, and planning for the future long-term collaboration model of the LEAP-RE. This pillar includes partners from 11 African and European countries.

LEAP-RE is a huge consortium that is still in the launch phase; Pillar 1 proposals are being collected, tools are being developed, and ideas and views are still being exchanged. There is still room to collaborate in the implementation at different levels and in different projects. The project results will also be shared.

Comments and questions

1. **Participant opinion:** Stakeholders in Africa's energy transition should get clearer on what the continent and countries therein are transitioning from and to. Transitioning from fossil fuels to renewable energies may not work in Africa, as Africa's reality seems to be that fossil fuels are still key. Africa is not at the point to transition from fossil fuels to renewables. There seems to be a need on the continent to exploit fossil fuels first.

- **Mr. Cesar (Rwandan Ministry of Infrastructure):** Rwanda is on board with transitioning to clean fuels, in a bid to adapt towards the changing energy climate. This move is not just because of the international agreement to do so, but also because the country gets a sense of pride in playing its part in sustainable climate change mitigation. The country is also willing to learn from the development mistakes of

continents like Europe and South America. There is no need to make the same mistakes now that African countries know better. Fossil fuels will inevitably run out. It is, therefore, best that countries nurture renewables so they can move on somewhat smoothly when that happens.

2. **Are the energy resources (fossil and renewable) adequate to further the development of Africa?**

- **Ms. Makanza (IndustriALL):** The energy countries use is derived from the resources available. The energy mix of a country is defined by the existing resources within their boundaries. African economies must work with the resources they have and harness what they can, to promote access. There is a need to consider all relevant aspects, including financing, technical, resource, and political aspects, to ensure sustainable access to energy.

3. **Hydropower, in terms of how it has been applied in Rwanda, is a good strategy, but has an investment cost that is 2 or 3 times higher than that of solar. How does Rwanda justify the focus on hydropower?**

- **Mr. Cesar (Rwandan Ministry of Infrastructure):** Between 2012 and 2013, Rwanda was in an energy crunch and let in different private sector players somewhat indiscriminately to address the issue. As a result, electricity was expensive. The problem has since been addressed, and hydroelectricity is now costed at a rate commensurate with regional rates.

4. **Does LEAP-RE financially support 3-6-month internships/training in energy transition models? What opportunities exist?**

- LEAP-RE's structure focuses on capacity building, so there are indeed opportunities to be leveraged. Several partners in Europe and Africa are actively hiring young practitioners and making the effort to include them in the programme's development. The programme is at a point where stakeholders can collaborate to effectively address issues raised and convert them into 'pilot feedback actions' as much as possible. At present, the consortium is composed of 80% academic and research centres; their task is to foster capacity building through internships, but also strengthen international mobility, including students and PhD candidates. All stakeholder feedback is welcome and will be given due consideration.

5. **Suggestions, recommendations, and lessons learnt for LEAP-RE: How can social aspects be integrated into the LEAP-RE programme, also factoring in partner coordination?**

- **Ms. Makanza (IndustriALL):** The program should consider strategically and systematically setting up/leveraging platforms to ease constant consultation, inclusion, communication, and coordination among all relevant stakeholders. Consumer organisations and energy/energy-linked trade unions should also be included in the project, with room to not only deliberate on, but also implement, agreements within their scopes of influence. The capacities of all stakeholders that contribute to/are affected by the project should also be built to ensure that they can effectively weigh in, e.g. the communities for whom these projects are intended.

6. **What do you think about the involvement of the public sector and academia; how can this large multinational project be better coordinated?**

- **Mr. Cesar (Rwandan Ministry of Infrastructure):** The private sector engagement under LEAP-RE should be stronger to avoid a disconnect at the rollout level.

- **Participant opinion:** Start-ups could be a good private sector representative at the table, as they are more flexible and fast-moving in rollout than traditional private sector actors.

7. **Question to the panellists: In your experience, what are the key elements for successful partnerships and a fruitful intervention?**

- **Mr. Cesar (Rwandan Ministry of Infrastructure):** Fairness is key for fruitful collaborations in this energy transition process.

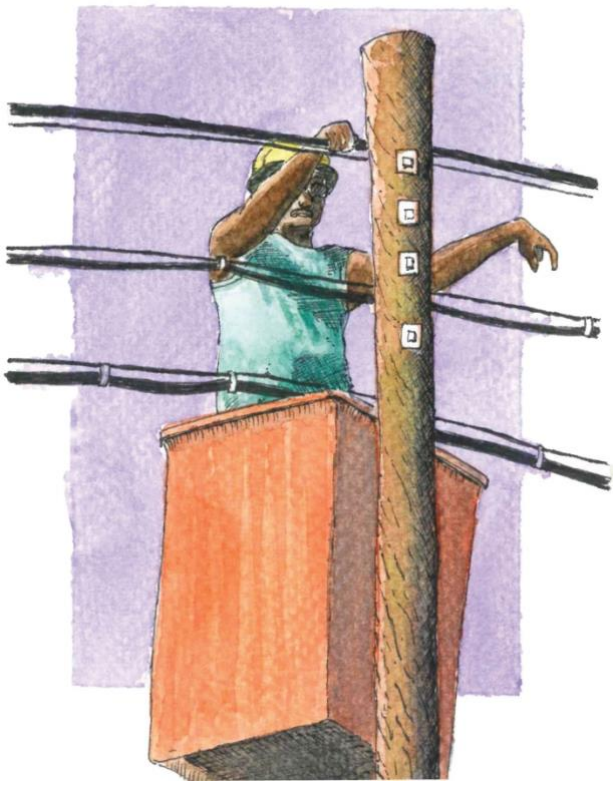
- **Mr. Lévêque (LEAP-RE):** Stakeholders need to coordinate, interlink, and establish all connection points for ideas and collaboration.

- **Ms. Tendai Makanza:** Transparency, accountability, and inclusion must be integrated into economic development processes. Furthermore, interventions under the energy transition should aspire to be not only profit-oriented but also human-centred.

Development of the energy sector in Rwanda

Energy Private Developers Association (EPD)

Dr. Alice Ikuzwe, Offgrid Data Expert, EPD



Up to 2004, the private sector's role in the energy sector in Rwanda was limited, as the electricity supply and access sector was seen as a public sector domain. The 2004 Energy Policy encouraged private investment in RE. In 2013, EPD was formed and registered. The association is one of 15 associations that make up the Chamber of Industry under the Private Sector Federation of Rwanda. EPD was formed to bring together private companies operating in the energy sector and serve as a platform for coordinating engagement with the government to foster successful public-private-partnerships (PPPs). It has 117 company members at present. The association aims to ensure that all Rwandans have access to modern energy through the achievement of universal energy access in an environment where the private sector can innovate, grow, and thrive.

EPD's member companies are grouped into 6 sub-sectors: solar home systems (SHS), hydropower, mini-grids (solar and hydro), clean cooking, transmission lines and distribution, and methane gas and peat. Most fall under solar and biomass.

To achieve its objectives, EPD offers 5 services:

- Advocacy – fostering a conducive environment for the private sector and community, e.g. by advocating for minimum energy performance standards on government distributed SHS to ensure high-quality, reliable service for the users.

- Capacity building and activities for members to improve their knowledge, skills, and competence, e.g. training on resource mobilisation, proposal writing, benchmarking visits, customer care, etc. Training is done in collaboration with partners.
- Investment facilitation – ensuring companies in the sector, especially off-grid companies, have access to financing, providing links to relevant institutions like government and banks. This effort fosters easy and frequent investment in the sector. EPD also organises and attends conferences to facilitate networking among its partners.
- Information sharing – organising dialogues and meetings with stakeholders to foster information sharing to support investment.
- Consumer awareness – awareness campaigns on RE and new government initiatives on RE adoption and programmes.

EPD's contributions

Grid-based electricity access: Through the rural electrification strategy, household access has increased cost-effectively. In line with this, EPD has signed memorandums of understanding (MOUs) with private companies to increase the supply of solar off-grid systems and improve the country's supply chain. In June 2021, private companies connected over 334,000 households to off-grid solar solutions, mainly through SHS.

Clean cooking: Despite the benefits of clean cooking, its adoption is still low mainly due to limited financial support, limited fuel availability, negative attitudes towards the technology, lack of awareness of the risks of regular stoves, and social and cultural influences. The Ministry of Infrastructure approved a Biomass Energy Strategy (2019-2030) that aims to reduce firewood-using households to 42% by 2024 and phase out charcoal use in urban areas. In line with this, private sector companies, with the government's support, are now fostering competition-based development of markets for clean cooking products and technologies.

From 2012 to June 2021, private companies distributed 902,000 improved cookstoves across the country. 302,000 of these stoves were distributed from July 2020 to June 2021. The transition from biomass to liquefied petrol gas (LPG) for cooking fuel can be seen through the marked increase in the use of LPG, from 0.9% in 2018 to 5% in 2020 countrywide, with Kigali registering a drastic increase, from 5% in 2018 to 26.6% in 2020. LPG imports also increased from 5,531.9 tonnes in 2016 to 28,265.5 in 2020.

Gender: Despite high gender equality, the number of women working in the energy sector is still low. EPD is doing the following to address their underrepresentation in the sector:

- EPD, in partnership with United States Agency for International Development (USAID) through the Women in Rwanda Energy (WIRE) initiative, set up an apprenticeship programme for new female graduates. The programme provides women the skills and knowledge needed for the energy industry.
- EPD builds women's capacities through training on energy technology and management skills.
- EPD also conducts gender equality training in the workplace, to not only enable career growth and increased income but also establish the norm of women as employees and discourage gender-based violence.

Challenges

Challenges faced by the private sector include:

- Limited access to finance, since local lenders deem the private sector risky.
- Capacity gaps among local key actors such as off-grid companies. These gaps exist in various aspects such as technology, supply chain, negotiation and networking skills, and knowledge acquisition.
- Supply shortage of off-grid products, e.g. SHS components. There is limited capital available to local solar companies, along with limited manufacturing on the continent to reduce costs.
- Incomplete organisational structures, which lead to prolonged or stalled processes, e.g. due to understaffing.
- Low sales and marketing capacities.

Stakeholders

EPD is affiliated with the Private Sector Federation (PSF) - Rwanda and the Rwandan Ministry of Infrastructure. To achieve its objectives, EPD has formed partnerships with numerous national and international companies, such as Rwanda Energy Group (REG), Rwanda Development Board (RDB), Rwanda Environment Management Authority (REMA), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), USAID, Shell Foundation, and bfz, among others. The association is mainly funded by the Shell Foundation and bfz.

Opportunities

Numerous opportunities exist for private sector companies in the Rwandan energy sector, including:

- Renewable electricity generation – Opportunities lie in consultancies, feasibility studies, engineering, procuring, and contracting.
- Development of transmission infrastructure - Investments in transmission systems are needed.
- Distribution - Smart grids and meters and off-grid solutions are critical for the country to meet its 2024 targets.
- Financing - Finance is required to fund the energy sector's plans for generation, transmission and distribution, and clean cooking.
- Capacity building - This is critical for improved sector performance, through adequately equipping the country's private sector.

EPD has supported the growth of the industry over the years and plans to keep improving to make the energy sector even more attractive to investors.

Market, programmes, and government support: Prospects for corporate development

Mr. Esdras Rugira, Acting Director, Energy Planning, Energy Development Corporation, Rwanda Energy Group

Rwanda Energy Group is entrusted with energy development and utility service delivery. Its mission is implemented under its two subsidiaries:

- **Energy Development Corporation Limited (EDCL),** which works to increase investment in new energy generation projects to meet the national targets, develop appropriate transmission infrastructure to evacuate new plants, and plan for and execute energy access projects to meet the national target.
- **Energy Utility Corporation Limited (EUCL),** which works to provide energy utility services throughout the country through the operations and maintenance of existing

generation plants and the transmission and distribution network. EUCL further facilitates electricity sales to end-users and the execution of power purchase/power sales agreements with independent power producers (IPPs) and other regional utilities, for import and export.

These subsidiaries were created to ensure focused attention on enhancing efficiency in utility operations on the one hand, and timelier and more cost-efficient implementation of development projects on the other. The companies are independent but closely aligned.

Programmes

To guide the implementation of energy programmes such as those on energy efficiency, economic development, poverty reduction, and national electrification, the Government of Rwanda has different policies to ensure that the country fulfils its targets. Policies that have impacted Rwanda's energy development and transformation include:

- Poverty Reduction Strategy Paper-II (2006-2008)
- Economic Development and Poverty Reduction Strategy (EDPRS II) (2013-2018)
- National Strategy for Transformation (NST1) (2017-2024)
- Energy Sector Strategic Plan (ESSP)
- Rwanda Energy Group Strategic Plan 2019-2024
- National Electrification Plan (NEP) (2018-2024) (revised in 2021).

In line with these policies and national targets, and to enable REG to meet its goals, the company has created the Energy Group Strategic Plan and a detailed National Electrification Plan. REG's progress on indicators extracted from the Energy Sector Strategic Plan, highlighting the status and targeted figures, is summarised in the table below.

Energy Sector Strategic Plan (priority indicators)	Status (June 2021)	NST1 targets (2024)
Generation capacity (with 15% reserve margin)	238.368 MW (installed capacity)	556 MW
Energy efficiency (losses reduced to 15%)	19.14%	15%
Universal electricity connection to all households	65.4% (47.6% on-grid and 17.8% off-grid)	100% (52% on-grid and 48% off-grid)

Universal electricity connection to all productive users	90.56%	100%
Biomass consumption reduced to 42%	77.7%	42%
Public lighting and street lighting	Street lighting completed on 190.73 km of roads	1,810 km

REG, through the Rwandan government, is working with different local, regional, and international partners like Japan International Cooperation Agency (JICA), Arab Bank for Economic Development, the EU, Energising Development (EnDev), and Enabel to successfully implement projects in the electricity access sector. Working with financial partners such as the European Investment Bank (EIB), World Bank, African Development Bank (AfDB), and Exim Bank, the project aims to provide electricity access to an estimated 1,004,713 customers (households). Of these, over 630,000 households will receive grid connections, and 370,000 will be connected to off-grid systems.

According to the NEP, an estimated 820,819 households are earmarked for grid extension and fill-in, 44,450 households for mini-grid electrification, and 370,000 households for stand-alone systems. These projects will not only be implemented by REG and its subsidiaries; Engineering, Procurement, and Construction (EPC) companies and contracts will also be employed to facilitate material supply.

The implementation of energy projects is guided by several key documents, including:

- Least cost development plan (generation) - Target: 556 megawatts (MW)
- Transmission development plan (2020-2028)
- Distribution development plan
- Access plan.

Government support to REG comes from policy, subsidies, and incentives, e.g. subsidies for SHS and clean cooking systems, to ensure affordability for Rwandans. The government has also supported REG by formulating development plans and policy documents to guide REG in shaping its development plan and implementing its business plans.

Comments and questions

1. **Is there a plan for Rwanda to be a key exporter of electricity, bearing in mind the strong demand in the region?**

- **Mr. Rugira (REG)**: Yes. The electricity currently being generated and imported can so far supply the existing load in Rwanda, However, the REG has plans to further export electricity in the future. Rwanda currently exports and imports electricity to and from the DRC. To expand existing electricity exports to the DRC, an interconnection substation is under development. Burundi and Tanzania are also being targeted as consumers, with an interconnection substation linking the 2 countries with Rwanda under development. The substation should be operational next year.
- **Mr. Cesar (Rwandan Ministry of Infrastructure):** Exports depend on Rwanda's surplus. Eastern Congo (Goma and Bukavu) and Burundi are two of the more attractive potential markets. However, there needs to be a strong framework to guide Rwanda's trading. This framework will automatically fall in place once the country has an electricity surplus.

2. **Any plans for smart grids, bearing in mind the challenges around hotspots?**

- **Mr. Rugira (REG):** REG is aware of them and is doing its best to maximise the efficiency and reliability of the system. We are working with smart equipment and planning for smart grid projects on the side of distribution management. Once these are in place, REG will advance to monitoring power flow from generation to end-users. REG is undertaking this project in partnership with other stakeholders.

3. **Is the government considering giving sovereign guarantees to offer technical or financial support for any major infrastructural development?**

- **Mr Cesar (Rwandan Ministry of Infrastructure):** Sovereign guarantees are meant to boost foreign investor confidence. They are given as a government's guarantee that the debt will be settled if the borrower defaults. These guarantees are mostly given when a government has a stake in a project.

4. **Tell us more about the electrification goals and how you track achievements in electricity supply.**

- **Mr. Rugira (REG):** For the connection targets, REG's plans and projections are drawn from the Rwanda National Institute for Statistics. The National Strategy for Transformation (NST1) is also guiding REG work up to 2024, targeting 100% electricity access for all households. If all goes as planned, the focus will move to productive use of electricity, targeting, among others, school and health centre connections. In terms of generation capacity, there are power plants in the pipeline that, once brought online, will enable Rwanda to reach its targets in the set time. Concurrently, hydropower is being developed in Rwanda, Tanzania, and Burundi. Solar projects are also being developed, in partnership with Exim Bank, India. These interventions are sure to increase the renewable energy market share in the country.
- **Dr. Ikuzwe (EPD)**: EPD has been working towards the targets set in the 2018 NEP, i.e. 52% on-grid connections and 48% off-grid connections. There is a 2021 NEP now, so the targets are moving. EPD supports the ongoing work to increase electrification by helping its members access finance—e.g. under a renewable energy fund, 15 companies have been approved to receive subsidies, and 14 have signed agreements with EDCL. These interventions are accelerating off-grid connections.
- In terms of clean cooking, EPD is building member capacities to write bankable proposals to access renewable energy funds. Members are also being trained to better negotiate/lobby, in line with the existing clean cooking policies and guidelines. EPD is further encouraging and supporting them in testing their cookstoves before putting them on the market. There has also been the establishment of standards for clean cooking, with the expected thermal efficiency set at 20 percent.
- Regarding EPD tracking, there is a database for monthly figures, especially off-grid connections. EPD receives these numbers from their members, assesses those numbers, and sees where to focus effort and support members to better achieve the national goal.

Workshop: Tracking and reporting SDG 7 progress in Africa

Tracking and reporting SDG 7 progress in Africa

Dr. Tekalign T. Sahilu, Senior Advisor, Water Resources & Energy, The Sustainable Development Goals Center for Africa (SDGCA), Kigali, Rwanda

SDG Center for Africa

SDGCA is an autonomous not-for-profit international organisation headed by a Board of Directors composed of the presidents of African countries and representatives from international organisations, academia, and the private sector. Based in Kigali, Rwanda, SDGCA started its operations in July 2016, going on to open a sub-regional centre in Lusaka, Zambia for the Southern African region. The centre provides technical support in monitoring/tracking and reporting progress towards the SDGs, including SDG 7: Affordable and Clean Energy.

Energy supply and consumption

The workshop, although on Africa, emphasised SSA, as it is one of the most disadvantaged regions in the world. The continent's main sources of energy supply are biofuels & waste, accounting for 44.7%, followed by oil at 23.1% (IEA 2019). As per the International Energy Agency's (IEA) 2019 report, of the total African energy supply, renewables account for 47%, and non-renewable sources, i.e. coal and natural oil and gas, 53%. The conventional natural gas and oil resources are more dominant in the North African sub-region. According to United Nations Environment Programme's (UNEP) 2017 Africa Energy Atlas, of all energy sources, Africa consumed mostly non-renewables (oil + gas + coal) - 92%, while the share of

renewables (hydro + nuclear + other renewables) was only 8 percent. The energy consumption data did not take into account biofuels, which are dominant in SSA.

The IEA Africa Energy Outlook projects that in 2040, Africa will be generating more electricity from renewables (60%) than non-renewables (40%). This projection indicates the potential of the energy transition, as the figures were 20% from renewables and 80% from non-renewables in 2018. At 487 kilowatt-hours (kWh) per capita, SSA had the lowest electricity consumption in the world in 2014. This figure is over six times lower than the world average and over 27 times lower than the region with the highest consumption, North America. The low level of electricity consumption highlights the high reliance of the SSA population on traditional energy sources like biofuels, the usage of which harms health and the environment.

Discussion point: Given that Africa uses more renewable energy than any other continent, primarily due to its prevailing overdependence on biomass, how can Africa's enormous renewable energy resource potential be transformed in a modern, efficient, and environmentally friendly manner?

- African countries need to implement more training/awareness raising so that people have sufficient capacity to adopt the various RE technologies that can help the continent leap to a more sustainable economy. This aspect should even be integrated into school curriculums at all levels.
- There is a need to avail of RE technologies to support such an energy transition.
- Scaling up pilot projects and integrating them into SSA's national plans will support a sustainable energy transition.

Access to modern energy

Energy poverty remains a serious obstacle in SSA. The region has the lowest electricity access in the world. There is also a high disparity in electricity access between urban and rural areas in SSA. There is therefore a need to focus more on rural access. Of the 48 countries in SSA, over 58% (28 countries) have electrification rates below 50 percent. Concerning access to clean cooking fuels and technology, SSA has the lowest access in the world.

Tracking progress

The rate of RE access has not kept pace with the population increase. There were more people without access to electricity and clean fuels in 2019 than there were in 2010. If nothing changes, even more people will be without access to electricity and clean fuels in 2030.

Discussion point: Do participants share these concerns of not meeting the SDG 7 targets by 2030? If so, what are the major challenges? What opportunities exist? What practical measures need to be taken to remove the barriers to achieving this goal? Has the pandemic exacerbated the problem?

- Much of Africa's progress is hindered by the economic situation. For example, the Ugandan government is not investing enough in the energy sector. Besides that, consumers have no purchasing power. The situation has worsened due to the COVID-19 pandemic. Even those who had connections before can now not afford to pay for electricity, and demand for solar systems has dropped.

Challenges

A UNEP study states that for SSA to reach the SDGs, United States Dollar (USD) 43-45 billion would have to be invested per annum. In contrast, only USD 8-9.2 billion is available per annum. Other challenges include insufficient data, including tracking data, lack of finance, lack of accompanying regulations to attract investment, absence of demand control management/measures, inadequate skills, and poor resource assessments, among other aspects.

Opportunities

However, many opportunities for progress exist. These include abundant RE resources on the continent, ever-increasing energy demand, increasing energy access, job creation, improved wellbeing, many climate change mitigation and adaptation initiatives, and vast potential for an energy transition.

Global and regional initiatives to promote sustainable energy in Africa

Global and continental development policy processes to promote sustainable energy in African countries include:

- The combination of the adoption of the 2015 Paris Agreement and SDG 7 of the 2030 Agenda for Sustainable Development
- The designation of 2014–2024 as the "United Nations Decade of Sustainable Energy for All" in the African Union Agenda 2063 on Energy
- The creation of a Solar Alliance, of which 49 out of the 54 African countries are either members or prospective members
- The African Renewable Energy Initiative.

Initiatives that have been undertaken by SDGCA and its partners include:

- Optimal energy mix planning, which is being implemented in partnership with UNEP. This intervention provides support and guidance to 13 Eastern & Southern African countries in optimising their energy mixes (predominantly hydro, solar, wind, and geothermal resources) to help achieve global and continental development targets, i.e. the Sustainable Development Goals, Paris Agreement 2015, and African Union Agenda 2063: The Africa we want. A concept note has been developed to facilitate this work.
- The establishment of a water-energy-food nexus research initiative in the agricultural sector, which focuses on solar energy and rainwater harvesting for arid and semi-arid areas in Africa. The initiative aims to enable rural households to maintain their livelihoods through the utilisation of the water-food-energy nexus under changing climatic conditions.
- The development of the Renewable Energy for Africa Agriculture Sector initiative based on best practices and accumulated knowledge. This initiative assesses the nexus between renewable energy, water, agriculture, and socioeconomic development in Africa. This initiative was also presented under LEAP-RE; SDGCA participated in the initial phase of the LEAP-RE programme. The centre coordinated the universities and other partners that were participating in the programme. While administrative issues at present hinder collaboration during the implementation phase, SDGCA still supports the LEAP-RE initiative.

