

Africa-EU Symposium on Renewable Energy Research and Innovation

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Executive Summary

Building local capacities and promoting applied research are essential pillars in the development, promotion, and dissemination of renewable energies in Africa. However, while an increasing number of academic institutions in Africa are dedicated to renewable energy research, the exposure to the international scientific community, as well as access to available support mechanisms and funds remain limited. In order to tackle the above-mentioned issues, the Africa-EU Renewable Energy Cooperation Programme (RECP), the Pan African University Institute for Water and Energy Sciences (including climate change) (PAUWES), and University of Abou Bekr Belkaïd Tlemcen have jointly organised the first Africa-EU Symposium on Renewable Energy Research and Innovation from the 8th to the 10th of March 2016 in Tlemcen, Algeria. 135 international experts attended the event, representing universities, research institutions, public sector, industry associations, and international organisations from 30 countries in Africa and Europe.

The objectives of the symposium were as follows:

- Foster the dialogue and exchange between renewable energy experts
- Promote Africa-EU academic networking and research cooperation
- Share information and build capacities to access research funds and cooperation platforms

Several universities and institutions are already conducting high quality research on renewable energy in Africa. A wide range of renewable energy research projects from Africa and the EU were presented and discussed at the symposium, including: wind energy resource assessment, innovative electrification approaches, modelling of energy storage systems, fuel cell technologies, and employment impacts of renewable energy market developments. During a series of panel discussions, thematic sessions and workshops, the needs, challenges and potentials of renewable energy research and innovation in Africa were identified, as summarised in the findings below:

A people-centred approach should be applied in every research project on renewable energy in Africa, addressing the ultimate goal of ensuring sustainable energy supply and use for all people in Africa. Social, economic, and environmental dimensions must therefore be taken more into account in the development and improvement of technical solutions. Research projects should not only focus on grid-based power supply, but should also address cost-effective off-grid solutions for electricity