While these initiatives provide a strong foundation for Africa's energy transition, there need to be more extraordinary efforts to overcome the challenges, exploit opportunities, and accelerate the provision of access to modern energy. The energy transition in Africa entails shifting from non-renewables to renewables and from the traditional way of using resources to a modern, economical, and efficient way. It also involves removing physical, legal, financial, socio-cultural, and political barriers, especially for the poor and disadvantaged groups, in order to increase access to basic services. Africans need to join hands to get rid of energy poverty and all other forms of poverty.

Comments and questions

1. **What recommendations do you have for governments and ministries that must report on their achievements/progress annually? How can they work with their statistics offices to get good results? Who oversees data validation and tracking?**

- SDGCA collaborates with national governments, NGOs, and international partners to ensure that data collection, analysis, and reporting happen regularly. All stakeholders, especially national governments, however, must follow this process and track the generated data.

2. **What is the role of academia in government-led processes for tracking and monitoring data?**

- Academia's role includes contributing data to data collection processes, alongside other stakeholders, e.g. the private sector.

- The involvement of universities and the private sector can also be leveraged to support capacity building, data collection, and analysis. As a regional organisation, the SDGCA is strategically placed to enable exchanges between research institutions and foster collaborations to facilitate meaningful data collection.

3. **Are there opportunities for internships and exchanges for recent graduates at SDGCA?**

- Yes, SDGCA encourages such networking and partnerships. So many sectors are involved in the SDGs, and, thus, collaborations are important now, and will continue to be in the future, to support SDGCA's work. At present, SDGCA hosts interns and volunteers from different universities and governments. There are plans to focus more on this area in the future.

4. **Which RE resource do you think is going to spearhead this transition, according to the data at your disposal?**

- Hydropower and solar, followed by biofuels, although there is a need to find more modern uses for biofuels. It is imperative to sustainably harness and use the continent's existing resources. These resources include geothermal, solar (off-grid systems), and hydropower. However, to enable this, existing barriers need to be removed.

5. **SDGCA works closely with JICA. Is there still room for other development agencies to monitor and evaluate indicators on energy and water sanitation?**

- Yes. SDGCA also works with Korea International Cooperation Agency (KOICA), regional development banks (e.g. African Import-Export Bank and Africa Development Bank), national banks, and other international partners. Financial institutions must be involved, especially when talking about financial crises and how the capacities of the institutions can be built to support the implementation of the different African energy programmes more effectively.

6. **Considering that the different workshops in this seminar will be exploring stakeholder partnerships and collaborations on different initiatives, including research, finance, e-mobility, and hydrogen, among others, how can the role of development cooperation in a just transition on the continent be better shaped?**

- Africa needs to form partnerships, not just on the continent, but also between the North and South. These partnerships must be enhanced using, among other things, the continent's local/regional capacities in all areas. SSA does not only have enormous energy challenges, but also enormous energy potential. Initiatives must therefore focus on closing the gap through idea exchange, innovation, research, and development of sustainable, impactful solutions.

- Among Africa's main challenges is a prevalent inability to pay for energy services. Investors on the continent must factor this into their planning and implementation if their interventions/solutions are to work. The government must intervene by employing subsidies where needed. The private sector must consider how to operate in places where people simply cannot afford to pay for the services. Otherwise, the access disparity will grow. The SDGCA Social Boundaries Report highlights the exclusion of sections of the population from energy services due to various reasons. There is a need to develop integrated solutions to this.

7. **Do you think that solar PV or wind power will dominate the electricity supply in the medium and long term? Do you think this generation will be centralised, distributed, on-grid, or off-grid, or a combination of these?**

- All participants in the workshop were encouraged to discuss this question.

- **Mr. Cesar (Rwandan Ministry of Infrastructure)**: In Rwanda, currently, the final goal is to have every household on-grid. Hydro or solar PV mini-grids will only be installed in certain areas that are too far for grid connections in the next 8-10 years. The standards for these installations will have to comply with the national utility standards. Once the mini-grids are installed and running satisfactorily, citizens shall enjoy this electricity source. When the grid reaches these areas (projected in 2030), customers

will then have the option to choose their source of electricity, as there will now be two effective power supply sources in these regions—the main grid and mini-grid.

8. **Most energy developments are financed through loans. As a result, the project costs and subsequent tariffs are quite high. Can the SDGCA or other institutions support the formulation of arbitrary energy generation contracts?**

- **Dr. Sahilu (SDGCA):** No. This is outside of SDGCA's mandate. Financial agreements are usually bilateral, between the national government and funding organisation.

- **Mr. Cesar (Rwandan Ministry of Infrastructure):** There are other institutions, however, that could step in as needed to act as an external mediator to re-check the tariff of the operator, but this is rare, as most of the time, the tariffs are mutually agreed upon.

Renewable Energy Development in the Continent

Tuesday, 26 October 2021

Day 2: Renewable Energy Development in the Continent - Tuesday, 26 October 2021

Moderator: Ms. Giselle Bamundekere, Munyax Eco

Opening session: Renewable energy development in Africa

According to Ms. Bamundekere, forecasts show that by 2050, solar PV power will represent over 50% of the total electricity production in Africa. This implies that renewable energies are and will be affordable and reliable, when backed up by alternatives like thermal power plants. However, without a long-term vision, meaningful cooperation, and transnational planning, the energy transition may not take place.

ENGIE Energy Access (EEA)

Ms. Sylvie Kanimba, Managing Director, EEA Rwanda (formerly Mobisol)

EEA works in the off-grid power sector in Africa. The company has a product range with 3 different solutions: SHS, mini-grids, and pay-as-you-go (PAYGO) software. The company is operating in nine countries, with 6.5 million lives impacted thus far. The company aims to have impacted 20 million lives by 2025.

Interview sessions on RE development on the continent, with Ms. Sylvie Kanimba - Managing Director, EEA Rwanda and Louis Rwagaju – Head of Corporate Partnerships and Government Relations, EEA Rwanda

Interview I – Ms. Sylvie Kanimba - Managing Director, EEA Rwanda

1. **What is required at the national and continental level to facilitate large-scale deployment of renewable energy technology**?

- There need to be policies and regulations that facilitate the private sector or companies involved in renewable energy to easily introduce RE technologies in their sectors of operation.

2. **What are the main challenges stakeholders face in catalysing the energy revolution, and how can they be addressed?**

- One of the main challenges is an incompatible mindset in Africa, whereby many do not yet see RE as a feasible alternative to traditional energy sources. There should be more widespread awareness campaigns on RE as a feasible energy solution and suitable alternative in African countries. The government can support this shift in mindset with appropriate policies and regulations.

3. **What existing partnerships contribute to renewable energy development in Africa?**

- Regarding ENGIE, partnerships are mostly with financial institutions like the World Bank and AfDB. The EU and Power Africa also support many energy projects, specifically in Rwanda and the 8 countries where EEA is active.

Interview II - Louis Rwagaju – Head of Corporate Partnerships and Government Relations, EEA Rwanda

ENGIE supplies and installs solar systems in rural areas. These include SHS (100-200 watts (W)), with advanced utility, i.e phone charging and powering televisions and cooling fridges, for middle-income families. There are also smaller systems (pico) for low-income families. Engie is also expanding to now provide bigger systems for productive use to customers like hotels. Additionally, ENGIE is designing and building mini-grids for villages and bigger manufacturers.

1. **How long has EEA (formerly Mobisol) been working in Rwanda, and what are your achievements?**

- Mobisol was registered in Rwanda in 2013. Service and distribution centres cover all districts across the entire country.
- So far over 50,000 families and approximately 500 schools and health centres/posts in rural areas have been reached with SHS.

2. **What are the main partnerships that have you maintained since the beginning?**

- ENGIE's main partnership has been with the Government of Rwanda, which adopted a policy for universal electrification by 2024. The government has done a lot of public awareness and education campaigns at the grassroots level using district local governments and leaders in the villages to show people the benefits of alternative RE

solutions. In the past, there was a general mistrust of RE technologies, and hydropower was also the only source of RE being exploited.

- A grant from the EU helped the company roll out the PAYGO system in Rwanda, which allows customers to pay for an SHS in instalments for up to 3 years.
- EEA customers have also participated in a government subsidy programme, which is funded through grants from the Renewable Energy Fund managed by the Development Bank of Rwanda (BRD). It is a demand-side subsidy that contributes a percentage of the system price to make it affordable for low-income households.

3. How did Mobisol engage the local people from rural areas, i.e end users? Have you involved researchers?

- Market surveys were done to find out the customer needs and what they could afford, the existing Local Government (LG) structure, microfinance institution (MFI) structure, and all other financial institutions there. The survey included banks and telecom companies (necessary to facilitate the PAYGO model for revenue collection - MTN mobile money) and revealed a huge demand for electricity in off-grid areas, despite government efforts to expand the grid quickly. This research informed the design of SHS of appropriate sizes for different households with different appliances.

4. Would you recommend the same business model approach in other African countries?

- The replicability of the business model used by ENGIE has to be assessed based on the specific context, as many situations and realities vary across the continent. Cross-cutting aspects to consider include financial affordability, limited electricity access in rural areas, poor infrastructure, and high investment for grid extension. These are common issues that can be addressed by operating a solar PAYGO business model, which can provide lighting and power for other appliances, enhance children's education, and improve social conditions for many families across the continent. Partnering with development aid organisations can help speed up this process.

5. In a country where the government is not as supportive as the Rwandan Government, what other strategies can be adopted?

- It is difficult for private companies to achieve success without government intervention and backing. The major stakeholder in electricity provision across the country is the government. The private sector can help, but with very limited success. The government must provide a conducive and secure environment for private investors to conduct business successfully. It is the government's role to establish infrastructure, provide security, develop policies, and assist businesses in obtaining loans. Private investors can then enter the country, in the appropriate business environment. For example, in Rwanda, good road networks make it easier for investors to access all regions across the country.

6. What are your recommendations for companies involved in energy access provision regarding how to work efficiently with the government?

- The Government of Rwanda, in partnership with so many other stakeholders, including private companies, has only achieved a 67% electrification rate. 33% of the population is still unable to afford electricity and still uses kerosene for lighting. Children cannot do homework in the evening when it is dark, and their standards of living are generally low. These challenges point to business opportunities for private companies to intervene and make an impact by supporting this section of the populace to sustainably transition to improved living conditions. To facilitate this, companies must inform themselves of, among other things, the market needs, existing legal framework, taxation system, and business registration process in the country of operation.
- For Rwanda, a new business/private company must register with the Rwanda Development Board (physically or online) and get certified. The private company can then carry out field visits and conduct market surveys to better understand the market needs on the ground, e.g. what kinds of solar systems are needed by and affordable for the local communities. This information can support the proper design of solar systems. Private companies must also market and sell good-quality systems, not only to maintain a good company reputation, but also to foster sustainable operations. Maintenance services should be planned for as well, and service centres, be well-situated (geographically) to promote sustainable operations.

7. What mechanisms does EEA Rwanda have in place to ensure timely and quality maintenance services?

- The Ministry of Infrastructure, in partnership with various stakeholders, including the private sector, has put in place an SHS minimum standard requirement of a 1.5-day

self-autonomy period—i.e. without sunlight, the system battery can store enough electricity for 1.5 days. All SHS imported into Rwanda must meet this standard. Additionally, these systems must be certified by international and local testing laboratories. In Rwanda, the Rwanda Standards Board must test a sample of all systems imported to ensure that they meet the standard requirement. If the systems do not meet the requirement, they are not eligible for supply in the country.

- Internally, EEA Rwanda has recruited technicians and established an academy with qualified trainers who train technicians. Every district has sales representatives, installation technicians, and maintenance technicians who regularly visit customers. EEA Rwanda works to ensure that maintenance is carried out within 48 hours of receiving a complaint. A software database helps monitor all the cases and complaints from the different provinces. Automatic notifications are sent to the nearest maintenance technician, who must provide a solution to the customer within 48 hours. Corrective measures are taken in case the 48-hour agreement is breached.

8. How can an organisation establish a partnership with EEA Rwanda, and what are the requirements? What kinds of partners are you looking for in other countries, e.g Ghana?

EEA Rwanda engages in different kinds of partnerships, including:

- Business-to-Business (B2B) partnerships - for partners who want to operate a solar business in another country, e.g. in Ghana, but have no time to do technical design, conduct studies, or source quality systems, etc. With a signed B2B contract, EEA Rwanda can supply their SHS to the partner for local distribution.
- Corporate Social Responsibility (CSR) partnerships - with big corporations like banks and telecom companies that have a CSR budget for promoting electricity access for vulnerable populations. EEA Rwanda supports such interventions by supplying the systems to their intended targets through a CSR partnership agreement.
- Banks and MFIs have also partnered with us to provide loans to customers to acquire SHS. In Rwanda, EEA Rwanda has partnered with nearly 40 MFIs to reach the rural population. The MFIs/banks give loans to people to facilitate access to SHS, and these people pay back the financial institutions gradually over time after being served by EEA.
- Subsidies with several organisations, e.g. the Sustainable Villages Foundation (SVF). In SVF's case, the organisation pays a certain percentage for the system, and the end-

user pays the remaining lower, but significant amount for the system. This method promotes not only affordability, but also ownership.

- **Mr. Hauschopp (Sustainable Villages Foundation):** SVF, in partnership with EEA Rwanda, cooperates with existing local saving groups. Payments are channelled through these groups to reduce default rates and credit management costs. The collaboration with ENGIE (former Mobisol) is 2 months old and has been working very well thus far.

9. Have there been any partnerships with researchers, and what are the benefits of involving researchers?

- Research is a useful tool for business development. It helps with understanding the market and designing appropriate products. EEA Rwanda (formerly Mobisol) began with only two products: the 100 and 200 W systems. Through research, the company expanded its product portfolio.
- EEA Rwanda has an internal team of researchers and business developers constantly doing surveys to assess aspects such as customer demographics, customer needs, performing and non-performing systems, customer satisfaction, and customer financial situations to establish, for example, why people are not paying regularly and their sources of revenue, among other things. Such information and findings prompted Mobisol to develop smaller products for low-income households, while also expanding to provide bigger systems for productive uses, as the team discovered a huge demand for systems that provide up to 10 kW of power among manufacturers, big farmers, and industry owners.
- Research keeps the business striving for excellence and staying current, enabling the company to operate sustainably.

10. Is there ongoing research and development regarding product improvement, especially regarding intermittency in solar systems?

- EEA Rwanda is well-known for the strong batteries in its SHS. SHS batteries must have a good life cycle and be of good quality. The batteries in Mobisol SHS can store electricity for between 1 night and 2 days. The bigger solar systems of 1, 5, and 10 kW even enable households to own and generate their own electricity. Big energy consumers are given many batteries and inverters to ensure continuous use and storage of solar electricity.

- A digital platform/database monitors the daily battery operations, capturing information on the amount of energy stored and consumed per day, among other things. Our engineers, technicians, and solar experts monitor and analyse battery performance using this information to improve existing batteries and introduce new modified types of batteries.

11. Where is innovation needed most to ensure a sustainable energy transition in Africa?

- With Rwanda as an example, 85% of primary energy consumers still use biomass (charcoal and wood) for cooking. There is a need to shift from traditional cooking technology to more modern solutions like improved cookstoves (ICS) and solar cooking systems. Uptake of these cleaner technologies will protect the environment by reducing carbon dioxide (CO_2) emissions and, in turn, help the continent. Universal electrification is also a top priority. A third of households in Rwanda still use kerosene lamps, which produce a lot of CO_2 emissions. These people should be supported to transition to solar electrification. In parallel, the government and its partners can work together to extend the grid to areas it has not yet reached.

12. How does ENGIE/Mobisol engage women as both employees and end-users in working towards a sustainable energy transition?

- ENGIE is an equal opportunity employer that sees the participation of both men and women as a means to bring about faster sustainable development on the continent. The company encourages women to apply for all positions and respects women's rights. Women are also encouraged to participate actively in company operations for sustainable and inclusive development.

13. If you had the power, what is the one thing you would change to achieve universal energy access on the continent?

- People's mindset needs to change. There is a need for greater participation of people in embracing RE electrification and technologies. Partners and government cannot provide everything; people also have to contribute to the effort and choose to improve their standards of living. This change in mindset will expedite the impact of government and partner efforts, leading to universal electrification.

Panel discussion: Harnessing renewable energy potential in Rwanda and beyond

Renewable energy in Rwanda: Local context, challenges, and recommendations for fostering the energy transition

Mr. Anicet Munyehirwe, CEO, Geni Green Solutions

Understanding the local context

The energy demand in Rwanda, and most of Africa, is largely met by biomass energy, especially in terms of cooking energy. This points to a real need to focus more activities and funding on biomass and cooking energy. Furthermore, most of the African population still lives below the poverty line. Therefore, when thinking about the energy transition, private sector actors need to understand the priorities of the local communities, assess their ability to pay for potential solutions, and determine the most appropriate solutions for the next 5-10 years.

Challenges

Challenges include market distortion due to government and donor funding, which does not adequately support the market-driven sector. Most of the RE interventions do not respect market principles. Most efforts/funds are directed at creating output and not impact. More money is spent on overheads and activities that go directly to the development of the sector, whereas less money is spent on technology transfer and production of equipment/material to produce renewable energy, e.g. hydropower, even though Africa has a lot of potential to develop these resources.

Furthermore, Africa has limited local/homegrown technologies. Most RE systems are designed and manufactured abroad, e.g. in Germany and China, and shipped to Africa, an aspect that impacts the continent's potential for a sustainable transition. African governments are generally not spending on building local capacities to manufacture these technologies or leading in the development of these technologies internally, e.g. by developing turbines for hydropower.

Additionally, the absence of customised homegrown RE solutions for cooking and lighting may hinder the transition. Most solutions are shipped to Africa and are designed to fit a certain context that may not match that of the target area. For example, improved cookstoves that work in China may not automatically meet the local needs in an African country, since such needs were not factored in during the system design. There is therefore a need to customise or develop these solutions in Africa, rather than import them.

Recommendations

The RE market/sector should also be allowed to run on the market principles of supply and demand, with the government regulating the sector, putting in place quality control systems, and giving licences, while leaving private companies room to operate in the market. Subsidies given only to a few private sector companies inhibit the innovation capacity of the African economy and will also inevitably kill the RE market in general. Funds could instead be channelled to the end-users to enable them to choose the most ideal solution for themselves from among the different solutions on the market. This would promote sustainable access to electricity.

Mr. Munyehirwe opined that the current North-South partnership (especially in Rwanda) makes Africa seem like an international testing laboratory for RE technologies. A comprehensive study of the existing products in the value chain is needed to foster understanding of what enables the success or failure of products on the market and explain why many people still opt for kerosene, or, increasingly, Chinese-made battery-powered lanterns, for lighting solutions. Learnings regarding these aspects can inform Africa's planning for the energy transition.

In conclusion, the market should remain open and create or support local/homegrown solutions. Funding aimed at supporting access should also target the demand side, rather than only the supply side.

Comments and questions

1. How is Geni Green Solutions coping in the market?

- Geni relies on locally available raw materials and only sources a few from abroad. Thus, despite the market conditions, Geni has remained competitive. The company also gets government tenders, which has led to large sales of thousands of ICS in Rwanda this year. This model, although good for the company, is not necessarily sustainable for the sector, as it is not market-driven, but rather a tender from the government and donor partners. The model also does not facilitate technological transfer.

OffGridBox

Mr. Christian Yesashimwe, Project Manager, OffGridBox

OffGridBox offers rural communities in East Africa access to clean energy and water. The product is durable and offers one solution to multiple rural community problems. The company also provides local employment, with a strong focus on women entrepreneurs that manage the OffGridBoxes, hence supporting economic development in the area.

The company is registered in the United States of America (USA), with a sister company registered in Rwanda. OffGridBox has been operational in Rwanda for about four years. The company operates in the region, particularly Rwanda, because there is an established need for the services it provides, i.e. 1.7 million people without access to basic electricity and 5.1 million

people without access to safe drinking water. The Rwandan government aims to provide universal energy access by 2024, with 48% of households using off-grid solutions. It further aimed to provide universal access to safe drinking water by 2020.

Furthermore, Rwanda has taken steps to become a hub for investors to pilot their RE technologies; the investment and policy climates are quite favourable and make it easy for the company to operate and work towards the national electricity and safe drinking water goals.

To date, 30 boxes have been deployed in Rwanda, providing over 50,000 people with clean water and energy, with each box providing 5 jobs for community members and sustainable utilities for 400 families. Four more boxes will be deployed in the country before the end of 2021.

With just 20% of the installed power, the boxes can pay for themselves in 5 years. The company is working to ensure that in the future, this additional energy can provide an expanded portfolio of services, including solar water pumping for irrigation, vaccine refrigeration services, and electrification of learning centres/schools. In Rwanda, presently, the boxes serve the functions of water purification, productive use, and electrification (micro-grid) of health centres.

OffGridBox also operates in other countries, including the DRC, Tanzania, Somalia, Uganda (used in the refugee camps), Madagascar, Italy, and the U.S., among others.

Water and energy solutions: container for water, power, and connectivity

The 8 cubic metre (m^3) boxes provide 12-32 kWh per day of off-grid electricity, which can be used for different purposes such as water purification and power for productive uses. The box also has a water module that purifies water from different sources, e.g. rainwater and ground/underground water, producing 1000 litres (L)/hour (hr) of clean water. This eliminates the need for communities to travel far to collect sometimes undrinkable water. The box also has an electricity storage capacity of 15-50 kWh.

Among the box's competitive advantages are the fact that the box is so easy to deploy, taking a short time to set up (3-hour installation), and the box is durable and has proved itself disaster-resistant, having survived a cyclone in Madagascar. The box has other unique features, including Plug & Play functions, an anti-theft shelter, a PAYGO app, and Wi-Fi (cellular 2G & 3G). These boxes are monitored remotely for power production and consumption statistics to make sure they are running optimally. Several add-ons have been developed for coastal island

communities, such as a desalination unit, micro-grid for productive use, and drip irrigation systems to benefit local farmers.

Box sizes vary and can be customised, based on the community's demand and needs. In Tanzania, one of the boxes has been adapted to purify water from a borehole over a kilometre away. This has greatly enhanced the community's access to safe drinking water.

Water solutions

The box's water module offers three water distribution models:

1) Ayacu branded water - Water is purified, bottled, branded, and sold at an affordable cost. The water is produced and distributed in peri-urban areas. Its quality complies with Rwanda Standards Board (RSB) standards. The water premises are further regulated by Rwanda Food and Drugs Authority. OffGridBox sells 10,000 L of Ayacu drinking water per week at different outlets.

2) Affordable and clean dispensed water - To cater to rural populations who cannot afford bottled water, OffGridBox's model entails producing and distributing purified drinking water right at the box. A litre of water is sold at Rwandan Franc (RWF) 50. The model makes use of German technology—Lorentz smart app technology, which enables the tracking of the amount of water being sold and how many people the box is impacting with clean water. The purification of rainwater, groundwater, or surface water from lakes or oceans is done with the help of specially engineered solutions like desalination, particularly for units deployed in islands or coastal communities.

3) The water module in the box can also be used for productive activity. The box supports the provision of purified borehole water for community use, e.g. irrigation, livestock, and other domestic use. This approach is quite useful for coastal and island communities.

Energy solutions

OffGridbox provides clean energy to households, businesses, and public institutions like health centres and schools. More specifically, OffGridBox focuses on the following:

i) Family kits, which have 1 lithium battery pack, three 2 W light-emitting diode (LED) bulbs, and phone charging adapters. These kits are sold in the target communities. Recharging the power battery bank is fairly easy, as the box is within reach of most households. For households that are further away, there is a delivery mechanism that can be set up between the customer and box keeper by phone.

ii) Powering productive use

iii) Using microgrids to power schools and health centres.

Other contributions to the rural communities include:

- Local women entrepreneurs are hired to manage the boxes. All the boxes are run by women who are equipped with the necessary resources, knowledge, and material to ensure they can successfully run the boxes.
- There is a revenue sharing model for communities to ensure the box's sustainability. Of the money made from the boxes, a certain percentage is allocated to the community to ensure their participation for maximum sustainability.

OffGridBox's work, therefore, supports the energy transition by replacing fossil fuels and disposable battery usage with cleaner energy in businesses, households, and community institutions. OffGridbox implementation is not without challenges, the biggest being the high investment costs, which, in turn, require a high return on investment, particularly in low-income communities. The hope is that the technology prices will eventually drop. There is also a lack of expertise in the energy sector in Rwanda, which has negatively impacted clean energy deployment. Additionally, there is a need to adjust the electrification plans, with greater clarity needed particularly for off-grid and micro-grid investors, who may face sudden competition from the grid in the future.

Nonetheless, several opportunities exist in the renewable energy transition:

- There is a large market across Africa, with many SSA countries still not electrified. Energy companies therefore still have a large market for exploration.
- The policy environment in Rwanda is also improving, by providing incentives to renewable energy players, but these need to be allocated better.
- Technology is also still improving.

Comments and questions

1. How can an organisation enter into a partnership with OffGridBox, and what are the requirements for such a partnership?

- OffGridBox is open to partnerships with anyone with a vision to impact a community, people looking for an exciting job, donors looking to make an impact, and government institutions, among others.

East African Power

Mr. Dan Klinck, CEO and Founder, East African Power

East African Power (EAP) is an integrated renewable energy development and engineering company that delivers affordable and reliable clean energy solutions. 95% of EAP's projects are outside Rwanda, although Rwanda is its base of operations. EAP operates on a build, own, operate, and transfer basis. Out of its 200 staff, 150 operate in Rwanda alone, with the figure expected to double in 3 years. EAP has over 50 projects in development across Africa, with a specific focus on the South African power pool in hydropower and solar energy.

The expectation on the Rwandan front is to see a combined, unified approach from the public and private sectors to addressing energy issues. Rwanda has set a good example of successful PPPs that can be replicated in many other countries. Rwanda is also a good place for technology developers to establish their base in Africa. PPPs are a way forward in efforts to transition to RE.

Comments and questions

1. **What is required at the national and continental level to facilitate large-scale deployment of RE technologies?**

- Some challenges seen are on a macro level; for example, the COVID-19 pandemic has impacted the logistical cost of moving equipment, particularly in the solar markets. There have been some disruptions in the supply chain whose impacts may still be seen 6-12 months on. This has led to a delay in meeting short-term targets.
- On a more long-term basis, there are two major downsides: the cost of capital and cost of human capital. Regarding the cost of human capital, educational developments are not matching the speed of technological advancement. Millions of new jobs will be created, but there is likely to be a human resource gap. Therefore, academia needs to quickly catch up with the technological advancement taking place.
- There is also a need to address significant issues regarding the cost of capital. The cost of debt and senior lending is still too prohibitive from the developers' standpoint, which limits the ability to bring down the cost of the new generation, both on- and off-grid. The solution is blended financing instruments with more participation in PPPs, as governments have access to cheaper capital in these arrangements.
- In the East African Power Pool, generation investment is doing well, but transmission and distribution are still lagging.

2. Challenges faced by companies in the RE revolution

- The development process is not as fast as desired or envisioned. A lot of patience and diversification is required. The expectation is that the developer (for on- and off-grid development) is operating within a conducive regulatory environment that lends itself to a clear investment process. The project timeframe may be expected to be 1-2 years, including licensing, permitting, feasibility and environmental studies, off-take agreements, power purchase agreements (PPAs), and implementation. The reality is that this is a 5-7-year journey in SSA.
- There is generally a lack of developers in the region due to difficulty finding conducive regulatory environments and standardised agreements. This eventually comes down to the cost of capital to make the projects bankable.
- EAP is now setting aggressive timeframes for gender equity, but in the engineering department in particular, it is very difficult to fill the gap. With an 80:20 male-female ratio, the question of how the gap will be filled, factoring in the inclusion of women as operators, technicians, and implementers, remains. Programmes like Women in Renewable Energy (WIRE) and POWERHer will help EAP bridge that gap, but it is going to be a significant challenge in the next 3-5 years to achieve this.
- Access to affordable or blended capital: There is a lack of grants and subsidies for feasibility studies. There have to be more grants made available for this activity, in order to de-risk the projects on the front end.

3. What is the significance of partnerships in RE development, and what other resources are needed to invest in partnerships?

- **Mr. Klinck (EAP):** PPP frameworks need to encourage a fair market where private operates run the RE systems for a period of about 25 years, and at the end of that period, the assets are transferred to the host government or community to operate in the long term. PPPs provide a lower cost of capital.
- Partnerships need to be thought of for longer periods and not the typical 5-10 years. The challenge is that the regulatory framework around PPPs is complex, and more intensive training is required for a process like this.
- **Mr. Yesashimwe (OffGridBox):** The supply and demand imbalance can result in project delays. When demand is lower than supply, this can be a barrier to healthy PPPS. However, the gap in human capital presents an opportunity for investors; it should not be looked at only as a challenge.

4. **Which technology will be dominant in the future?**

- **Mr. Klinck (EAP):** Solar and hydro may take up 60% of the market share.

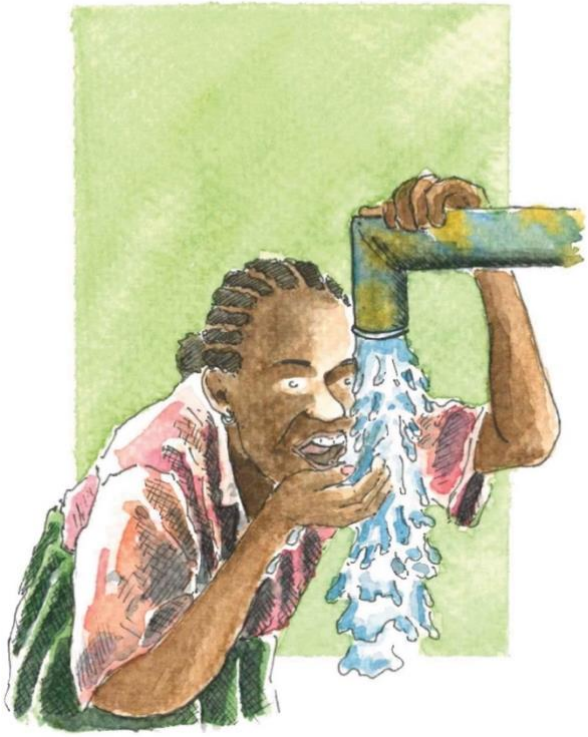
5. **If you had the power to change one thing to accelerate universal energy access, what would it be?**

- **Mr. Munyahirwe (Geni Solutions)**: Rural electrification through hydropower and building local capacities. In cooking energy, we have to improve biomass technology efficiency.
- **Mr. Yesashimwe (OffGridBox):** Having a conducive policy framework environment would enhance investment in clean energy. Involving investors in designing these policies can drive more clean energy deployment.
- **Mr. Klinck (EAP):** Privatisation of utilities across sub-Saharan Africa would accelerate the necessary energy reforms to close the energy gap.

Webinar: Approaches to enhancing energy access in rural areas

Water to survive. Energy to advance. The JuruProject in Rwanda

Mr. Joachim Hauschopp, Founder and Executive Chairman, Sustainable Villages Association, Kigali



Sustainable Villages Foundation is a non-profit organisation registered in November 2020 in Germany with the mission to support the development of a pilot village and development and replication of a holistic model based on the experiences gained from the pilot village in other villages. Twin pilot villages were chosen for the project—Bisagara and Rugarama—, in close partnership with the Mayor of Bugesera district.

Using a holistic model, the project seeks to, among other things, address the interplay of all challenging areas of life (energy, food, water, health, education, and income generation), develop a blueprint that can be quickly replicated in other villages, make use of proven products/technologies, and make existing funds accessible to villagers.

Before implementation, household surveys and needs assessments were carried out in the two selected villages. The assessment was conducted through:

a) Household surveys, where 245 of 600 households were visited with the support of HEDERA/IMPACT-R at IASS in Germany (Dr. Natalia Realpe Carrillo, Dr. Alfonso Caiazzo, and Dr. Grace Mbugu) and the ACE-ESD in Rwanda (Dr. Alice Ikuzwe, Dr. Charles Kabiri, Dr. Jean de Dieu Hakizimana, and Mr. James Ntaganda).

b) A needs assessment with 9 key stakeholders in the village and administration and 7 focus group discussions.

The survey revealed that:

- Drinking water is the biggest challenge, with people using rainwater in the rainy season and travelling long distances in the dry season. 93% of respondents mentioned that the water is not good quality, and 34% stated that the water is not treated before drinking.
- 55% of the households had an SHS. 37% of these reported battery problems, and 3% reported a broken-down system. 50% have solar lamps, and 52% have battery torches (there are overlaps here).
- 80% use traditional three-stone systems for cooking, 10%, a simple day stove. There is not enough wood for cooking fuel. The school's temporary dropout rates can be directly linked to children having to fetch firewood and walking long distances in the dry season to get water.
- Villagers are usually unable to contribute money to get electricity, clean water, and improved cookstoves.
- 66% of surveyed households spend about USD 45 or less per month.

The programme, therefore, provides households without electricity with small solar systems with three lamps, phone charging, and radio through microloans with the help of a private company (EEA). Households are subsidised based on their income level.

An innovative payment mechanism was developed where all payments are routed through savings groups to get the default rate to zero and minimise the credit management effort, thus lowering the system cost. Any individual that cannot pay in a given month is given a loan by the savings group automatically.

To date, 82 systems have been installed, with an additional 33 expected soon (44% of the non-electrified), with a target of 100% next year.

SHS strengths and weaknesses

Strengths include provision of SHS by established companies that offer good products, including service and microloans. If the customer has the money, they can choose any option, and shortly after, the system is installed. Dispersed households can also be reached easily and quickly.

Weaknesses include durability problems for some suppliers with poor quality products and inadequate electricity supply for boiling, cooling, and productive use cases like welding. The

microfinance model also makes the products expensive due to high default rates and expensive credit management, resulting in high interest rates. In addition, in the rainy season, the systems might not provide enough power.

Clean cooking energy

In collaboration with Safer Rwanda, SVF distributes an improved cookstove made of steel that consumes 80% less wood than the traditional three-stone system. Customers pay in local currency in two monthly instalments. The price is partially subsidised by Atmosfair Germany and is USD 28. A further subsidy of up to USD 20 is offered for the lowest income class. Sales are made through a sales agent in the village. 39 stoves have been sold so far, and the target is to have 90% coverage by the end of 2022.

Other projects in the pipeline include the construction of a drinking water supply system for the entire Juru cell (quite challenging and expensive), school electrification with alternating current (AC) solar systems, and agricultural training, among others.

Comments and questions

1. **What is your plan for when the grid arrives at your pilot village?**

- The solar investment will still not be lost. The system can become a backup or a cheaper alternative to expensive grid electricity.

2. **How is the circular economy embedded in the holistic framework you presented?**

- Efforts should be made to find recycling options. The batteries can be recycled and new batteries made. The lithium-ion batteries need to also be recycled economically. There is a plant in Bugisera, Enviroserve from Dubai, that recycles solar component waste responsibly. To support this, it would be good to promote awareness in the communities about recycling old solar components.

3. **How do you convince people that have encountered and paid for poor-quality solar systems which failed them to buy your SHS?**

- If the system is broken, then it is replaced. Assessment is also done for reportedly weak batteries.
- The issue of durability is crucial. Older systems possibly did not perform as expected because they were generally weak and therefore did not last long. Newer products are

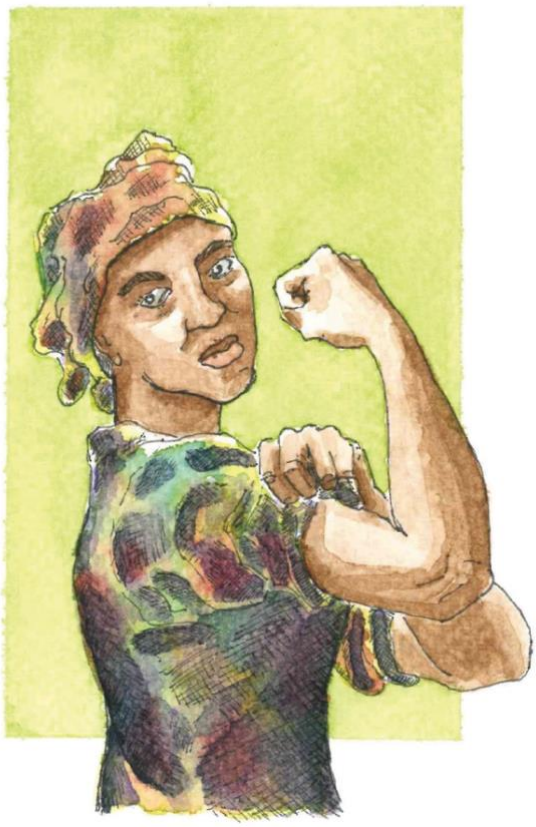
better and have a longer lifespan, especially if purchased from high-quality suppliers, many of whom are present in Rwanda.

4. **What are the main factors considered in partnering with others?**

- The company's reputation and services are considered. For example, EEA is well-known for its durable products. Safer Rwanda Atmosfair in Germany is also quite reputable.
- Durability, price, and service are very important factors to consider, e.g. the small SHS distributed by SVF has a warranty period of three years, even though it is designed to last longer than 3 years.

Approaches to enhance power access in rural areas

Ms. Mukwindi Nicole, Founder, POWERHer, Africa, Rwanda



POWERHer is a network of women working in the energy sector in Rwanda. It aims to build women's capacities to advance, empower others, and contribute to society. POWERHer has developed clubs and trained women on proactivity, technical capacity empowerment readiness, internship opportunities, and energy coaching. The organisation additionally wants to develop a training centre for entrepreneurial women. POWERHer implements its work through networking, which involves community outreach, coaching and mentorship, workforce skills development, and development of leadership and entrepreneurship skills.

Activities that have been undertaken thus far include a regional webinar for women and the signing of an Memorandum of Understanding (MOU) with a global women's network and Munyax Eco for training women in the energy sector.

Energy access in rural areas

Rural communities are characterised by remoteness and low population densities. They face development challenges that can best be addressed by off-grid solutions. These areas are mainly agro-based and use rudimentary technology, e.g. sun-drying; production could be increased using innovative RE technologies.

RE solutions for such communities should be sustainable to enable improved quality of life in these areas, which, in turn, will have a positive impact on their social life, economics, and environment. Possible solutions include SHS and efficient use of readily available biomass resources. These areas have abundant biomass and biowaste resources that can be leveraged and turned into fuel.

The benefits of RE in rural areas are many and include lighting for households and schools, and access to information, as it encourages people to buy TVs, radios, and mobile phones. RE can further foster productive use of energy with a focus on agro-based activities, which can increase productivity, e.g. through the use of solar irrigation.

The recommended approach to RE dissemination in rural areas

There is a need for more investors in RE, especially food processing industries that use renewable energy. This could lead to small business development for the youth, enhanced capacities, and sustainability.

Rural women's household burden should also be reduced through innovation and ICS distribution. Furthermore, more outreach activities are necessary to boost the population's awareness of the benefits of RE.

Comments and questions

1. **Referring to the apprentice/capacity-building initiative where companies are hiring women through POWERHer recommendations, what are the mechanisms in place to evaluate this programme and ensure it is attaining its objectives?**

- Testimonies from beneficiaries of the programme help us evaluate its success. In addition, more monitoring is being done by POWERHer's bigger partners. However, the figures have not yet been made available.

2. **Which technology do you see dominating Africa's future energy mix?**

- The dominating technology may vary from country to country, but for Rwanda, it could be hydropower.

3. **What factors do you look at when forming partnerships?**

- We are open to working with all companies that are willing to support women in the energy sector and that have the concept of inclusive workspaces for women and men.

4. **What are the requirements to join the POWERHer platform?**

- You have to be a female graduate of an energy course ready to work in the energy sector. POWERHer is also planning school clubs for pre-graduate level women.

5. **What advice do you have for girls who view you as a role model?**

- I encourage these girls to be themselves, fight for their dreams, never give up, and not be afraid to take calculated risks.

6. **Are opportunities for mentorship and apprenticeships available to non-Rwandese people?**

- Yes, they are. Opportunities to join POWERHer are open to non-Rwandese nationals, as long as they work in Rwanda.

Workshop: Enabling access to renewable energy technologies - Setting up financial schemes

Enabling access to renewable energy technologies - Setting up financial schemes

Andrew Muhwezi, Penda Capital

This workshop aimed to present the investment opportunity for renewable energy and related technologies in Africa, describe the various financing and credit options and risk considerations for RE technologies, explain the various advantages and disadvantages of each of the above, and differentiate between absolute financial and social impact returns.

Opportunities for renewable energy in Africa

There are many opportunities for renewable energy in Africa, including:

- Less than 50% of 1.3 billion people have access to electricity, and over half are less than 25 years old, which points to huge market potential.
- With over 50% of the world's population growth anticipated in Africa, energy demand in Africa is expected to double by 2040.
- The cost of access to RE technologies like wind and solar has reduced considerably, meaning that they are more accessible now than ever before.
- Infrastructure development in SSA is improving according to the Africa Infrastructure Development Index, with information and communication technologies (ICT) taking the lead, whilst energy and transport recorded slower growth, among others.

Views on existing renewable energy financing models in Africa

- Appropriate financing models depend on whether they aim at off-grid or on-grid utilities. Off-grid and on-grid systems have different financing models and depend on sovereign

guarantees for major developments, as no one embarks on such projects unless they are sure concession is sitting, and they can recover their money with profit.

- There are different financing models, e.g. public sector/development partner-led, donor grant de-risking programmes, equity financing (pay-back driven), and PPPs (collaborations between government and the private sector to deliver RE projects).

Market-based models

Market-based models that can be adopted by companies include direct cash sales and consumer finance (direct loans and gradual ownership and leasing or PAYGO models - very dominant). Systems can be paid off in instalments, after the initial down payment.

Case study: BrightLife in Uganda (FINCA Plus LLC)

Products marketed by the company include improved cookstoves, solar lanterns, SHS, and solar television sets. The company uses different financing models such as cash sales, PAYGO, and PPPs.

The technology used includes the following: a lockout technology that requires a code (that you must regularly pay for) to start supplying power; a customer relations management (CRM) tool that includes data on all the customers and their payments, locations, age, sex, products purchased, etc.; SOLARIS security sensors that enhance the product, e.g. motion sensor solar security lights; and an enterprise resource planning (ERP) tools management system. Every market needs systems that are customised to the local context.

Cash sales

In the cash sales model, sales agents are hired by BrightLife to market and sell products and get commissions for their sales. This model is heavily reliant on human capital. The benefits include a good customer experience, a localised distribution model, and the possibility of partnering with telecom companies to facilitate payment. However, the risks associated with this method include cash risk and agent flight, along with the risk that not many clients will be able to pay upfront for solar solutions. This model is not easy to implement, as it lacks technology (for accountability and sales tracking) that enables the organisation to control what they are selling.

Pay-as-you-go

This method is good, as it enables efficient and convenient payments for the customer. Additionally, it is affordable, as down payments are lower compared to those in cash sales. It

also reduces the chance of fraud, cash risk, and agent flight risk, among other aspects. Challenges include the high dependence of operational effectiveness on other infrastructure like mobile money and efficient mobile networks, repayment fatigue leading to delinquency, high credit risk, and huge associated management costs when deployed in rural areas.

Considerations for rural credit modelling

The 6 key 'Cs' of credit must be considered before a lender gives a borrower money:

- Character: Borrower's track record
- Cashflow: Does the borrower have a steady income?
- Collateral: Secondary security to hold onto if the borrower vanishes
- Capacity: Absorption (Can the borrower pay their dues on top of their other priorities?)
- Capital: What is the borrower's contribution to this project that they want to undertake with the lender's money?
- Conditions: Creditworthiness.

Credit modelling in rural areas has to factor in, among other aspects, cashflow, conditions, and client character and capacity. Many people in Uganda need RE products but cannot afford them. Other considerations here are whether the cost of credit administration is worth it and how remote the targeted area is.

Collateral: Control of the product even after it leaves the shop is important if people have not fully paid for it. For solar lanterns, the cost of credit management can impede the benefit; SHS should have lockout technology, and the product must be durable.

Capital PAYGO technologies require long-term capital, as the payback period is long. Down payments are a litmus test for affordability in the PAYGO space.

Discussion point: Considerations under each of the guiding principles for investment in RE technology

- The need and affordability in specific contexts have to be considered, especially in rural communities.
- Having a conducive policy environment is important because of the risks. Systems for accountability and monitoring of consumers must be established.
- Regarding customers: Customer willingness to pay and the technological solutions they already have should be evaluated.
- Regarding the company: The company must uphold its reputation, ensure product reliability, and offer warranties.

- The business climate is very important, including policies and regulations.
- Infrastructure should be available.
- The quality of the proposals submitted and guarantees behind the proposals should be evaluated.
- Protection of the investment is another critical consideration.

These considerations were summarised using the PESTEL (Political, Environmental, Social, Technological, Economic, Legal) model, to highlight success factors for RE financing and technology models.

Investors should consider several factors when considering RE technologies. These include business plans, feasibility studies, projected cash flows, margins, permits, and, above all, the sustainability of the business.

Comments and questions

1. **How can Africa tap into climate change funds and carbon offset programmes to finance RE projects?**

- Africa is in a good position to leverage such funds because it has a lot of resources and potential. Worldwide, many development projects are focused on Africa because of this. One of the biggest challenges Africa is facing is getting organised and focused. African countries need to understand their own national growth models and figure out where they want to go, then identify projects that can impact the communities of interest, as well as deliver economic returns; currently, it appears neither governments nor private sector players are intentionally putting effort in this direction. For example, in Uganda, the Uganda Solar Energy Association (USEA) still has no evidence of contribution to impact policy, attract investors, or entice donors into project funding. There is therefore a need to get better organised and focused to tap into this funding. It is not just about the funding, but rather the benefits that the funding aims to generate for the communities.

2. **Referring to your experience with the 3 different financial models (development partner-led, PPPs, and market-based models), which one impacts/stands to impact the African continent most?**

- There is more potential benefit in governments and/or international development agencies working with the private sector than them going it alone. Sustainability is best

derived by adding an economic element to interventions so that they generate both economic and social returns and foster sustainability.

3. **What model should be adopted to promote access to electricity while simultaneously increasing people's income?**

- Purchasing power is an issue; if someone does not have money, they cannot access a solar system. There are so many priorities before solar. The COVID-19 pandemic has exacerbated the situation. Thus, development agencies have come in to support companies to recover from COVID-19 losses so that they do not quit the industry, e.g. EnDev and GIZ.

4. **Do you have suggestions on how to set up solar kits for households?**

- Yes, companies should sell community-relevant technologies. Solar kits are not hard to set up. Link a panel to the controller, pay, and punch in your codes, and you are connected to light.

5. **Systems appear to be owned by people with relatively higher purchasing power; however, in rural areas, purchasing power is still low, so solar products can easily end up being unaffordable. What is your recommendation to ensure that all are electrified and affordability increases?**

- Affordability, and purchasing power, especially, is a big issue. It cannot be solved by solar companies and requires the intervention of the government. Development agencies have come in with COVID-19 relief funds to help companies recover COVID-19 related losses. For example, GIZ has intervened to ensure that solar companies do not stop operations during the pandemic where it has been particularly hard, and there has been poor customer repayment. Governments and development agencies can stimulate private companies to make sure that costs are subsidised and they can stay in business.

6. **How is inflation handled under the PAYGO model?**

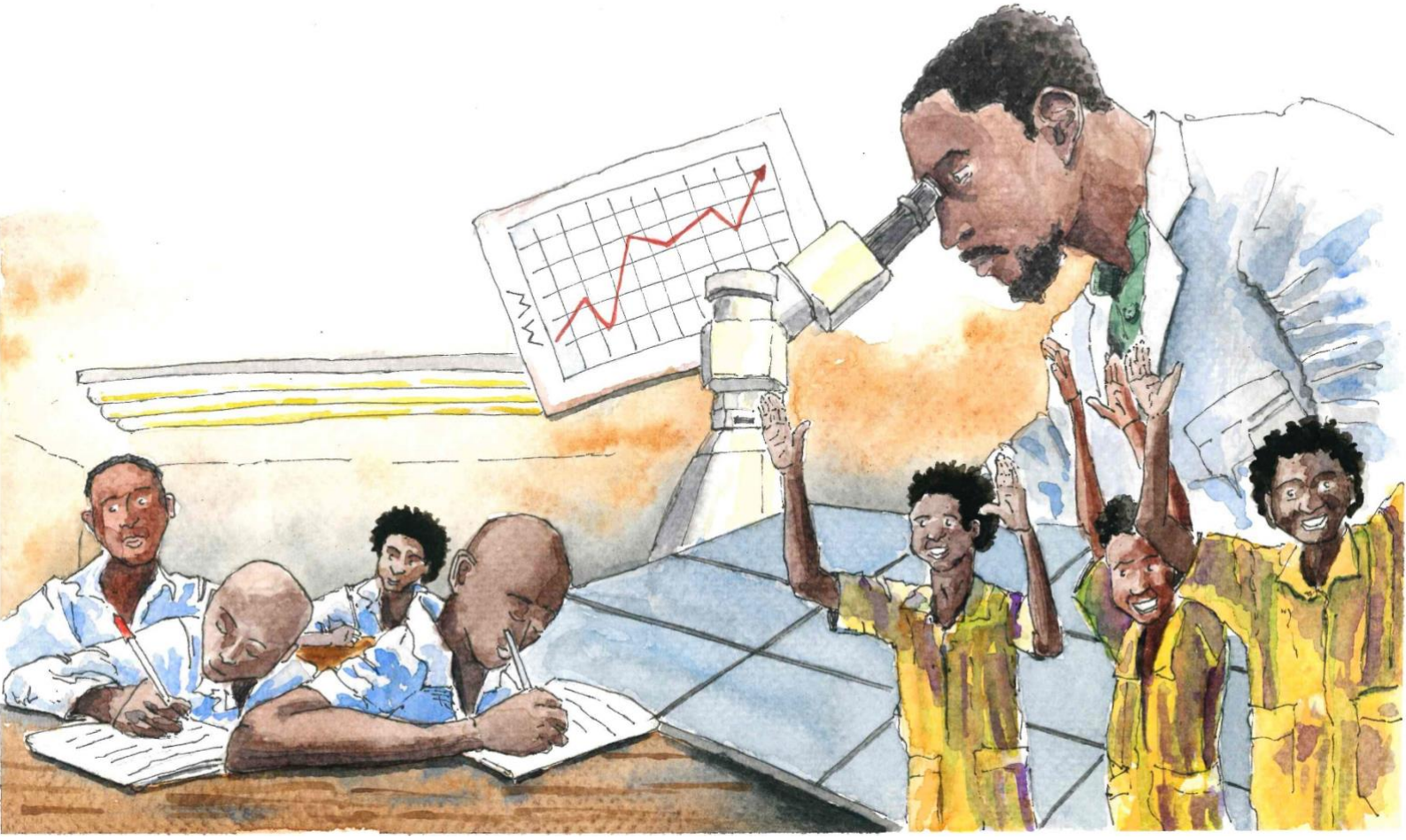
- Companies must insulate their pricing model. For a product like this, prices are predictable for at least up to 20 months. As pricing model eventualities like increases in the cost of production due to foreign currency fluctuations and increases in the cost of doing business due to freight increases are a reality, they must be anticipated and addressed beforehand. This is easier said than done, so development agencies should come in to subsidise costs and help companies to stay afloat.

7. **Talking about subsidies, they can be implemented for the businessperson or customer. What is your take regarding which side the subsidy should be implemented on?**

- The approach varies from scenario to scenario and also depends on the objective. Sometimes the government or its partners want to promote affordability, so they subsidise the customer, and other times, they may want to stimulate investment in the sector, meaning that subsidies target business owners. Donor agencies in Uganda, for example, used to fund the government to fund the private sector, but sometimes funds got 'lost in translation'. These days, they disburse funds to beneficiaries directly.

Energy & Finance

Wednesday, 27 October 2021



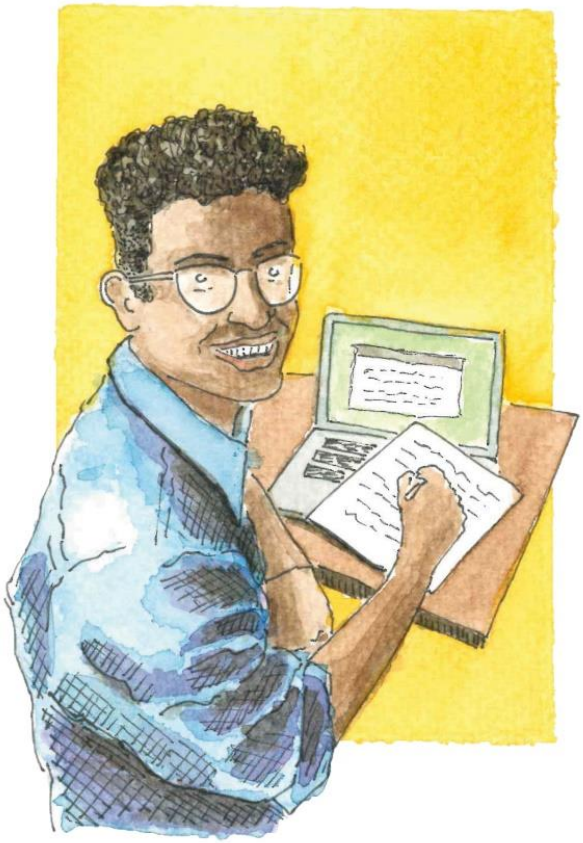
Day 3: Energy & Finance - Wednesday, 27 October 2021

Moderator: Dr. Grace Kageni Mbungu, Institute for Advanced Sustainability Studies

Opening session: Research & finance

Keynote speech: Energy transition in Africa –

Dr. Erick Tambo, Head of the Pan Africa Cooperation on Education and Technologies (PACET) and PAUWES Research coordinator at the United Nations University-Institute for Environment and Human Security (UNU-EHS)



About UNU-EHS and PAUWES

The UNU has campuses all over the world, with 13 institutes in 12 countries with 670 staff. Studies therein tackle development topics and focus on the SDGs.

The Pan African University (PAU) is a flagship project of the African Union for the creation of African excellence in education and science. The PAU-Algeria campus, hosted in the Institute of Water and Energy Sciences (WES), aims to provide science-based advice to national, regional, and pan-African policymakers, be a think tank and leader in shaping future strategies to address Africa's water, energy, and climate change issues, and train scientists to address societal questions and challenges across the continent.

Innovation and research at UNU and PAUWES

The PAUWES research agenda and key research priorities include energy, water, climate change, and the water-energy, energy-climate, and water-climate nexuses. The UNU Campus in Bonn has 8 sections and key focus areas, including PACET - the water-energy-food nexus. PACET, in particular. aims to establish and strengthen strategic institutional partnerships, research, and capacity building between the UNU Vice-Rectorate in Europe (UNU-ViE) and institutions in the Global South, with a focus on sustainability in Africa.

Research projects in these institutions include research on water and energy security for Africa (Nov 2016-June 2021) and the RE-powered water-food-economy nexus for sustainable livelihoods in the Dosso region in Niger (June 2020-June 2023).

International RE partnerships

The UNU collaborates with different partners under several frameworks, including:

Africa-EU Energy Partnership - It is funded by the EU and the Republic of Germany and fosters intercontinental collaboration to facilitate the achievement of universal access to affordable, sustainable, and modern energy in Africa.

LEAP-RE: This programme uses research and innovation to fight climate change by addressing key RE challenges.

REEEP - The Renewable Energy and Energy Efficiency Programme (REEEP) is an international not-for-profit organisation that contributes to the development of innovative, efficient financing mechanisms to advance market readiness for clean energy services in low- and middle-income countries.

Energy transition in Africa - Challenges

- Projections show that by 2040, there will be a 70% population increase in Africa's cities, translating to increased energy (cooking and lighting) demand. This projected population growth and increase in demand significantly outpaces current efforts and planned interventions in the different countries.
- Africa needs funds (USD 120 billion per annum) to achieve full energy access by 2040.
- Addressing Africa's energy demand requires a drastic change in the current energy supply mix, driven by renewable energies, natural gas, and energy efficiency measures.

Energy transition in Africa - Opportunities

To leverage the potential opportunities, Africa should:

- Develop appropriate policies and regulatory frameworks to address the persistent lack of access to clean energy for cooking and lighting and unreliable electricity supply.
- Plan climate-resilient energy infrastructure.
- Develop cleaner energy systems, focusing on renewable energies and gas.
- Embrace digitisation (smart grids) and youth entrepreneurship through, among other things, using digital technologies and tools for the development of energy plans, building youth's entrepreneurial capacity to facilitate their effective contribution in the energy transition, and leveraging the potential of digital technologies like Artificial Intelligence (AI), blockchain, and big data to create innovation, leading to entrepreneurship in the African energy sector.

The PAU mini-grid digitisation and entrepreneurship programme

The PAU mini-grid digitisation and entrepreneurship programme is an online programme that will begin next year and work towards strengthening youth entrepreneurship capacities in the nexus of digital technologies and mini-grids. It will also link youth entrepreneurs in Africa to ICT and RE through its programme, which integrates entrepreneur knowledge throughout its curriculum.

Comments and questions

1. **Many African countries like Mozambique and Nigeria have gas resources; do you see these resources being imported from Africa or other continents?**

- Stakeholders on the continent need to be pragmatic. The African Union is working on how to add value for African countries based on the existing resources they have, rather than just ignoring them because they are not renewable.
- Gas indeed still plays a large role in Africa's energy mix. African countries are still assessing how best to integrate already existing resources into the energy transition. These resources should also definitely be included in Africa's energy policies.

2. **Have any projects been implemented by the PAU and Ethiopian government?**

- Yes. Under the Water and Energy Security for Africa Programme (Nov 2016-June 2021), doctoral students researched different RE aspects. One study by an Ethiopian student from PAU is on the Grand Ethiopian Renaissance Dam. The research focuses on environment-climate impact assessment, policy-level aspects, conflict, and

potential for conflict, among other aspects. This PhD is being conducted in collaboration with the Centre for Development Research in Bonn and is going to be concluded soon. The student's contact info can be provided if needed.

- Ethiopian universities are also involved in many of UNU's projects and research.
- The World Bank Centre of Excellence also has a centre of excellence in Ethiopia focusing on the energy-food nexus. In addition, Ethiopian universities collaborate closely with the West African Science Service Centre on Climate Change and Adapted Land Use (WASCAL) in West Africa. They have been invited to share experiences and have applied together for different projects.
- While the Directorate of the AU is in Cameroon, Ethiopia still plays an important role in translating UNU research results into policy, especially when it comes to presenting issues at the High-Level Policy Dialogue with the EU.

3. When will the PAU mini-grid digitisation and entrepreneurship programme start?

- Course development is underway, and updates will be shared soon. The pilot phase will run from February to December 2022. The programme is a unique pilot implemented as a virtual incubator linked to online academic programmes to strengthen entrepreneurship. Based on how the pilot goes, the programme will be implemented regularly. It shall be hosted by Pan African Virtual and E-University in collaboration with PAUWES in Algeria.

4. What are the advantages and opportunities of pursuing educational opportunities in Germany?

- In Germany, there is flexibility for students to do their exams whenever they are ready. This helps them build expertise and practical implementation of the things learnt. There is also the flexibility for students to work as they study. This allows students to become independent and support themselves, relying less on their families for sustenance.
- Germany is a leader in research, knowledge, and innovation and has a free education system.

Challenges

- The language is a challenge that must be overcome to be successful in your studies. This is a worthwhile pursuit, however, as it will give the student access to the German economy and all its opportunities.

Geopolitics

Germany and France are drivers of geopolitics, and Germany's interventions across Africa are quite vast and far-reaching. The free education is also soft power that is resulting in free ambassadorship when students return home to work.

- Germany is in the lead in terms of fostering green development, supporting different countries throughout Africa in embracing it.
- There are numerous opportunities to influence international policies through platforms open to German university alumni.

5. **There is still a divide between European and African development, despite all the joint projects and engagement. What could be done better?**

- Africa needs to work on having a more felt presence at the 'partnership' table for a more sustainable result and enhanced partnership. Africa should think about what they can bring to the table when partnership opportunities come up. This could be by increasing the education and research budget, volunteering infrastructure, specialised knowledge, or funds, to strengthen the partnership and make it more meaningful.
- Europe should also collaborate with all relevant stakeholders, not just the traditional ones.

Panel discussion: Research initiatives, projects, and roles in the energy transition in Africa

Decentralised approaches in energy supply: Participatory tool development

Dr. Catherina Cader, Head of Off-Grid Systems, Reiner Lemoine Institute (RLI)

Dr. Cader explained that RLI is a not-for-profit organisation located in Berlin, with over 70 researchers and students working to support the energy transition to 100% renewables. They do so in different research units:

- Transformation of Energy Systems (targeted towards Europe and Germany)
- Mobility with RE (integrating renewables into the mobility sector, e.g. focusing on e-mobility and hydrogen-based mobility)
- Off-Grid Systems Research Unit.

All units work towards supporting SDG 7. The work under the Off-Grid Systems Research Unit, in particular, is done in 3 different steps:

- Determining how decentralised supply systems can be cost-effective and CO_2 optimised to make them better-suited to the local context and also derive appropriate operational strategies.
- Rural electrification planning (Geographic Information System (GIS) mapping and demand modelling), focusing on renewable resource assessment, power supply infrastructure, and application of database systems, among other things.
- Climate resilience and transformation work to determine how resilient the existing climate change-resilient energy systems are and understand how increased energy access will make communities more resilient to climate change effects.

Informational collaborations, knowledge transfer, network activities, and tool development are cross-cutting topics in the Institute's work.

In Nigeria, out of its 200 million inhabitants, approximately over 80 million have little or no access to electricity. This has resulted in high usage of climate-damaging and costly diesel gensets. The main challenges for off-grid solar PV systems in Nigeria are:

- Lack of understanding of the energy system preferences and users' ability to pay
- Technical challenges in sizing and optimising suitable off-grid systems and services
- Lack of economically viable energy delivery models for off-grid electrification.

The project, therefore, focuses on:

- Developing innovative and sustainable solutions for community energy supply with solar PV technologies appropriate for the Nigerian context.
- Developing customised policy recommendations and deriving feasible market entry points to accelerate the uptake of decentralised solar PV electrification.
- Activating commercial market growth of decentralised solar PV-based community energy supply for both local and German small and medium-sized enterprises (SMEs).

Data collection under the project is both quantitative and qualitative, integrating cross-cutting issues like gender. At present, the project is conducting research to inform the development of an open-source energy system modelling tool that fulfils user requirements.

Opportunities that the programme could leverage to achieve success

There is an increasing number of open-source energy system modelling tools that can be customised to the Nigerian context, rather than starting from scratch; FAIR principles encourage open-source development and open-source tools to ensure equal opportunities in a resource-constrained setting. By the end of the project, it is expected that there will be:

- Publicly available data sets on electricity demand and the solvency of rural electricity users (by the beginning of 2022)
- Open and freely available tools for project developers, researchers, and policymakers to improve evidence-based decision making (by the beginning of 2023)
- Recommendations for SMEs and policymakers to improve the framework conditions (by mid-2023).

Global online knowledge management in energy access –

Mr. Robert Heine, Founder and CEO, Energypedia

Energypedia was developed in 2007 under the Dutch-German energy partnership EnDev, implemented by GIZ. It started as an internal tool for knowledge and project management. Over time, it has evolved into the Energypedia not-for-profit platform for the general public. A subsidiary company “energypedia consult” was also founded as a consulting organisation that offers mainly information technology (IT) solutions for development cooperation organisations. GIZ is still a key partner.

The Energypedia platform is wiki-based and empowers energy practitioners worldwide by facilitating free knowledge exchange, global collaboration, and mutual learning on RE, energy efficiency, and energy access. The platform provides a space to collect and disseminate free, relevant, and high-quality information. User-friendly tools allow registered energy practitioners to write/edit articles, upload tenders, advertise job opportunities, upload publications, and advertise events, all for free. The platform has, on average, 90,000 unique visitors per month, 11,000 registered users, and over 4,500 articles. 2-5 articles are written each week by experts worldwide.

The majority of the users are from Africa (45%), followed by Europe (24%), Asia-Pacific (23%), Latin America (9%), and North America (5%). 34% of users are private sector, 21% not-for-profit, 20% government, 14% academia-research and universities, and 14% others.

The content of the platform is divided into different portals: Energy Technologies, Energy Use, and Cross-Cutting Issues. Key features of the platform include the publishing of pdf files of studies, different databases, e.g. a publication database (pdf files and studies), libraries, and a database on solar lighting, working groups to discuss portal topics, functions that allow users to see what articles have been edited or created within that portal, and toolkits on thematic aspects such as solar-powered irrigation systems. These toolkits have web pages on Energypedia and are often developed in partnership with other organisations. The web pages enable these partners to publish their results in an easily absorbable manner.

One challenge currently faced by the platform is that researchers and students want to publish their studies on Energypedia, with only them as the authors. The platform, however, allows any user to edit the work of another, which is an issue for such content developers. Content on the platform is in wiki-article format, rather than pdf.

The process of creating articles on the platform starts with the user registering/signing up to Energypedia; the user can then create or edit articles. Users are encouraged to check that a similar article does not already exist before creating articles. They can also edit existing articles if they feel they have input to add. Basic Google Translate is also available for articles that may be of interest but are written in a different language.

Organisations that have collaborated with Energypedia thus far include REEEP, International Renewable Energy Agency (IRENA) Renewable Energy Learning Partnership, Red Cross, GIZ, Power for All, and Access, a coalition of civil society organisations for clean energy access.

Anyone can contribute to the Energypedia newsletter and get in touch with the platform for partnerships on proposals and other opportunities for future collaboration.

Energy transition in Africa

Ms. Mary Suzan Abbo, Centre for Research in Energy and Energy Conservation (CREEC), Makerere University, Uganda

Ms. Abbo began her presentation with a situation analysis of Africa in terms of electricity and access, with a focus on Uganda.

Africa currently has an electrification rate of 43%, with the highest access seen in Northern and Southern Africa. There are also small pockets of access on the north-western coast, whereas the lowest access is seen in the central and eastern parts of the continent. Uganda has achieved a 51% electrification rate, mostly thanks to the deployment of mini-grids and decentralised systems. Optimised mini-grid systems present a huge potential for Uganda to meet its access targets.

Africa has a lot of potential to utilise the solar, wind, geothermal, and bioenergy resources it has. The continent has a quite high land-to-energy-use ratio, so there is room to partner and invest in RE to accelerate the energy transition. Since most of the continent's energy demand is met by biomass, there is a need to focus on sustainable use of biomass, to avoid depleting forests and exacerbating climate change issues. One study done in Uganda found that the country could meet its energy needs using solar energy alone. Across Africa, national electric grids are being extended in various countries, with support from different partners under different projects.

The continent is divided into different power pools, e.g. the Eastern pool under which Uganda falls, and the Southern, Central, Western, and Maghreb Union pools. These pools provide platforms for discussions on implementing a more integrated approach to national grid extension planning in the different countries. A Common Market for Eastern and Southern Africa (COMESA) report on world energy Issues further highlights the need to focus on RE resources across the continent, with a special focus on unutilised resources, energy for economic growth, regional integration, e.g. with hydro development, and investments to increase energy access.

CREEC participated in an IRENA study in 2015 titled "The African Clean Energy Corridor." The study developed a multi-criteria tool to create RE zones for 22 countries in Southern and East Africa. Governments were consulted to compile the information needed to do resource assessments and create project opportunity areas for different technologies. The resultant multi-criteria scoring was used to zone the regions covered in the study, to generate information to guide development partners and investors on which areas they should prioritise for RE developments and investments.

The study highlighted particular zones, e.g. those earmarked for concentrated solar PV and wind development. The subsequent recommendation was that these countries should conduct further studies in these identified areas and use the information to inform policy and guide investment and entrepreneurship decisions.

About Uganda

Over 90% of the population in Uganda uses biomass for cooking. Electricity access has increased over time (51%) thanks to the deployment of solar PV systems, stand-alone systems, mini-grids, and other alternative electricity systems. There are also programmes focused on rural electrification with support from different development partners, e.g. GIZ, United Nations Development Programme (UNDP), and the United Kingdom Department for

International Development (DFID). Over 600 micro-grids are also being planned by the national Rural Electrification Agency (REA) for the next 10 years. This points to an upcoming demand in the country for mini-grid design tools.

The country's regulatory structure has the Ministry of Energy and Mineral Development (MEMD) at the top, the Electricity Regulatory Authority (ERA), which regulates generation transmission and distribution activities as implemented by the Uganda Electricity Generation Company Limited (UEGCL), Uganda Electricity Transmission Company Limited (UETCL), and Uganda Electricity Distribution Company Limited (UEDCL), and concessions for different companies that have been licensed to develop smaller systems in different demarcated areas/territories in rural and urban areas. There are about 14 territories, and all companies can apply to develop regulated mini-grids and systems.

The country's generation capacity in terms of grid supply is over 1200 megawatts (MW), with an increased contribution of off-grid systems as compared to grid-connected systems. A mix of resources is being used, although there is still a lot of untapped potential for on- and off-grid solar PV (50.8 MW - 4.1%) and biomass and cogeneration systems (96.2 MW - 7.7%). Bagasse from sugar factories also contributes to the grid capacity. There is some thermal energy from fossil fuels, although the percentage is decreasing as efforts are increasingly focusing on RE-based generation. Uganda's highest contributor is still hydropower (1004.2 MW - 80.1%), with both small and large hydro systems.

There is a high energy demand in the commercial and medium-sized industry sectors, an increasing annual growth rate of domestic energy requirements, and a lot of potential for exports, making discussions with neighbouring countries very relevant.

As Uganda is improving technology, building infrastructure, and leveraging its partnerships, the country is experiencing a decline in transmission and distribution losses over time, and the government is working to further reduce them. In terms of network connections, there is an increasing contribution from mini-grids. Research in this sector is very relevant for Uganda right now.

Key investment issues identified in Uganda's context to expedite the goal of transitioning to 100% renewables include:

- New connection costs (no pole and one pole services)
- Substations (new, interconnecting lines and upgrades)
- Loss reduction projects, quality of service, and safety
- Prepayment and retrofit costs

- Automatic meter reading (AMR) projects
- System improvement
- Project network restoration and transformer injections
- Load growth and plant reinforcement
- Refurbishment.

The funding partners in the energy transition thus far include the Government of Uganda, Royal Norwegian Embassy, DFID/BEIS UK, EU-Africa Infrastructure Trust Fund (ITF), GIZ, Power Africa-USAID, UN agencies, Sustainable Energy Fund for Africa (SEFA)-AfDB (investments in infrastructure and building capacity of stakeholders), and private investors.

About CREEC

CREEC is part of the College of Engineering and Design at Makerere University. It aims to enhance access to modern types of energy through research, training, and consultancy in East Africa. Thematic areas include rural electrification, energy for productive use, household energy, energy entrepreneurship, and testing services using International Organisation for Standardisation (ISO) standards; energy efficiency is also a cross-cutting topic in all the Centre's work.

CREEC is focused on increasing access to modern types of energy and has partnered with various organisations on different applied research projects. These include the formation of the African Clean Energy Research Alliance (ACERA) with researchers and PhD students from Congo, the DRC, Tanzania, and the University of Leeds, with DFID funding. The Alliance is researching the solar-powered treatment of biomass for power generation using carbon slurry in integrated, hybrid renewable energy systems that can feed into micro-grids. CREEC is also working with the Alliance on research to create resilient sustainable micro-grids through hybrid renewable energy systems. The study focuses on optimising systems and implementing better designs.

CREEC has a partnership on research dissemination with Atongamedia under the 'Dare to Care' Campaign on innovative knowledge sharing using audio-visual methods, e.g. through feature films on energy, radio dramas, media engagements, and a TV series on clean energy called Kampala. This approach is pertinent in the move to ensure that research results are communicated in a way where the populace can use them to understand the benefits of RE and make informed decisions about energy systems. Platforms like Energypedia can further support and accelerate this effort.

CREEC has also undertaken community engagement, especially in partnership with the WIRE association. Activities aim to enhance women's energy entrepreneurship capacities. There is also capacity building for young energy entrepreneurs. Other activities include quality assurance and standards and testing.

Comments and questions

1. **What is CREEC's main role in closing the energy access gap in Uganda?**

- CREEC's role is two-fold: 1) applied research focusing on technology and related aspects, e.g. socioeconomic surveys and getting user perspectives and using the results to inform policy and potential users; and 2) training and capacity building - the Centre has a network of 2000 entities, including a large private sector base. The entities are empowered to recognise, produce, and/or sell good-quality clean energy technologies that will work as advertised and, in turn, not spoil the RE market. This is critical, because studies have shown that products that do not work as promised/poor-quality products affect over 50% of the market quality. CREEC also provides consultancy and advisory services.

2. **a) Of the 45% of the user base located in Africa, how many of Energypedia's customers are regular users/researchers?**

- About half of these users are from GIZ and its partner networks, and the rest are regular users. It is a rich mix; the majority of new registrations are from the general public.

b) Based on the data provided on the Energypedia platform, what strategies do you have in place to ensure that this information trickles down to implementers?

- It is hard to track the rate of use of the information provided on the platform. Energypedia focuses on promoting access, compiling information, moderation, and facilitation. Several surveys to assess content relevance and use have been done on a small scale, with good results. When resources are available, Energypedia undertakes work on the ground. For example, Energypedia supported the successful replication of a biogas digester project that was undertaken in Bolivia and Rwanda.

3. **What role does RLI play in enhancing the transition?**

- A strong emphasis is placed on applied research aimed at making the knowledge available to all stakeholders who can implement it on the ground. An effort is made to provide information, knowledge, and tools that allow stakeholders to independently do their multi-criteria analyses and define optimal solutions in their local contexts. The

tools are open source. The Institute closely collaborates with stakeholders from Europe and Africa, as much as the funding structure allows, to enable long-term sustainable impact.

4. **Regarding the divide between Europe and Africa, how can the dynamic be changed, especially in the funding of energy-based research towards a just energy transition?**

- **Dr. Cader (RLI):** Several institutions are already on the right track, encouraging the setup of mixed (North-South) project teams to undertake projects and PhD research. RLI also has such partnerships and routinely works with universities in different countries to foster joint master thesis projects, joint PhD work, and joint guest researchers. These have yielded extremely beneficial exchanges.

- The Institute also focuses on gender equality; for example, for their workshops on energy system modelling, the Institute insists on equal gender representation. From experiences in Nigeria, we realised that there is massive potential coming out of the African universities, with many startups emerging in the off-grid sector. There is a need to extend the potential of these decentralised approaches into the policy and legal framework arena to foster a legal basis for joint RE business models. Emerging North-South business models can work towards fostering closer collaboration.

5. **In your opinion, what can Africa do to add more value to its partnerships? What hinders the process of more equal engagement?**

- **Ms. Abbo (CREEC):** Africa needs to have 360-degree knowledge of the various local resources and contexts when it comes to the discussion table, to better inform joint projects. For example, Uganda has about 50 tribes, with each having a different perspective on cooking technologies and practices that work for them. This nuanced knowledge can determine a project's success or failure. To facilitate this, stakeholders across the continent need better knowledge management and improved skills in strategic information presentation. There is also a need for Africa to facilitate access (for partners) to pertinent information about the continent.

6. **What data is available on Energypedia concerning the nexus between climate change, climate justice, and the energy transition?**

- Energypedia, while focused on renewable energy and energy efficiency, is also very relevant to climate topics. There is a climate category in the Energypedia system but still no clear delineation, as climate aspects are cross-cutting across the energy and environment landscape. With more funding, the content in the climate portal can be expanded, and more research can be done.

- However, knowledge management is still an issue. Many countries, donors, and/or organisations are conducting similar energy studies among the same stakeholders but not sharing their findings. As such, a lot of resources are being lost in duplication. One study conducted by Energypedia in Bangladesh revealed that another organisation had recently been there asking almost the exact same questions. The different stakeholders still want to brand and own their information and portals, and this leads to difficulties in accessing knowledge. Nevertheless, progress is being made, as different partners take steps to strengthen collaborations and work together on knowledge management. This will greatly ease access to relevant data.

7. **COP 26 is around the corner. How can Africa address the divide between climate change/climate protection, energy justice, and sustainable energy access? How can the gap brought about by the 'we need to develop before we ponder climate' rhetoric be bridged?**

- **Ms. Abbo (CREEC):** African countries can choose to develop along a different, better path. Africa can opt to progressively use more sustainable, cleaner, and more affordable conversion systems. If the continent focuses on that, it can more effectively and sustainably handle both topics.

8. **How can research organisations from the North collaborate more with Southern stakeholders to foster more successful, sustainable projects?**

- **Dr. Cader (RLI):** Funding lines and schemes that encourage increased Southern stakeholder partnerships would have to be adopted, perhaps through lobbying from researchers, as a means to more successful and sustainable long-term collaborations.

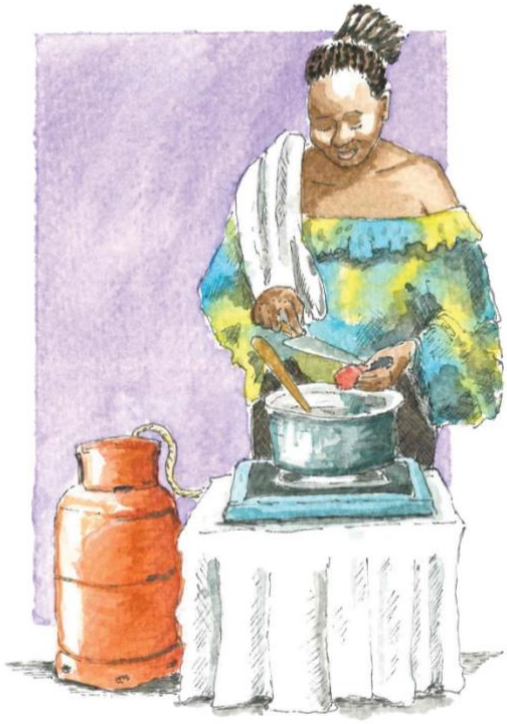
- Open source and open data help facilitate collaboration on tool development, project implementation, and information transfer to intended users.

- The COVID-19 pandemic has also led the world to undertake more online engagement; now stakeholders in this transition do not have to wait to travel to collaborate. Online engagements have proven quite useful in facilitating the knowledge sharing process and fostering research and discussion.

Selected presentations: Energy financing through microfinance

Access to renewable energies through microfinance: Objectives, activities carried out, and results achieved

Mr. Pierre Casal, Impact Manager, CIDR Pamiga



CIDR Pamiga is a French NGO active throughout sub-Saharan Africa, with offices in Côte D'Ivoire and Kenya. The organisation works to unlock the economic and social potential of disadvantaged rural and peri-urban areas. It provides small businesses and households with easier access to market, finance, energy, water, and sustainable agriculture. The firm also manages impact investment funds.

Regarding RE access through microfinance, the organisation set up a programme in Benin, Senegal, and Madagascar to work with MFIs to facilitate access to solar products for rural households and micro-, small, and medium-sized enterprises (MSMEs) through the provision of appropriate financial services. The programme ran from 2017 to 2019, with an extension until June 2021 due to the impact of the COVID-19 pandemic. It was funded by the African Development Bank, Agence de La Transition Ecologique (ADEME), Alstom Foundation, DFID, and Led Liechtenstein Development Service.

The programme developed a local offer of financial products to overcome access barriers due to the initial investment costs of solar products, build a local network of distribution, installation, and customer service agents, and strengthen rural communities' capacity to optimally use their solar solutions and finance.

MFIs saw the partnership as an opportunity to fulfil their green social mission and also attract investors interested in green investments. CIDR developed financial products and built a local network of distributors and installers. They also worked with local communities on how to use the solar products, including productive use, and identify appropriate financial solutions to

improve living conditions, increase youth employment, and environment preservation, among other things.

Under this partnership, MFIs were responsible for providing expertise in financing rural households/SMEs, promotion of solar products and loans, analysis of credit applications, granting of loans, and payment collection. Solar solution providers had the role of providing expertise in solar energy, stock management, guarantee provision, and customer service, providing technical training for the MFIs, and development and management of local technicians for installation and customer service.

CIDR Pamiga's role in the partnership was to conduct market studies, set up partnerships, develop financial products and procedures, provide financial education training, coordinate and monitor activities, and conduct evaluation studies.

Programme results

Under **Component 1 of the programme: Technical advice to MFIs to develop a financial offer for solar energy**, over 13,000 solar products were distributed, reaching over 56,000 people. CIDR Pamiga also conducted 2 market studies on the RE sector in Senegal and Benin and 1 study on solar equipment for productive use in Madagascar. Five MFIs were further supported to develop a credit offer for the purchase of solar lamps and kits (solar credits).

Under **Component 2: Support to solar providers to better reach rural clients**, 6 partnerships between MFIs and suppliers were developed in the 3 countries, and 56 local technicians (energy entrepreneurs) were trained and made operational.

Under **Component 3: Support to end clients to manage their energy needs and finances**, energy and financial education modules were developed, and over 10,000 clients were trained in the 3 countries of operation.

Under **Component 4: Capitalisation and knowledge sharing,** the programme successfully implemented results monitoring tools in 5 MFIs, conducted 1 outcome evaluation study in Senegal, and published 1 case study on PAYGO in Benin. One workshop on international capitalisation was also organised in Benin in June 2020.

Over its years of operation, CIDR Pamiga has seen a growing demand for solar products.

Lessons learnt and recommendations

A concrete long-term promotion strategy is crucial to stimulate solar product sales. Field staff need regular coaching and training even after the initial training.

Clients should see and test the products themselves. Trainers and staff of the partner MFIs now leave product samples with clients for a few days, e.g. solar lanterns.

Existing MFI clients should be considered as partners, as the programme revealed them to be good promoters/ambassadors for the product, because they are familiar with the product and can convincingly vouch for it. This approach worked especially well with a partner in Benin.

Despite the presence of project champions at the MFIs and supplier level, the numerous activities and commitments of the different parties led to misunderstandings and information gaps due to insufficient communication. Partners/stakeholders therefore need regular communication at the management and operational level to facilitate collaboration. A steering committee of stakeholders can share challenges, table issues, communicate goals and responsibilities, and make sales forecasts to guide the business.

Concerning MFI operations, access conditions to solar credit should not be the same as in the case of classic credit. Requirements like having an account, mandatory savings, and a guarantor demotivate clients, who see these as a waste of time and not of value to them. Consequently, MFIs have identified innovative solutions to ease solar credit requirements, e.g. PAYGO SMS activation codes.

Furthermore, local technicians are very motivated at first but can lose steam over time if they are not adequately supported. There is a need to build a brand identity, set and monitor goals, build peer-to-peer platforms, help them expand their market through promotion of a variety of products, and build their capacities in business management and marketing.

Despite their wide impact, solar products for lighting, cell phone charging, and entertainment (radio kits, TVs, etc.) remain mainly for domestic use. Clients still had (and often expressed) a desire to have access to solutions/equipment to help them increase the profitability of their income-generating activities such as sewing, processing of agricultural products, and horticulture.

Scaling Carbon Offsets

Mr. Christoph Lange, Co-founder, Atem. Green

Atem. Green is a new start-up that focuses on decentralised climate action built on blockchain protocols.

Referencing a 2021 Mckinsey study, Atem sees an opportunity in the fact that carbon offsets are on the path to having a USD 50 billion market by 2030. These offsets (emission avoidance and removals), which are traded as certificates, enable voluntary carbon offsetting for organisations and individuals. However, the process of supplying offsets is still inefficient and inaccessible for smaller actors; only large-scale actors can participate.

Atem works to scale carbon offsets through small-scale supply, with the expectation that a significant portion of the USD 50 billion offsetting market will consist of small-scale supply and that there is, therefore, a need to increase accessibility for small actors. In line with this, Atem is setting itself up as a solar-based carbon offset machine on the blockchain.

The firm chose to work with blockchain because it is permissionless (open, transparent, accessible) and automated (instant, low cost, economically viable). This means that individuals/households/businesses can do their part to remove/avoid emissions, e.g. through the use of solar, and subsequently create their own offsets and sell them. Regarding automation, paying for an offset certificate can be instant and low-cost (only a few cents), with no need for centralised intermediaries, who may increase the cost and bureaucracy.

The firm decided to start with solar-based carbon offsetting because they believe that solar is the energy source that can help realise the vision for this offset market the fastest. Using already existing data monitoring equipment, data can be collected and sent to an oracle (a blockchain module that can track energy production and turn it into an offset). This oracle highlights that the energy has been produced purely from solar and the alternative would have been a non-green energy mix. The offset is then sold to actors on the blockchain. A new protocol was recently launched that bought 8,000,000 tonnes of CO_2 offsets in a week. This was quite a massive demand for offsets coming online. Funds from such a proceeding are channelled back to the generator of the offsets efficiently and at a minimum cost.

The Atem road map is the following:

1. Incentivise solar - work with stakeholders that have solar hardware. Anyone who installs and uses solar panels and monitoring devices, many of which can work with

Atem, can start making additional money. There will not be any requirement for additional investment, but, rather, an increase in the return on investment per square metre (m^2) of solar.

2. Scale off-grid solar – Atem. will use that starting point to enable further upscaling of off-grid solar by pooling capital from interested investors to fund off-grid solar installations and enabling them to generate reliable return streams through the Atem intervention.

3. Scale in other verticals in the offset market – Atem will expand their service to cover other sources of carbon offsets, such as forestry, rainforest preservation projects, and direct air capture, among others.

At present, Atem. Green is fundraising, looking for grants, and building a team of contributors. They are also working on a prototype, to be ready in the first half of 2022. Atem can be engaged further via discord.gg/CNNbMmPeYb or christoph@atem.green.

Comments and questions

1. **From the MFI angle, how could innovation occur with an MFI implementing Atem's approaches?**

- **Mr. Casal (CIDR Pamiga):** CIDR Pamiga initially considered harnessing carbon finance to improve the affordability of solar solutions. However, there were huge barriers to implementing small projects/programmes using this approach. In Benin, small programmes are not that interesting for carbon finance investors. It is great that people are working on decentralised solutions for small-scale projects.
- **Mr. Lange (Atem. Green):** Carbon finance is indeed quite costly for small-scale users and smaller projects. Getting access to this carbon finance market is generally ineffective for smaller projects. However, there are many potential connections between MFIs and Atem. Atem's goal is to provide plug and play solutions. The company wants to ensure that tokens/money earned and kept in a cryptocurrency wallet, e.g. on a mobile phone, can easily be turned into fiat money and transferred to the regular banking system. This connection to the regular banking sector is becoming more common. MFIs could add Atem products to their product portfolio.

2. **What is the strategy to engage with rural businesses/suppliers that already deliver solar systems and would be interested in engaging in this blockchain?**

- Atem. Green hopes to build a system that is plug and play so that rural suppliers can own and earn from it, with limited processes and upfront costs.

3. **Is Atem. Green planning to expand to forests and agricultural products?**

- Yes, Atem actually began with a focus on forest projects, but they turned out to be harder to automate in terms of the generation of carbon offsets. These projects have more variables, require a more on-the-ground approach, and are generally more complex. Solar panels, on the other hand, are straightforward and comparatively easier in terms of using the data to automate offset generation and getting the data verified so that the generator can access carbon markets with those verified offsets.

4. **Regarding supplier products, would CIDR Pamiga only support approved products?**

- Yes. The quality of the energy equipment provided is essential, because client dissatisfaction can lead clients to stop paying and inevitably spoil the RE market. MFIs must therefore be sure about offering the right solutions, partnering with the right companies, and having good-quality products.

5. **How does payment for carbon offsets using blockchain work? Is it transparent?**

- In the classic MFI sector, it is hard to track who is getting what. It helps that in the Atem. Green scenario, it is the seller who produces the data and feeds it to the computer to generate offsets. When these are sold, the earnings, minus 3% (Atem fees), are sent to the seller's blockchain wallet. The blockchain process is visible for anyone who wants to check.

6. **What role do you see Atem playing in the energy transition in Africa, concerning smaller actors?**

- Atem. Green hopes to offer a module that enables the transition for these actors. Atem would be a tool that they can use to access the carbon market.

7. **What strategy does CIDR Pamiga have regarding smaller actors to promote long-term sustainability in Africa?**

- In terms of household solutions, several actors are joining the industry to promote sustainable access to clean energy technologies.
- Productive use of energy is also growing, with many partnerships developing to ensure energy products reach people. The uptake of this aspect is fast, as the products generate their own repayment capacity. This aspect is more sustainable for businesses and MFIs.
- Equipment lifespan is crucial. Manufacturer guarantees are one way to ensure the minimum guarantee on these products, but MFIs engaging in the distribution of solar products have to ensure the products are good-quality, so the customers are satisfied and the market can remain stable.

8. How is the radical increase in supply chain costs impacting the microfinance business model?

- RE equipment is manufactured in Asia and imported by companies in Africa. A large portion of these supply chain costs is incurred in the last mile.
- MFIs are interested in energy companies as they have a local footprint, staff, rural branch expertise, and knowledge of the rural areas. Partnering with them makes it easy to transport energy products.
- One global supply chain issue is that increased supply chain costs impact the availability of products. These increased costs are more attributed to products being manufactured in Asia to be distributed in rural areas in Africa than to freight costs. Nevertheless, freight costs may become an issue in the future if the COVID-19 pandemic persists.

9. How has the COVID-19 pandemic impacted CIDR's work?

- Energy loan repayment deteriorated in the first few weeks, as clients prioritised meeting emergency needs, and MFIs could not send their staff out or organise meetings. However, over time, economies have bounced back. Clients have a strong relational link with these MFIs and have made efforts to catch up on their loan arrears. Work is now back to normal, with some partner MFIs even registering growth in their portfolios.

Workshop: Defining research questions and drafting research proposals

Defining research questions and drafting research proposals (in the African energy sector)

Mr. Chigozie Nweke-Eze, Research associate, IASS Potsdam

Research questions

A research question is a question that the research project seeks to answer. Choosing a research question is an essential element of research. Good research questions seek to improve knowledge on an important topic and are usually narrow and specific. To formulate a research question, one must determine what type of study will be conducted, such as a qualitative, quantitative, or mixed study. Additional factors such as research project funding may not only affect the research question itself, but also when and how it is formed during the research process.

The “FINER” criteria for research questions

Research questions should be Feasible (in terms of scope, the expertise required, and time), Interesting/Intriguing, Novel, Ethical, and Relevant.

Research projects

A research project is a scientific endeavour to answer a research question. Research projects may include case series, case-control studies, cohort studies, surveys, and secondary data analysis, among other things. A research proposal helps one transform a research idea into a valid, scientific research project. A research proposal presents a general outline of the research elements. The research proposal has a twofold purpose: 1) it provides the researcher

with a blueprint for implementing the project; and 2) it has to be submitted to the institutional review board for approval to implement a project.

What should be included in a research proposal

A good research proposal should include a clear title, the background and rationale of the proposed research, including a short literature review and summary of key debates and developments in the field, clear descriptive research question(s), a research methodology highlighting the research methods appropriate for the proposed research and a discussion of both the advantages and limitations of particular approaches and methods, a work plan, a schedule, and a bibliography.

What makes a good research proposal

An effective proposal clearly explains the research question, identifying and analysing the methods that will be used to perform the research. A good proposal must also position the research in the larger field of study, highlighting the significance of the research to foster visibility and also attract funding.

Current relevant research questions and projects in the African energy sector

Relevant research topics include energy development, energy policy and strategies, the relevance of different energy system options, the energy transition, political implications, and socioeconomic implications, e.g. inclusivity and cross-border cooperation for energy development.

Mr. Nweke-Eze concluded his presentation with some interesting aspects and research questions that he posed to participants:

- What experiences have you had in finding research questions or drafting research proposals in the energy sector?
- What should more research focus on in the African energy sector?
- What research gaps still exist in the African energy sector?
- Any other tips based on participants' own experiences?

Comments, inputs, and questions

1. **Participant comment:** Research must reference the community the researcher is focusing on. Data collection requires the involvement of the locals, their leaders, etc.

They are the ones who will take you where you need to go, get you the information you need, and ensure your information is localised and useful to the community.

2. **What strategies should a researcher employ to get access to the local community, build their trust, and foster collaboration during research?**

- A researcher must involve the traditional leaders, local government, state government, and/or traditional government, as much as possible. Once their support is garnered, they can link you to the local communities faster and more seamlessly.

3. Sometimes, during community leader engagement, a researcher may encounter power imbalance, with leaders giving wrong/deliberately skewed, unrepresentative information on community interests/issues/needs. How can a researcher ensure that they capture the true community issues and the true on-ground scenario, despite receiving skewed information from leaders?

- In such cases, e.g. if the researcher encounters a leader who seems to have a selfish personal agenda, the researcher must do their underground work. Even as the researcher engages the traditional leaders, they must get closer to the other locals and engage with them often and widely, so that the researcher can get the full picture. This should all be done diplomatically, without stepping on any toes, so that by the end of the research, the researcher has talked to as many people as possible and can reach an objective conclusion.

4. How can student researchers balance the inevitable culture clash that emerges from previously learnt research styles and the existing style at European universities? In some cultures, supervisors seem to dictate rather than bring/leave room for ideas, while in others, they seem to leave too much room for flexibility, almost putting the entire research burden on the student. What is the recommended middle ground?

- A research student should give due regard to the context(s) of where they are conducting their research. The question of ethics should guide the researcher in conducting their research; what is ethical to one group may not be ethical to another. Researchers should also embed themselves in the research environment as their question dictates; do not hesitate to ground yourself in the different relevant guidelines/rules that may apply to your research. Different interviewees also come with different rules, so researchers need to be aware of and follow such rules. A student should also consider timelines as they make their decisions, so that they do not waste too much time in bureaucracy as they try to rigorously follow the research process.

5. Question to the participant who presented their experience working with UNICEF: How does one manage the politicisation of projects, which makes some collaborate with the research (seeing it as pro-their political ideology) and others see it as an opposition gimmick?

- A researcher should have a strategic extended awareness campaign before starting the process, highlighting the advantages and disadvantages of collaborating on the research, objectives, intended outcomes, etc. Wherever the researcher can, they should involve the locals as part of their research team, e.g. as field attendants and guides.

- A researcher should also involve opinion leaders in their team, especially in awareness promotion activities. These leaders can generate support/promote awareness before the research implementation, as well as support the process throughout.

6. Question to the previous speaker and other participants: Considering government bureaucracy and geographical boundary issues, how does a researcher navigate the power dynamics in a given region? How do foreign researchers maintain their security when engaging at different levels?

- **Participant (previous speaker):** The researcher needs to find a way to get in touch with the federal government, which will link them to the state government, which will, in turn, link them to the local leaders. The researcher must also independently talk to the village leaders and explain their intentions and objectives. The benefits of the research should also be well-explained to avoid misunderstandings.
- UNICEF's work in the field to set up boreholes had a deliberate community engagement strategy. A team first went to the community to make initial contact, followed by another team that went to promote awareness and share information on the benefits of the intervention, to help villages realise the gains to be made. This promoted gradual acceptance of the imminent intervention. Of course, each scenario is different, so the researcher should assess the situation and engage appropriately.

7. Question to the previous speaker and other participants: How does one manage various stakeholders in the research context?

- When doing international research, all stakeholders must be involved right from the beginning of the research process. Critical stakeholders include community NGOs, community leaders, and opinion leaders, all of whom already have a strong network.

- **Participant (David Sackey):** A researcher should also have a stakeholder matrix. In some communities, a researcher can use the snowball approach, whereby the

researcher uses the first group of informants to identify the next group, and so on. This approach can also support the identification of stakeholders who may potentially resist the research, so that an action plan for how to handle them can be developed. A researcher can also benefit from support from opinion leaders like religious leaders. Their participation in the team helps to build confidence in the researcher's work.

- **Mr. Nweke-Eze (IASS):** A researcher should make his/her purpose clear, and people should understand that it is just a study, not aid or an intervention. The researcher should also desist from overpromising.
- **Dr. Mbungu (IASS):** It is important to be clear on what you are doing in the community, as in many cases, local communities demand compensation for information shared. They see their information as a valuable resource, which is right to a degree but can hamper research activities.
- **Dr. Realpe Carrillo (HEDERA):** Regarding overpromising, research on RE topics/technologies can easily lead to communities assuming it is a promise of technologies to come. Hence, a researcher could, for example, avoid mentioning specific technologies and use factual, closed, and multiple response questions on the status of access. This will ensure that the topic is never personalised. Community wishes can then be captured using selected focus group discussions (FGDs) with engaging conversations, rather than structured interviews.

Hydrogen & Electric Mobility

Thursday, 28 October 2021

Day 4: Hydrogen & Electric Mobility - Thursday, 28 October 2021

Moderator: Carol Ofafa, Kenya Electricity Transmission Company

Opening session: Hydrogen & electric mobility

Hydrogen, the global energy transition, and the role of Africa

Dr. Rainer Quitzow, Research Group Leader and Speaker of Research Area: Energy Systems and Society Change, IASS

Past, present, and future of the global energy transition

Under the Energy Systems and Society Change research area, IASS studies the energy transition as a process of societal change. The Institute sees the transition as an interplay between different fields such as social development and behaviour, politics and policy, technology and innovation, and economics and business. These fields interact to shape progress, with their priority level changing from time to time for different reasons.

The history of the energy transition

In the past, the RE power sector and associated research and development were implemented by a few industrialised countries, like the U.S., Japan, and Germany. This research was carried out in response to the spiking global oil prices. Germany's subsequent rapidly accelerated deployment of renewables and China's heavily increased investment in RE (from 2010 onwards) greatly supported the reduction in the cost of RE technologies, especially solar PV and wind energy.

After this initial phase of large-scale RE deployment, the signing of the Paris Agreement marked a turning point towards more ambitious climate action, shifting the focus from the introduction of renewables in frontrunner countries to a broader diffusion of renewables around the world and first steps towards phasing out fossil fuel technologies and carbon-intensive fuels. The UK kickstarted this by pledging to phase out coal fire-powered generation. This was followed by the announcement of climate neutrality targets in 2019. To reach climate neutrality goals by 2050, there is a need to also decarbonise electricity (while phasing out coal, oil, and

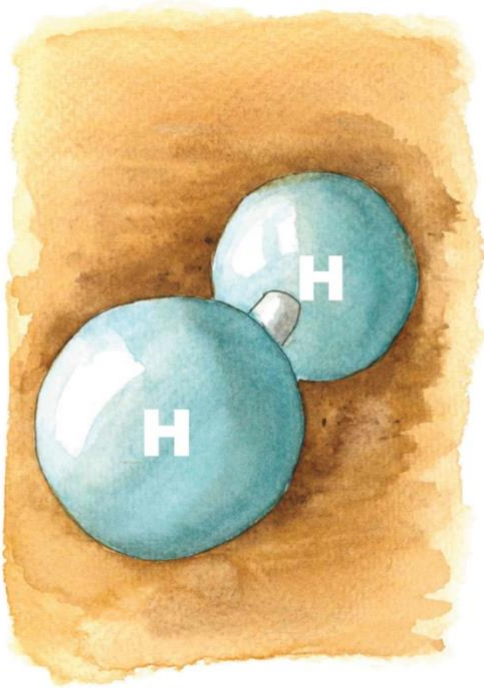
gas), reduce energy consumption, and decarbonise end-use sectors like transport and industry. Clean hydrogen, among other RE technologies, could be used to decarbonise the sector. Decarbonisation of the electricity sector is the underpinning aspect on which all other efforts are hinged.

Projections, however, show only a moderate reduction in oil and gas production and demand. Hydrogen and hydrogen-based fuels will continue to play an increasingly significant role, garnering increased demand and, in turn, increased production of hydrogen. However, this projected trajectory is dependent on policy and the actions governments, companies, and individuals choose to take going forward.

Africa in the global energy transition

Fossil fuels still dominate Africa's energy mix, along with biofuels and biomass waste. RE—predominantly hydropower, wind, and solar—constitutes a small percentage of the mix. There has been bottom-up innovation in the energy sector, including off-grid solar innovations and projects in the e-mobility space.

The COVID-19 pandemic has had an impact on the energy transition in that governments set up a lot of public spending programmes to facilitate economic recovery during the pandemic. A significant share of this funding has been directed towards the promotion of climate-friendly investments. However, such funding has been concentrated in industrialised countries, while countries in the Global South do not have the same access to financial resources. This risks slowing down the deployment of renewables in these countries.



Hydrogen and the global energy transition

Hydrogen has an important role to play in decarbonising certain sectors where electrification is not an option, such as steel, chemicals, long-distance shipping, and aviation.

There are different types of hydrogen, based on their mode of production. In Germany, the focus is on green hydrogen (produced through electrolysis processes using green electricity). There is also grey hydrogen (produced by splitting up natural gas into CO_2 and hydrogen). This type of hydrogen has a large carbon footprint. There is also blue hydrogen (produced by splitting natural gas and capturing CO_2) and turquoise

hydrogen (produced by splitting natural gas into hydrogen and solid carbon through pyrolysis, a process that does not produce CO_2 emissions).

There are differing opinions on the efficacy of using blue hydrogen vs. grey hydrogen. The cost of green hydrogen is meanwhile strongly dependent on the cost of electricity, so low-cost electricity is a major asset for countries that want to produce hydrogen.

Africa in the clean hydrogen race

Africa has a lot of renewable energy potential, especially solar and wind. The main issue with harnessing these resources for hydrogen export relates to ensuring efficient transport of hydrogen to demand centres. There are already many hydrogen-linked initiatives, associations, research centres, and events across the African continent, including:

- The African Hydrogen Partnership (AHP), a pan-African trade association that deals with hydrogen.
- Important research centres that deal with climate and hydrogen issues have been set up, mainly with support from Germany. These include WASCAL (Ghana) and the Southern African Science Centre for Climate Change and Adaptive Land Management (SASSCAL) (Namibia).
- Emerging hydrogen forums and events, e.g. on green hydrogen production and utilisation potential in Africa.
- Several West African countries plan to set up a production and importation chain for renewable hydrogen with support from the German Ministry for Education and Research.
- A West African regional training initiative on energy and green hydrogen.
- Research projects like the Hydrogen Atlas for Africa, which is assessing hydrogen potential on the continent, focusing on Economic Community of West African States (ECOWAS) and Southern African Development Community (SADC) countries. The project is funded by BMBF-FZ Juelich. This research project has found that there is major potential for hydrogen production in countries such as Niger, Mali, Senegal, Guinea, and Nigeria at very competitive costs. The issue, however, is that not all locations have a sufficient amount of water to conduct electrolysis. This presents a major point for further discussion.

Other initiatives and projects are happening across the continent, as summarised below.

South Africa

In South Africa, the South African Department of Science and Innovation is implementing a National Hydrogen Strategy (HySA), which focuses on research, development, and innovation. The government is setting up 3 centres of competence - HySA Infrastructure, HySA Catalyst, and HySA Systems. The vision here is to bring about wealth, jobs, and Inevitable Policy Response (IPR) creation through the initiation of new high technology industries based on South African minerals, especially platinum group metals.

South Africa is also pursuing a hydrogen-use strategy under the South African Hydrogen Valley project. The project aims to establish an integrated hydrogen ecosystem and industrial-cluster and leverage regional platinum group metals. A feasibility study has been completed by the South African Department of Science and Innovation in partnership with Anglo American Platinum, Bambili Energy, and ENGIE. Under the project, 9 green hydrogen and ammonia projects are being implemented across the mobility and construction sectors. The demarcated area for this hydrogen valley starts from near Mokopane in Limpopo, extending through the industrial and commercial corridor to Johannesburg and finally Durban.

There is also a strategic integrated project within the South African National Development Plan focused on developing an export hub for green hydrogen and ammonia. This is being implemented in partnership with SASOL, an integrated energy and chemical company in South Africa. At present, an MOU has been signed between SASOL and the Northern Cape and Gauteng Governments for a two-year feasibility study.

Morocco

There is a strategic partnership between IRENA and Morocco's Ministry of Energy, Mines, and Environment focused on green hydrogen development. There is also research and development cooperation with Germany to develop and promote hydrogen technology and the 'power to x' sector.

The HEVO Green Ammonia Project also aims to produce 183,000 tonnes of green ammonia, with an investment volume of USD 850 million. The project aims to enhance the country's green domestic fertiliser production and establish Morocco as an exporter of green ammonia.

Namibia

The Namibian government plans to present a hydrogen strategy in November. There is a joint communique of intent to establish a German-Namibian hydrogen partnership. Plans include the construction of desalination plants to provide the water needed to produce large quantities

of green hydrogen for export. Germany has committed USD 7 million for research and development and feasibility studies.

Democratic Republic of the Congo

The DRC and Germany are exploring an energy partnership to produce green hydrogen for domestic use and export through large hydropower (Inga Dam III). The Inga Dam III project has a potential capacity of 44 gigawatts (GW) and an estimated project cost of USD 3.5 billion.

Uganda

Uganda has installed the world's first solar hydrogen-powered mini-grid. The solar power plant is backed up by onsite hydrogen production and storage. The project was launched in 2018 by Belgian renewable energy company Tiger Power, in partnership with the Ugandan government, to power 3,000 rural households and businesses in Kyenjojo.

Egypt

Norwegian company Scatec plans to build a green hydrogen plant in Ain Sokhana, Egypt in collaboration with Fertiglobe and the Egyptian Sovereign Fund. Green hydrogen will be produced for use as a feedstock in the creation of green ammonia. The electrolyser will be 50-100 MW in size.

Mali

In 2015, natural hydrogen shallow gas was discovered in Mali. Canadian energy company Petroma has subsequently installed a pilot gas exploitation unit to supply the Bourakebougou village with electricity.

Open questions about the African context

The question of additionality:

- If Africa produces renewable power for green hydrogen export, what will the continent have left to power the rest of the energy transition? Green power may have more impact on the continent if Africa uses it to replace fossil fuels.
- Energy access in Africa is already limited. Why divert added electricity to export hydrogen?

The role of water constraints:

- Green hydrogen production requires access to water. How can this be embarked on without causing environmental risks?

Africa as a hydrogen partner for Germany/ Europe:

- How will the cost of transport be regulated?
- Will Africa export raw hydrogen or add value before export?
- Aside from Germany and the rest of Europe, will other partner countries and regions form partnerships with Africa? Will Germany and the rest of Europe always maintain the partnership interest?

Blue and green hydrogen:

- Is the blue hydrogen path worth it, or does it just consolidate activities towards promoting fossil fuels?
- Is investment in green hydrogen production actually a realistic way for fossil fuel-dependent countries to embark on their energy transitions?

Comments and questions

1. **To ensure a successful hydrogen-powered transition, Africa needs high-power RE sources. Concentrated solar power (CSP)/concentrated solar thermal (CST) hydrogen production installations could potentially be set up in areas like Morocco and the Sahara. Has such an intervention been tested elsewhere in the world?**

- Chile could be a benchmarking country, as they are undertaking large hydrogen power projects. They have invested in solar thermal and have a desert climate, so this works very well.

2. **Are the emissions produced during the manufacture of the equipment used in the manufacture of hydrogen factored into the estimation of emissions?**

- Those emissions do not seem to be included, considering green hydrogen reportedly has a zero-carbon footprint.

3. **Is there a formula for converting hydrogen consumption units from kilogrammes (kg) to kWh?**

- Yes, it is convertible, but for the price of hydrogen, kilogrammes may be more relevant.

4. **What is going on in Nigeria regarding the energy transition and uptake of RE technologies?**

- The discussion on RE in Nigeria is limited.
- Because of Nigeria's huge crude oil deposits, most of the planning and implementation focus is on oil and gas. However, there has been a marked increase in RE uptake around the country, with a plan to significantly increase RE generation and access by 2030. Several RE innovations and projects already exist, such as ENGIE's off-grid and mini-grid projects, and rural electrification projects funded by the World Bank. Most projects are focused on solar solutions.

Panel discussion: The H2Atlas-AFRICA Project

The role of green hydrogen in Africa's energy transition - Opportunities and challenges

Dr. Solomon Nwabueze, Agbo, Senior Scientist/Project Coordinator, H2Atlas-Africa, Forschungzentrum Juelich GmbH

Dr. Agbo began his presentation by saying that green hydrogen is going to play a key role in addressing the issue of climate change and global warming, as well as providing sustainable energy. It is for this reason that the BMBF is funding the H2Atlas-Africa project. As global warming is a global issue, its interventions must extend across borders in terms of partnerships between countries, regions, and continents.

Hydrogen potential in Africa

Green hydrogen generation presents a large opportunity to tap into the RE resources that have so far remained largely untapped on the continent; Africa has the opportunity for less reliance on just one energy source. The continent also has a vast land area that is largely unutilised (30.37 million square kilometres (km^2)). This means that there is a lot of room for RE projects on the continent. Furthermore, the African population has a median age of under 20, which is a big asset for the region.

Africa additionally has a lot of resources, e.g. water, that are critical for hydrogen production. According to UNEP (2010), the continent has 17 rivers with catchment areas greater than 100,000 km^2, 160 lakes larger than 27 km^2, and one-third of the world's major international

water basins (basins >100,000 km^2). This resource will play a role not only in hydrogen production, but also in the generation of other clean energy forms across the continent.

According to the AfDB (2017), Africa's compiled resource potential includes: 1000 GW potential from solar, 110 GW from wind, 350 GW from hydropower, and 15 GW from geothermal. Together, these resources are enough to generate 1000 times more electricity than the region would need in 2040. The ideal scenario therefore would be that these resources allow Africa to meet its energy needs and also play a key role in the international energy market.

Benefits of green hydrogen for Africa

One potential benefit of green hydrogen production in Africa is that hydrogen will create a big opportunity to tap the existing RE sources that have remained largely untapped. It will contribute to addressing energy access, enable Africa to meet its green targets, and combat climate change. The continent will also be able to rely more equitably on its different resources, e.g. wind, solar, and water (resource diversification). The establishment of hydrogen generation plants will further position the region as a key player in international energy markets and create opportunities to generate more resources and income-generating activities from local use or export.

German National Hydrogen Strategy

The German federal government is creating a coherent framework for action on the future production, transportation, and use of hydrogen and hydrogen-related by-products. The strategy aims to:

- Establish hydrogen technologies as core elements of energy system transformation.
- Create the necessary regulatory conditions for the market ramp-up of hydrogen technologies.
- Secure and shape the future national supply of CO_2-free hydrogen and its derivatives.
- Strengthen German companies and their competitiveness by promoting research and development and the export of technology related to innovative hydrogen technologies.

This strategy is being implemented with the shared understanding that global warming is a cross-border issue. International partnership for the green hydrogen economy for mutual benefits is the way to go to save the global climate and preserve a future for the world's children.

The H2Atlas-Africa Project: Atlas of green hydrogen generation potential in Africa

The H2Atlas-Africa project was created after the launch of Germany's National Hydrogen Strategy and BMBF's decision to start engagement with Africa on this topic. The project is a technological, environmental, and socioeconomic feasibility assessment funded by the BMBF and is running from 15/01/2020 to 14/01/2022.

The main programme partners include Forschungszentrum Jülich, WASCAL in Accra, Ghana and SASSCAL in Windhoek, Namibia. Other associate partners include the SADC Centre for Renewable Energy and Energy Efficiency (SACREEE) in Windhoek, Namibia and the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) in Praia, Cape Verde.

The H2Atlas-Africa project aims to create a database that reflects the potential of generating green hydrogen in Africa as part of the transition to a green hydrogen-driven economy to support sustainable development and contribute to the fight against climate change in both SSA and Germany. The project's underlying principle is that climate change and the need for sustainable development are global challenges that must be addressed, relying on cross-border partnership based on trust, understanding, and fairness.

The focus countries of this project include almost all ECOWAS and SADC countries. The project started in these regions because of the already existing partnerships and will be extended to other regions in the future.

Several Forschungszentrum Jülich institutes are also participating in the H2Atlas-Africa project, including:

- Corporate Development (general coordination)
- Institute of Energy and Climate Research - Techno-economic systems analysis (renewable energy potential assessment and system analyses, designing systems based on what is available on the ground to maximise production cost-effectively)
- Institute of Energy and Climate Research – Solar (RE potential from PV, photovoltaic model update to fit into the local scenarios)
- Institute of Energy and Climate Research – Systems analysis and technology evaluation (socioeconomic and political context analysis)
- Institute of Bio-and Geosciences – Agrosphere (Water availability for hydrogen generation and future climate models and how they will affect the availability of resources).

H2Atlas-Africa Project: Guiding criteria

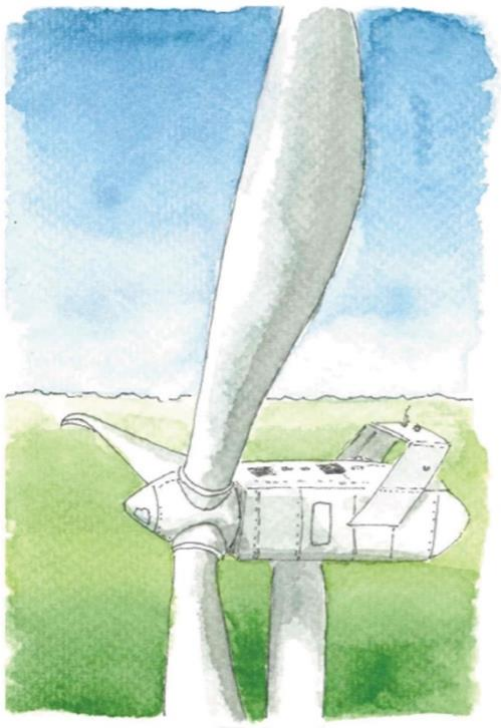
A complete assessment of the green hydrogen generation potential requires a comprehensive assessment of the process chain, starting from RE generation. This RE is used to split water/carry out electrolysis to generate green hydrogen, which can then be stored, transported, or converted into different derivatives of hydrogen. This hydrogen can then be brought to shore for export.

A land eligibility assessment is then done to determine/quantify how much of a given land area can be used to set up RE infrastructure, including hydrogen infrastructure, considering other existing land use in the area. This is critical, as it shows how much RE-based power (PV and wind) can realistically be generated on the land available. Based on this, a renewable energy potential assessment can be done. The hydrogen infrastructure can then be placed. Local demand and preferences are also taken into account on a country-by-country basis to respond to the differences in in-country scenarios, e.g. in the level of energy access, socioeconomic activities, and demographic distribution, among other things. All of these aspects impact how and where RE infrastructure is developed.

The unit cost of generating a kg of green hydrogen is then worked out and used to determine how much green hydrogen can be generated per kg per m^2/km^2 of the given land in a country or region.

To make significant progress in this sector, it is critical to have win-win, high-level South-South or North-South partnerships. Under the project, each country has a national team that engages with the local people to get all relevant local input and preferences, sensitise local stakeholders, and ensure that at every level, there is local participation. This is critical, as preferences differ from country to country; for example, in some countries, stakeholders prefer standalone RE systems, while in others, the preferred strategy is to generate RE, put it all into the grid, and use the surplus to generate hydrogen. The intensive engagement ensures that all stakeholders that need to be engaged are engaged.

Each region also has a technical committee composed of experts from different fields (policy, water, governance, socioeconomics, technology, etc.) to ensure that all perspectives and stakeholders at the national and regional level inform planning and implementation. The models used need a lot of local input data for calibration and an accurate representation of local scenarios.



The atlas is then generated. It contains maps that show several criteria, e.g. the cost of hydrogen generation, RE potential, the unit cost of PV or wind power, future climate change scenarios, water availability, etc. All that information is compiled in an interactive atlas.

Regarding climate change, the project is also making projections, e.g. 50 years from now, looking at historical data on climate change to see how these resources—e.g. land and water—will theoretically be impacted. This data will be integrated into the project calculations.

Key project deliverables include the Hydrogen Atlas and an optimised energy system that shows where the hotspots are, the possibilities to generate green hydrogen in the different countries, and at what costs and in which amounts.

The H2Atlas-Africa Project findings, mainly in the surveyed ECOWAS area, include the following:

- There is plenty of land for renewable energy generation and local development. For example, almost 70% of the land area in West Africa (WA) can be used to generate onshore wind power. PV also has huge potential. Potential RE locations exceed the need for renewable energy plants. Therefore, WA has huge potential to export green hydrogen.
- The surveyed areas have abundant and cheap RE potential. Open field PV costs as little as 2 eurocents per kWh, and by 2050, this number will be halved. This is based on how fast advancements in the solar PV sector have occurred, looking at costs over the past 20-30 years, which are used to plan for the next 20 -30 years. Interconnections are required to exploit the huge PV potential. In most locations, wind energy is significantly more expensive than open-field photovoltaic power. Preference should therefore be given to expanding open-field photovoltaic generation in WA.
- There is huge technical green hydrogen potential—production potential in WA is over 160 petawatt-hours (PWh) per year, without factoring in local demand/water constraints. Around 75% of the energy mix is based on open-field PV. Hydrogen costs start at EUR ~2/kg hydrogen (H_2), assuming no water constraints. There is only a

moderate increase in hydrogen cost with rising production. However, regions with the cheapest hydrogen production costs are generally the most severely constrained in terms of water availability.

- Local groundwater is not readily available in many places, and cheap and ready access to water is crucial to producing cheap green hydrogen. The study showed that local water availability constrains the technical green hydrogen potential by roughly 80 percent. Cheap seawater desalination (ca. +0.5-0.7% of the levelised cost of hydrogen (LCOH)) and transport of water or electricity is required to explore the full potential.
- Implementation of green hydrogen could have positive social impact. This result is based on the increased energy access this intervention would bring, along with stimulation of economic activities, and population distribution. Across the region, there is a huge possibility to make a social impact in terms of the value added for the local people. More results can be found in the Atlas.

Key challenges identified in the survey include dealing with the status quo, in which there is still heavy dependence on crude oil and simultaneously limited supporting infrastructure for local use and export. Looking at the investment climate, there is also low security for investments, which is a very big challenge for investors. Additionally, there is no regional concept for infrastructure and logistics (e.g. deep-seaports, gas and electricity networks, or transport/traffic routes). This would facilitate the exploitation of the hydrogen produced. Finally, there is a lack of an enabling framework in terms of hydrogen policies, regulations, and legalities.

The following is recommended to advance the hydrogen energy transition:

- All stakeholders (government, the private sector, research institutes, technical stakeholders, etc.) need to be involved in the planning and implementation of the transition process. Pilot/demonstration sites should be set up to foster understanding of green hydrogen and its associated processes, clarify its benefits, and build acceptance. Strong PPPs need to be developed, and the capacities of local context need to be enhanced
- The continent needs to formulate a science-based green hydrogen economy policy to guide the transition. There needs to be an engagement agenda, different (but aligned) national hydrogen strategies, and a green hydrogen action plan to foster the implementation of this approach.
- Strategic international cooperation/partnerships should be developed for mutual benefit. To use hydrogen locally or for export, we need high-level partnerships.

- Short- and long-term investment plans for energy infrastructure development should also be put in place, factoring in aspects like grid network development, off-takers, and a regional resource pool.

Stakeholders need to support an immediate start to transitioning, rather than a later one. All stakeholders must be part of the global green hydrogen movement.

Comments and questions

1. **Which countries are ideal for hosting green hydrogen generation plants?**

- Investors or partners need to determine this based on all the information compiled in the Atlas. There are hotspots all over the world. Aspects to consider when making such a decision should include politics, local markets, insecurity, and low economic activity, among others.

2. **What is your recommendation for African governments and policymakers regarding green hydrogen promotion?**

- Africa should properly position itself as an attractive region to invest in/partner with. Countries are forming alliances for cooperative growth. Investors generally focus on the investment climate and the profit to be made. An unstable, unstructured political system will repel them.

- It will take time for SSA to develop the infrastructure to start using hydrogen locally. Therefore, it is likely that initial activities will be focused on export, with countries working towards local utilisation in parallel.

The IMPACT-R Project

Impact-Driven & Action-Based Research (IMPACT-R) project

Dr. Natalia Realpe Carrillo, HEDERA Sustainable Solutions, Institute for Advanced Sustainability Studies

This presentation centred on energy aspects and the tools that the project seeks to promote to other stakeholders to facilitate the identification of household needs in rural remote areas regarding access to electricity and cooking solutions.

The HEDERA team is focused on the need for standard metrics to measure impact in impact investment. A standard metric ensures all projects, whatever their locations, can be assessed against the same criteria, and implementers can understand the impact they are making, compare and monitor it, and share this information with investors and beneficiaries.

How do you know you are making an impact?

Projects need to have reference points such as a detailed baseline, constant follow up at the household level, and impact management of the collected data.

How do others know you are making an impact?

This can be achieved by, among other things, reporting the results using standard frameworks and metrics and sharing these findings through constant communication online and offline.

A 2020 survey of impact investors of the Global Impact Investment Network revealed that they find impact assessment difficult due to limited skills, limited budgets, and complexity. This is what HEDERA addresses with its tools. The HEDERA Impact Toolkit is an impact management information system that empowers organisations to focus on the needs of their beneficiaries and effectively collect data from all employees, clients, and beneficiaries to ensure that all perspectives are captured.

The IMPACT-R project is a research project hosted by IASS, in the framework of the Klaus Töpfer Sustainability Fellowship, and HEDERA, which offers technical support. The project collects data on energy, WASH, and food security at the household level. It seeks to understand MFI customers' vulnerabilities and measure standard indicators at the household level. It further aims to support MFIs in developing data-driven products and services and offer informed recommendations to policymakers.

The project works to tackle end-user vulnerabilities because smallholder farmers and MSMEs continue to be underserved and underfinanced in terms of investing in and protecting the environment. HEDERA works with many MFIs around the world because they are the primary providers of private capital to smallholder farmers, MSMEs, and low-income populations in many developing regions. The following are some of MFIs' unique characteristics:

- MFIs are highly exposed to the impacts of climate change and environmental degradation, because their low-income clients are at risk of defaulting on loans.
- MFIs are highly motivated to develop products and reduce their exposure to environmental risk by offering lending products that factor in climate/environmental risks.
- MFIs require both technical capacity and softer financing terms to develop financial products that motivate clients to invest in the environment.

Data collection + frameworks

IMPACT-R addresses end-user vulnerabilities using data collection and specific results frameworks. As of September 2021, the project had implemented activities in 6 different countries, interviewed over 4000 households, and trained over 100 enumerators.

The frameworks being implemented include:

- For SDG 7: Access to Energy - the World Bank ESMAP Multi-Tier Framework
- For SDG 6: Access to WASH - the JMP developed by the WHO and UNICEF

- For SDG 2: Zero Hunger – Food Insecurity Experience Scale at the household level from the Food and Agricultural Organisation of the United Nations.

This means the surveys being implemented are based on existing standard frameworks and align with the SDGs. Results from data collection in Rwanda, Uganda, the DRC, Nepal, and Haiti are summarised below.

Project in Nepal – Muktinath Bikas Bank - MBB (data collected from 1000 households in 8 weeks with 15-20 loan officers)

Power sources: The IMPACT-R study established that electricity access rates were relatively high, with the population accessing electricity from different sources like the main grid, solar home systems, mini-grids, batteries, and generators. A small proportion of the population was found to not have access to electricity.

Cooking fuel: The survey identified LPG/biogas, wood/biomass, and coal as the predominantly used cooking fuels, whereas the least used fuels were electricity/solar systems, briquettes, waste, and plastic.

Clean water, sanitation facilities, and hygiene practices: The majority of households had basic access to clean water, with the second highest percentage having access to safely managed water. Most households had access to basic sanitation facilities. Most households reported using basic hygiene facilities, although a number reported not having any facilities.

Drinking water source: Most households had access to piped drinking water, followed by dug/spring water, rainwater, and, finally, kiosk/packaged/delivered water.

Sanitation facilities: The most prevalent facilities were flush (container), flush (pipe), and flush (open) toilets, and the least used facilities included mobile toilets and dry twin pits. The results revealed an opportunity for the MFIs to get into promoting more sanitation facilities.

Health vulnerability assessment: This assessment included evaluation of potential risk to household members due to lack of basic services. Thanks to the significant access to piped water, safe sanitation, and access to grid electricity, only 10% of the households were ranked in high-risk categories. Most households were reported to be coping. Others were ranked as vulnerable, slightly vulnerable, very vulnerable, and extremely vulnerable.

Project in Haiti – Palmis (data collected from 600 households in 8 weeks with 5 loan officers)

Power sources: In Haiti, access to electricity was found to be much lower than in Nepal; many households had grid access, but a significant number had no grid access. There were also no mini-grids installed. Very few people had off-grid solutions, with the majority of them having solar systems, followed by other sources, and battery/generator systems.

Cooking fuels: The primary cooking fuels were found to be coal, biogas, and biomass/wood, while the least used fuels reported were waste and plastic.

The study identified that there are specific needs for solutions in electricity supply and improved cookstoves.

Clean water, sanitation facilities, and hygiene practices: The majority of households had basic access to clean water, followed by those who had access to safely managed water and then those with limited access. A small but significant portion of households reported no water facilities. Most households had access to basic sanitation facilities, followed by those who had limited access; a smaller but significant number reported practicing open defecation. Most households reported having no hygiene facilities, followed by a small number that reported having basic facilities.

Drinking water sources: The predominant source of drinking water was piped water, followed by kiosk/packaged/delivered water. The least used sources were surface/rainwater and dug/spring water.

Sanitation facilities: There were mostly dry/twin pits and hanging/open sanitation facilities. Very few households had flush (container) facilities.

Another finding in Haiti regarding food security was that only 20% of households were above the food insecurity threshold. The rest were vulnerable. This points to an opportunity for MFIs to focus on strengthening food security for communities.

Project in Senegal: Entrepreneurs Du Monde - FANSOTO (data collected from 750 households in 8 weeks with 4 external surveyors)

Power sources: The study found that grid access was high, but there was still a significant percentage of households that did not have access to grid-based electricity, relying on solar systems, mini-grids, and/or batteries/generators instead. The MTF for access to electricity further analysed the results to capture the extent of electricity affordability, availability, capacity, quality of the connection, reliability, and safety.

Cooking fuels: The survey results showed a high dependence on coal and wood/biomass. Very few households use biogas to cook. For cooking, the MTF further assessed the extent of cooking fuel affordability, availability, convenience, safety, and exposure.

Clean water, sanitation facilities, and hygiene practices: The study revealed that an almost equal number of households had access to basic or safely managed clean water, followed by those who had access to unimproved water sources. Most households had access to basic sanitation facilities, followed by those who had access to unimproved facilities. Most households further reported using limited hygiene facilities, followed by a number that reported using basic facilities.

Drinking water sources: The primary source of drinking water was piped water, followed by dug/spring water. The least used source was kiosk/packaged/delivered water.

Sanitation facilities: There were mostly dry/twin pits and mobile sanitation and flush (container) facilities in use. Very few households reported having flush (piped) or hanging/open facilities.

Health vulnerability assessment: FANSOTO's health vulnerability-household ranking was similar to Nepal's MBB health vulnerability-household ranking, with most households reported as 'coping'.

Food security: Results showed that only 20% of the households have a high probability of being above the moderate food insecurity threshold.

Each organisation collected data from their clients to identify where their clients' needs are and the level of quality of services, to inform their next actions/interventions.

The purpose of the MTF is to support MFIs/governments in understanding basic service needs and quality, as well as how clients/citizens are making use of the existing resources. In the past, different indicators sought to support the measurement of energy access or energy poverty. There were binary, inflexible electricity supply assessment methods that only captured who had access and who did not. Such methods were not effective because they did not show the degrees of access and instead obscured issues like frequent power cuts and dim energy under the broad umbrella of access. In contrast, the MTF includes different criteria for assessment, citing ideals and leaving room to assess the extent of access. In this way, the focus can be on making more end-user specific solutions.

The MTF's list of attributes includes capacity, availability, reliability, affordability, health, and safety. The World Bank has further provided different matrices to assess different

development indicators, such as electricity supply, cooking solutions, electricity services, electricity consumption for heating, and electricity consumption for lighting and productive use.

As an example, for the availability attribute under electricity supply, if a household has less than 4 hours of electricity at night, it falls under Tier 0; at least 4 hours (4-8 hours), Tier 1 or 2; at least 8 hours (8-16 hours), Tier 3; at least 16 hours (16 -23 hours), Tier 4; and at least 23 hours, Tier 5. The matrix states that every household should ideally be in Tier 5. This framework is unique in that it shows the actual status of a household, regardless of the source of electricity.

With the HEDERA toolkit, users can view results via the dashboard, which shows the indicators and details on energy experiences. Data can also be filtered as needed. A user can see detailed information, including which power sources are used, cooking fuels used, how old the data is, what indices are used with regards to the SDGs, etc. The dashboard also has tutorials on the methodology.

IMPACT-R's goal is to address the lack of access to basic services on the ground by enabling MFIs, governments, and/or NGOs to understand the exact situation and establish what can be improved using partnerships and methodologies that foster the development of sustainable financial solutions. Appropriate products and services can then be developed to facilitate alleviation of the situation in a sustainable innovative way.

Approach, methodology, and tools

The approach is that each organisation is given a QR code, which is given to the loan officers who are going to the field and visiting households or groups to collect data. This data is uploaded to the cloud in the HEDERA server. Digital reports are then generated to enable the organisation to make informed decisions in specific domains. The methodologies used include;

- An e-learning platform that enables the sharing of surveys developed by HEDERA for the organisation to review, comment on in the pdf, and add keywords as needed.
- A tutorial app in different languages, e.g. English, Spanish, and French, that has video Q&A sessions for instant consultation. It does not require data to work in the field.
- Digital communication channels on WhatsApp and Telegram have been created to host research groups to facilitate communications/daily coordination between field officers, allowing them to discuss what is going on, e.g. how data collection is going and any technical issues encountered.

- Data dashboards/digital automated reports that include the theory behind the different frameworks, rationales for measuring set indicators, and graphs of the results. The automated digital reports show the results in the field in pdf format. Each question highlights the answers given, the type of question (obligatory or optional), the distribution of responses, etc.

The reason this methodology is being implemented with MFIs is that they have strong relationships with their clients, a mission to provide financial solutions, and the infrastructure/personnel to conduct these kinds of studies in remote areas.

Microfinance as a vehicle to meet the SDGs

Microfinance is an ideal route to meeting the SDGs; they just need the right partners, technology, and knowledge to implement sustainable programmes. The MFI model is a scalable business model, with proven financial sustainability, access to capital even in a credit crisis, mainstreaming of microfinance, reduced transaction costs, opportunities for portfolio diversification, and hedging, among other attributes.

The main goal of the project is to foster green inclusive finance, by enabling MFIs to make decisions more data-driven and identify vulnerabilities, so appropriate, customised efficient solutions and products can be provided to the communities they serve.

Comments and questions

1. **Please comment on the criticisms of microfinance, e.g. that it is a burden to poor people, with pressure to pay off the loans?**

- The main complaint is still high interest rates, but MFIs are the only alternatives to loan sharks in terms of financial solutions in poor communities. Interest rates can be reduced by lowering the operational costs of MFIs and impact investors. MFIs were created to fulfil an economic mission, so this has to be done using a viable business model.

2. **What is the scope of the IMPACT- R project in terms of the timeframe and country coverage?**

- The project is running from November 2020 to March 2022, with a short extension for data collection.

3. **Dr. Mbungu (IASS)**: The success of this project can be strongly attributed to the commitment of the team and HEDERA's well-developed network in the Global South. There is also a commitment among the clients from whom the data is being collected. These are the key aspects of the success of the tool and implementation methodology. There is a lot of human capacity behind the project, and it should be applauded.

4. **How does HEDERA establish different qualities of service and electrification modes like grid extension, stand-alone, mini-grids, etc. for each customer?**

   Different attributes are assessed using the tool, so an implementer can determine the quality of service and the sector in which they want to set up a project. Programmes used to be focused on increasing electrification rates, but now that the MTF exists, programmes can be more focused on their target scopes/areas.

   The tool and results frameworks therein state that services should have a Tier 5 level, so governments should be specific regarding what level of service they are providing, and researchers should state the tier level of services surveyed.

5. **To HEDERA: What level of access is acceptable? What determines which area will be electrified first?**

- That is a culture-specific question; the acceptable level varies in different areas. The ideal level of access is the one that enables an individual to have a good quality of life, not restricting any of their daily activities.

6. **What challenges have been experienced comparatively in the entire project in IMPACT-R and other private sector engagements?**

- Some aspects are hard to compare—e.g. customer willingness to pay, with the reasons behind this being complex and unclear. The more subjective the questions are, the harder the results are to compare. Using standard metrics, however, enables the same indicators to be assessed, greatly facilitating comparison of results. When the study is reliant on perceptions, it is more difficult.

Networking session: Hydrogen and electric mobility

Ms. Ofafa kicked off the discussion with some insights on e-mobility in Kenya, with a focus on E-Safiri, a startup that operates in Kenya and handles charging solutions for e-vehicles. The company's focus is currently on two- and three-wheelers, although there is also a market for four-wheelers. Kenya currently has up to 14 startups that are developing e-motorbikes and e-bicycles. This market exists because in Africa, two- and three-wheelers are popular modes of transport; however, since fuel prices are always fluctuating, the revenue of the drivers of these vehicles is irregular.

Most transport companies have embraced the move to e-mobility, seeing it to reduce their carbon footprint and improve the lives of the users of their vehicles. Many companies are converting internal combustion engine (ICE) vehicles into electric vehicles, so there is a niche for business models to foster such transitions. The most critical issues in this sector include the fact that there are very few women in this new industry and limited participation of small business owners at the bottom of the pyramid in setting up battery swapping and hosting charging points. Improving these aspects will foster greater inclusivity.

Discussion point: Activities and thoughts on a sustainable transition

- The outlook for e-mobility is very optimistic. The opportunities are vast thanks to the different nascent technologies. There are even biogas-powered motorbikes. Even with the challenges that come along with such technologies, this is innovation at its best. As well, focusing on LPG and biogas as fuels to power vehicles could improve the mobility space and also contribute to its development.
- Innovation in the battery sector is also needed. Spent batteries such as lithium-ion and solar system batteries should be recycled. Uganda already has one company that is recycling lithium-ion batteries. This is a niche market that could be exploited for the continent's benefit, especially since there is a global move towards solar electrification. As companies plan for component production, they should also be planning for component disposal, ideally through recycling.
- There is also an opportunity to invest in solar-powered battery charging points, as e-mobility becomes more prominent.
- Opportunities exist for remote powering of battery systems, e.g. using solar/biogas, in both urban and rural areas. The time is right to make this transition.

Advisory & Experts Leading a Just Energy Transition

Friday, 29 October 2021

Day 5: Advisory & Experts - Leading a Just Energy Transition - Friday, 29 October 2021

Moderator: Mr. Niklas Hayek, GFA

Opening session: Funds, tools, and networks for the African energy transition

Mr. Hayek, the session moderator, re-iterated that regulatory frameworks that are sound, understandable, transparent, and forward-looking are necessary not only for the transition in the energy sector, but also to enable research and innovations that meet the market's and people's needs and can be implemented on the ground.

Access to finance is key not only for energy projects, but also for R&I projects, and collaboration is therefore essential in all such initiatives linked to the energy sector.

As far as data collection and management are concerned, data access and quality is sometimes a challenge in rural areas, and yet this is a key requirement for market research to make sure that any innovative project addresses the actual challenges in the field.

Knowledge sharing and management is another gap and can be bridged through open data and access to open-source software. This can substantially contribute to increasing sustainable energy access worldwide.

Cross-cutting issues that are essential to an energy transition include women empowerment and cross-sectoral stakeholder engagement. Integration of these aspects will ensure that all the different actors' voices are heard and that their needs are addressed in the different projects.

Alumni relations are important as well and can help address the issues raised above. The knowledge gained from research and engagement with different experts in the sector will facilitate a smooth energy transition.

How can a just energy transition be achieved? Renewable energy transitions in Africa

Dr. Simone Claar, Research Group Leader, *Glocalpower*, University of Kassel

The Glocalpower project began 4 years ago and specialises in funds, tools, and networks that advance energy transitions on the African continent. The project is anchored in the Political Science Department at the University of Kassel and the University of Hamburg in Germany and receives funding from BMBF.

Glocalpower entailed researching how a just energy transition could be achieved.

The research focuses on Ghana, South Africa, and Zambia. Research questions that emerged under this study include:

Funds

- How can just transition components be integrated into renewable energy projects funded through global green funds?
- How is the political economy of green finance shaped?
- What are crucial factors for designing green funds in a fair, efficient, and transparent way?

Tools

- Which political/financial tools are effective for managing energy transitions? How do they contribute to SDG 7?
- What are crucial factors for designing political/financial tools that support an effective and inclusive energy transition?

Networks

- What modes of *glocal* stakeholder governance are evolving?
- How can inclusive and fair stakeholder participation be guaranteed?
- How can stakeholder governance be improved, particularly in the African context?

Renewable energy trends in Africa

Installed RE capacity on the African continent has increased from 26 GW in 2009 to 46 GW in 2018. Demand for investments in the green transition has grown as well, with the current investment required to meet the SDG 7 on sustainable energy at USD 308-333 billion. To understand a just energy transition, it is important to conceptualise justice. There are 3 dimensions of energy justice: procedural justice, distributive justice, and recognitional energy justice.

Procedural energy justice involves stakeholders' participation in policy implementation and articulation of each stakeholder's interests, democratising the potential of energy transitions and public consultation. In other words, all stakeholders (from big institutions to local communities) have a chance to provide inputs regarding government decisions.

Distributive justice refers to the distribution of burdens and benefits related to environmental interventions. It further refers to eased access to and affordability of energy, training, and capacity building for stakeholders, including knowledge transfer, local technological know-how (to develop and maintain technologies) to develop solutions in Africa, rural electrification and grid integration, pricing schemes tackling energy poverty, and green job creation.

Recognitional justice concerns who is given respect (or not) and whose interests, values, and views are recognised and taken into account (Svarstad and Benjaminsen 2020, 1). It involves policies that target specific groups, e.g. women, the poor, refugees, and rural communities. How are these groups impacted? Are they able to access energy? What are the alternative solutions to achieve success? This justice poses further questions: How can justice be achieved by political means? How can energy policies be reformulated according to justice theory?

Mapping African energy policies

In a key empirical paper (Müller, Claar, Neumann, and Elsner 2020), Glocalpower mapped and sampled 34 states to examine energy policy legislation using different data sources, including national websites and various other open data sources such as reports to establish the existence of a national energy plan, a renewable energy plan, and specific plans for solar

panels at schools or government buildings. This information on data collected in this research is available in the following open-source databases:

AFRO_ENERGYPOL 10.17632/grhystdwDr1. Open Access.

ZA_RE_Invest, doi: 10.17632/d3s9jchpfr.1. Open Access.

Transition scenarios

The research revealed several different renewable energy scenarios:

- Mauritius, Rwanda, and South Africa meet the energy justice criteria because they have comprehensive renewable energy policies in existence.
- The majority of African countries sampled - Botswana, Cabo Verde, Ghana, Kenya, Malawi, Mali, Namibia, Nigeria, Tunisia, Uganda, and Zambia - only partly meet the energy justice criteria because although they have some integrative and enabling policies, they do not have a comprehensive renewable energy policy framework.
- Countries like Burkina Faso, Burundi, Côte d'Ivoire, the DRC, Gabon, and Togo do not meet the energy justice criteria because they do not have comprehensive renewable energy policies and are highly dependent on foreign donors for economic development.

An in-depth look at Rwanda, South Africa, and Zambia

South Africa's Renewable Energy Independent Power Producer Programme (REI4PPP)

This program aims to get more renewable energy into the grid. The first round was in 2011, and the 5th round recently closed (in August-September 2021). The research focuses on who is financing RE projects, establishing that there are many transnational energy investments, as seen by the fact that the projects are largely financed by transnational energy investors such as ENEL, Biotherm Energy, Mainstream Renewable Energy, Old Mutual, and Thebe Investment Corporation, among others. In the South African case, although scoring is largely based on pricing (70%), the local context and socioeconomic criteria are also considered (30%). Socioeconomic criteria include transnational renewable energy investment (37%), transnational social entrepreneurship (33%), and localised ownership (30%).

South Africa's energy justice performance criteria includes:

1. **Recognitional justice**

- Local context requires identify local industry and stakeholders to strengthen the national industry.

- There are socioeconomic development contributions of over South African Rand (ZAR) 384 million.
- Market needs trump the needs for job security and energy access.

2. **Procedural justice**

- REI4P is implementing an energy integrated resource plan, with several avenues for public consultation and debates on the plan and the role RE should play in it.
- South Africa has developed social programmes for the participation of local communities. However, language sometimes poses a barrier for local communities in policy debates, because South Africa has 11 national languages.

3. **Distributive justice**

- Energy companies are obliged to share revenue and ownership with local communities.
- There is limited job creation (some 50,000 jobs so far).
- On the other hand, electricity tariff effects are ambitious, and the tariffs are still quite high. Electricity is not yet affordable for minorities.
- Profitability sometimes trumps local industry interests.

The main challenge in the South African energy sector is the predominance of coal-based energy generation; however, 35 GW of coal is expected to be decommissioned by 2050.

Beyond the Grid Fund for Zambia (BGFZ)

Zambia is largely dependent on large hydropower (72% in 2019, down from 92% in 2010). The country has an energy deficit and faces frequent load shedding. Electricity access is at 28%, with 5% in rural areas. Thus, there is a huge demand for energy production, but various obstacles remain, such as the national debt crisis, which has delayed the overhaul of the national utility, ZESCO.

Beyond the Grid Fund for Zambia (BGFZ) is a private initiative established with Swedish funding - initially USD 10 million. The goal is to provide 1 million Zambians with access to clean, affordable off-grid energy by 2021. The available data show 970,000 people connected thus far. BGFZ is tender-based, selecting foreign companies providing SHS, other clean energy appliances, and energy services based on mobile payment schemes. The project plans to expand to other countries, including Liberia, Burkina Faso, Mozambique, and Uganda. Zambia's energy justice performance criteria include:

1. **Recognitional justice**

- Rural communities are targeted by BGFZ.

2. **Distributive justice**

- The project is very selectively low-tech, with basic electricity access.
- Some knowledge transfer is occurring, although there is little involvement of domestic companies in the project, as it is dominated by foreign companies.

3. **Procedural justice**

- There is also low engagement with civil society and limited consultation of state representatives.

In conclusion, there is still a lot of potential for Zambia, and there needs to be more financial support from international investors to address the challenges being faced in the project.

Rwanda‘s national energy strategy

Rwanda planned to have rapid electrification progress (2010-2020), with 200 MW more commissioned. Electricity access increased from 10% in 2010 to 65% in 2018. All energy players are state-owned except power generation companies. SE4All Action Agenda 2030 is targeting 100% electricity access with 60% on-grid renewables. Their transition agenda integrates a gender mainstreaming strategy in that Rwanda is not only looking into providing more access to energy for women, but also how women can be more engaged in implementing the national energy strategy. The country’s energy mix includes small hydro, solar, and biomass. The main challenges in Rwanda include outdated hydropower infrastructure, high electricity prices, and load shedding.

Rwanda’s energy justice criteria includes:

1. **Distributive justice**

- There are energy audits and capacity building for local industries.
- There is access to electricity, although electricity prices are high.
- There is poverty reduction and job creation.

2. **Recognitional justice**

- The country promotes and undertakes capacity building for women.
- There is a focus on rural electrification and access.
- However, there is a large energy access gap between local communities and refugees in the same area.

3. **Procedural justice**

- There is formation of partnerships and communication with civil society organisations.
- There is also a balance between government decisions and donor influence.

From the review of the three countries, all of them are pursuing market-driven solutions. There is successful channelling of international investments into the RE sector, with significant drops

in generation costs, but only moderate success in terms of green job creation (South Africa). There is a need for greater emphasis on local job creation in manufacturing (Zambia). There needs to be greater inclusion of local stakeholders in industry and politics in implementing transition endeavours. This will reduce domestic resistance to a private actor-driven renewable energy transition and lawsuits filed by trade unions due to lack of inclusion, as is the case in South Africa.

There is also a need for more research-based policy documents and open-access web sources that consider justice factors in the energy transition in the Global South. Many countries have distributive justice efforts but focus on electrification/access rather than SDGs 8 (decent work) and 9 (industrialisation).

Procedural justice concerns also remain largely ignored by international private actors and donors.

The following are recommendations based on the research on how to foster a just energy transition:

Government & policymakers should:

- Combine auction instruments, feed-in tariffs, green funds, green industrial policies, and cross-cutting socioeconomic policies (education, training, technology transfer, etc.) to arrive at an effective policy mix.
- Mainstream energy justice within renewable energy policy frameworks and mainstream the justice dimension into the SDG agenda to stimulate synergies.
- Expand the RE value production chain and promote green industrial policy.
- Tackle the policy formulation/implementation gap.
- Ensure participation of civil society, as well as that of the communities.
- Learn from initiatives like the Climate Justice Charter in South Africa.

Development partners and regional organisations should:

- Develop transition scenarios based on SDG7 progress and policy frameworks.
- Include energy justice criteria, green industrial policies, and the creation of decent jobs in regional organisations' policies, like SADC's energy agenda.
- Facilitate learning from good-practice cases and create an African peer-review mechanism for RE policies.

- Strengthen alignment among governments, donors, regional organisations, and specific policy initiatives (IRENA's Renewable Readiness Assessments (RRAs) and SE4ALL).
- Provide carefully curated de-risking measures to stimulate and facilitate investment.

Comments and questions

1. **There is scepticism regarding the concept of a just energy transition, because many jobs have been lost and more will be lost as countries transition away from coal and hydro. What were the findings of the research in this regard? How can this challenge be addressed in a just energy transition?**

- It is always necessary to think about the broader context of what you want to achieve, aside from tackling the climate change issue; it is important to consider the impact on the socioeconomic environment.
- A phased approach should be taken to enable re-training of skilled labour and their integration into green jobs, which normally require certain skills or specialisation.
- In addition, a lot of work must be done in advance in terms of needs assessment, e.g. through public consultation. Trade unions must be involved from the start to support the transition.
- It is important to listen to the people. Livelihoods are as important as climate change, especially in African countries where social systems are weak, and people are heavily dependent on their jobs for survival. It is necessary to address the skilling gap on a global scale to ensure cross-cutting solutions.

2. **Based on Glocalpower's mapping, which institution is guiding the energy justice transition? What is the role of affordability in energy access?**

- The leading institution differs from one country to another and largely depends on the country's strategy, but in general, there are several actors/development institutions interested in fostering a just energy transition.
- The main focus, for now, is on access and affordability. Affordability depends on the investor. Whoever is providing the access determines how affordable the energy will be.

3. **What are the opportunities available for bridging the gap between energy policies and implementation, and what could be the scope for benchmarking good practices from leading countries in terms of policy implementation?**

- African countries should encourage policy learning from best practices. They should also think about what would be possible in terms of de-risking mechanisms—e.g. in Zambia, the state guaranteed the investment and agreed to pay it back should the investor lose the investment. Such an action boosts investor confidence.

- In addition, there should be an investigation of the policy frameworks developed within the respective states or brought by the different donors into the respective states. Policymakers can make sure that justice is incorporated into the whole process to ensure that a just energy transition is achieved.

4. Where was the research conducted in Zambia?

- The research on Zambia was conducted in various phases, beginning with explorative research in 2015, where the team talked to different stakeholders, including local ministries, the European Union, and people working in cooperatives. In 2019, there was more extensive field research in which broad interviews were conducted with different stakeholders, mainly in Lusaka. There were also participatory observations, such as hearings with the Energy Regulation Board on increasing prices. The team also spoke to the beneficiaries of the fund mentioned earlier and the team implementing the GetFit solar programme on renewable energy.

- As a European researcher, there was limited time to collect and analyse research on Africa. Nevertheless, there is room for further information to be integrated, and all feedback is welcome.

Paths for ensuring a just energy transition in Africa

Ms. Clare Komuhendo, Energy Access Coordinator, United Nations Capital Development Fund (UNCDF), Uganda

At UNCDF, the dialogue on the energy transformation focuses on how the sector can transition in a just manner to reflect different national circumstances and opportunities, with the overall aim of improving access to renewable energy for low-end users.

Energy access issues are being addressed as links to other SDGs and cross-cutting issues such as technology, innovation, and finance. A transformation of the energy sector offers opportunities for sustained economic development, social inclusion, energy security, improved health, job creation, and other societal benefits such as women and youth involvement. Such opportunities will only be achieved if the transformation is implemented in a just and inclusive manner.

UNCDF's approach to just energy access with a focus on rural people focuses on supporting energy service companies (ESCOs). This is done through a grant-funded challenge model, as well as direct debt financing to ESCOs, to reach the last mile-users effectively and affordably.

To do this, UNCDF has focused mainly on a market-driven approach by supporting SMEs' productive use of energy in various economic activities and making use of digital technologies such as PAYGO that provide new opportunities to integrate supply and demand. UNCDF's initiatives include the following:

Clean cooking

Under clean cooking, support has been given to briquette-making companies, LPG gas companies, and clean cookstove companies. The interventions here focus on mindset change to foster the transition from traditional cooking technologies to clean cooking technologies to reduce greenhouse emissions. Through the RE fund, grants have been provided to 12 clean cooking energy companies.

Solar technologies

Over time, solar users have progressed from only using SHS for lighting and charging phones to using them to power other larger devices, such as televisions and other household

appliances. Under solar for productive use, UNCDF has supported several companies. For example, one of UNCDF's solar mini-grid partners set up solar infrastructure on an island to power an ice plant that is being used by the community to preserve their fish. The solar mini-grid has also been used to light up the community, as well as power small businesses such as barbershops, small shops, and bars with refrigerators. Solar water pumps are also being used in villages in eastern and northern Uganda, which has boosted agriculture. This has greatly improved the community's standard of living.

Because solar PV costs are relatively high for the target beneficiaries (USD 2,500 per system, on average), UNCDF has provided the farmers financing through groups and savings and credit cooperative organisations (SACCOs), which allow for 12-18 month instalment/payment plans. As a result, farmers can grow more, earn more, and pay off their loans, enabling the companies being supported to sell more solar products.

Regarding digital technologies, UNCDF has leveraged mobile phone use; beneficiaries can make their initial deposits and monthly repayments using their mobile phones. All this is financed by the UNCDF Renewable Energy Challenge Fund Grant.

UNCDF has also been involved in debt financing backed by the Lease Development Investment Platform (LDIP), the international arm that offers loans to ESCOs. UNCDF also partners with other investors (financial institutions) in the market that can increase the borrowing levels of the beneficiaries.

To date, 5 ESCOs have benefitted from UNCDF loans, and another 2 ESCOs have received loans in partnership with other financial institutions such as Uganda Energy Credit Capitalisation Company (UECCC) at a subsidised rate of 15%, compared to a 24% market rate.

UNCDF's current focus is on increasing the pool of companies that are eligible for this financial support through direct mentorship in the areas of financial literacy, human resource (HR) planning, marketing strategies, and business models, in order to build these companies' capacity to take on more RE solutions and effectively sell them to end-users.

Women and youth empowerment is also a key focus for UNCDF, through capacity building to get them involved in the just energy transition by carrying out activities like solar installations and other economic activities.

Comments and questions

1. **What are your key lessons learned regarding women empowerment in SMEs in the energy sector that can be transferred to other countries?**

   - UNCDF has been able to reach a significant number of women in different ways. Out of all the activities mentioned above, most agricultural activities are supported by women, so the percentage of women in economic activities has grown because of increased access to renewable energy. However, there is more work to be done to enable women to take on greater decision-making roles in the energy transition.

2. **There seems to be some overlap between the mandates of UNDP and UNCDF. Are there any synergies between the two?**

   - The two are indeed related. UNCDF is a subset of UNDP and an implementing partner for several UNDP projects. Often, the two programmes work hand in hand, with financing undertaken by UNCDF. There are also other projects on greenhouse gas (GHG) and carbon markets that UNDP directly runs.

3. **What is the typical duration of UNCDF projects?**

   - The project duration is usually 2 years. For loans, funds are advanced for 2 years, with the potential for a top-up for good performance.

4. **In the clean cookstove project, how did you achieve the mindset change?**

   - UNCDF facilitated several campaigns, trainings, and field activities led by the ESCOs to sensitise the public about the benefits of the energy-saving stove vs. the regular stove.

5. **How did you evaluate the mindset change?**

   - Aside from the ESCOs registering an increased number of improved cookstoves sold, several customer impact stories have been compiled that tell a story of a change in mindset. Before the conclusion of each project, customer impact stories are shared to assess the success rate of each project. A link to the mindset change stories can be shared.

6. **Does UNCDF support extend to Zambia, or are there opportunities for Zambia to benefit from projects?**

   - Yes, there is some outreach in Zambia. Loans and guarantees are extended Africa-wide. One UNCDF colleague is currently undertaking a loan assessment for an ESCO in Zambia. There are also outreach initiatives in the DRC and West Africa, especially Burkina Faso. There are plans to further upscale this outreach.

7. **Has UNCDF faced any challenges related to monitoring and evaluation, especially considering most beneficiaries are non-sophisticated users and UN systems are sometimes complex?**

   - Recently, UNCDF adopted HEDERA data collection and software systems to facilitate impact evaluation; users have been trained on how to input information into the mobile data collection app, which is shared with UNCDF, which, in turn, shares the resutls with donors.

8. **Can you share any experiences regarding collaborations with university research centres?**

   - In Uganda, UNCDF is working with Makerere University Research Centre, under the CREEC project, which tests and certifies the stoves made by the clean cookstove companies. On the international level, UNCDF has partnered with Columbia University on a project focused on implementing last-mile inclusion using data collected through geo-mapping.

Energising Rwanda in a sustainable way – a consultant's perspective

Dr. Kevin Schiele, Senior Environmental Scientist, Earth Systems, Rwanda & Ms. Claire Fabrer, MSc candidate, Ecole Centrale de Lille, France/ Earth Systems, Rwanda

Earth Systems is a multi-disciplinary environmental and social consulting firm that develops and implements innovative and effective environment, water, and sustainability solutions throughout the world. Founded in Australia in 1993, Earth Systems currently employs over 50 professional staff and has a network of offices around the world. Four permanent staff are based in the Kigali office. Earth Systems offers a range of services, including environmental and social impact assessments (ESIAs), environmental and social management and monitoring plans (ESMMPs), resettlement action plans (RAPs), and livelihood restoration plans (LRPs). Earth Systems is also involved in advisory services on carbon emissions, resource efficiency, mining management & treatment, rehabilitation, groundwater assessment, agroforestry, waste management, and sustainable urban development.

Besides having special scientific expertise, an environmental consultancy firm like Earth Systems can advise and support clients with:

- Finding funding opportunities for a positive and financially viable energy transition, e.g. for carbon credit financing.
- Showing a pathway to secure necessary permits for project implementation.
- Advice on project implementation to ensure projects are carried out as per the donors' standards.

The traditional Rwandan economy is characterised by small-scale agriculture, tea and coffee production, mainly for export, and tourism. The country is very attractive to foreign investors because of its stable political environment. The energy mix in Rwanda is dominated by biomass, with over 80% of the population using wood for cooking. Petrol is imported, and there is a plan to expand storage facilities for petroleum products. Electricity is the smallest component, a third of which is hydropower. Power cuts are common across the country, although the situation has improved over the years. Electricity is prepaid and is expensive compared to the average income level—USD 0.25 per kWh vs. USD 3 per day.

The demand for electricity is increasing by approximately 8% per year. A new project to generate 400 MW from hydropower in the Ruzizi River is expected to become operational in the next few years. The generated energy is planned to be shared equally between the Rwanda, Burundi, and the DRC. Methane gas also contributes to the energy mix; it is present at depth in Lake Kivu and has the potential to add another 100 MW to Rwanda's energy mix. Peat is also poised to contribute to the energy mix, with an 80 MW power plant in development. Solar power makes up 6% of the energy mix, and there is potential for geothermal energy generation in the northern, volcanic region of Rwanda.

Rwanda is pursuing the following initiatives with local funding to achieve an energy transition:

- Grid-connected hydropower generation
- Solar street lighting
- Reduced use of firewood and electricity in the coffee and tea sectors. To minimise environmental emissions in all forms, Earth Systems has developed a charmaker. This technology entails a pyrolysis process that converts biomass waste such as chipped green waste, agricultural residue, biosolids, etc. into high-grade biochar – a high-nutrient charcoal-like soil amendment for which there is a growing global market.
- Increasing agricultural yields are also of particular interest in areas with growing populations such as SSA. Additionally, charcoal is a more efficient energy source, e.g. compared to wood in cooking.
- Improved energy efficiency in cement production using methane as an energy source instead of coal
- Implementation of vehicle emissions standards
- Promotion of efficient cookstoves to reduce GHG emissions
- Solar pumping for irrigation.

With foreign funding, Rwanda intends to pursue the following initiatives: solar mini-grids, public transport infrastructure, electric vehicles, off-grid and rooftop solar electrification, a solar water heater programme, and promotion of on-farm biogas for energy.

Rwanda's Nationally Determined Contribution (NDC) Plan identifies hydropower (at 32%) as its biggest potential for mitigation to reduce the country's carbon footprint and GHG emissions. The focus is on the Ruzizi IV hydropower project, which forecasts an additional 400 MW of grid power. Other smaller hydropower projects have been successfully implemented over the past few years, such as Rukarara IV and Rubagabaga, contributing 9.7 MW and 0.35 MW, respectively. It is important to note that all these projects have and will have to comply with international standards and best practices. This means that ESIAs must be carried out before local authorities grant permission for construction and operation.

In Kigali, road traffic is the second-highest source of CO_2 emissions. In 2021, 5,000 traditional petrol-powered combustion engine motorcycles were converted into electric engines through substitution funding from the government. By 2025, the government aims to convert a third of all moto-taxis in the country from ICEs to electric engines. The benefits of these interventions include reduction of GHG emissions, less air pollution and noise, and greater independence from fossil fuel imports.

In conclusion, there are challenges and opportunities, not only for the energy transition in Rwanda, but also for consultancies to implement best practices and support a shift towards reducing GHG emissions.

The major challenge is the cost of the transition, especially moving away from free firewood. In addition, the traditional culture is also a barrier; intense grass-root sensitisation and engagement will be required. Furthermore, data collection on energy consumption and the resources being used is also a challenge.

If the government supports the transition, it can allocate local funding and also attract international funding. Rwanda could also benefit from knowledge gathered from interventions in other countries and adopt strategies that have proven successful.

Comments and questions

1. **Comment:** There is a lot of improved technology for irrigation equipment using renewable energies in countries such as China and other western countries that can be introduced in Rwanda to contribute to the energy transition.

2. **Sometimes, due to the high cost of foreign financing, interventions end up being expensive and not feasible for local beneficiaries. How can interventions in the energy sector be structured to make them more affordable/sustainable, in order to ensure financial viability and higher uptake?**

   Because of the political stability in Rwanda, donors are willing to finance the energy transition there, and this example can be used in other African countries. This is an incentive for affordable foreign funding. For local market development, there is a need to build local capacity and demand. For example, in the automobile industry, imported cars are heavily taxed, which makes locally manufactured cars more attractive to buyers and may generate local job opportunities.

3. **Is the volume of methane in Rwanda sufficient to power industrial production?**

   The quantity of dissolved methane gas in Lake Kivu is estimated at 60 billion m^3 (Tietze, 1980; Schmid et al., 2005, 2019), and the gas is currently used, for example, by the Kivu Watt project to produce electricity. More important, the Rwandan 7 Years Government Programme: National Strategy for Transformation 2017 – 2024 aims to nearly halve the number of households depending on firewood as a source of energy for cooking, from 79.9% (2016/17) to 42% by 2024. The aim is to achieve this target by focusing on promoting the use of alternative fuels such as LPG and biogas. Currently efforts are concentrated on increasing the use of LPG in urban areas.

4. **Hydropower has an environmental impact. How can the resettlement challenge be addressed with minimal impact on people's lives?**

- Sensitisation and grassroots engagement are critical to minimise the environmental impact and achieve a just energy transition.

Globally connected: Workshop on alumni relations

TU Berlin Alumni Relations Office – Ms. Bettina Klotz and Ms. Juliane Wilhelm, Alumni Relations Coordinators, TU Berlin

TU Berlin conducts several activities to foster alumni relations. These include organising international alumni training seminars and workshops, often held face-to-face in Berlin and abroad.

A short video on the alumni's work was presented. It highlighted the fact that the TUB Alumni Program builds relationships to generate a positive impact for the university. The programme targets former students, junior researchers, employees, and guest researchers at the university. The member count currently stands at 35,000 members in 139 countries. The programme offers services like international alumni training seminars and workshops and international alumni clubs with focal point persons.

TU Berlin is keen to collaborate with alumni to make an impact. The following guiding questions to support this were posed:

1. What offers and services do you expect from your alma mater's alumni relations office? (Alumni from other universities were also encouraged to share their insights.)

2. In terms of alumni engagement, what are you able to give back to your alma mater (monetary and non-monetary engagement)?

The main feedback on these questions was that alumni have to foster TU Berlin's existing international alumni clubs to thrive. Members could even foster partnerships with international partners to enrich the clubs more. However, first, alumni need to be more responsive. Communication should not only be the job of the central office. The coordinators provided an email address for participants to share further information as it came up.

Closing session

Participants expressed their thanks for a well-coordinated and engaging online seminar. The organising team, in turn, encouraged them to keep networking and collaborating amongst themselves and with other partners.

References:

Schmid M, Halbwachs M, Wehrli B, Wüest A. Weak mixing in Lake Kivu: new insights indicate increasing risk of uncontrolled gas eruption. Geochem Geophys Geosyst 2005;6. https://doi.org/10.1029/2004gc000892.

Schmid M, Baerenbold F, Boehrer B, Grilli R, Triest J. Intercalibration campaign for gas concentration measurements in Lake Kivu, technical report, Kivu monitoring programme (LKMP) of the energy development corporation limited (EDCL). 2019. Kigali, Rwanda.

Tietze K. The unique methane gas deposit in Lake Kivu (central Africa) - Stratification, dynamics, genesis and development. In: SPE unconventional gas recovery symposium; 1980. p. 13. https://doi.org/10.2118/8957-MS.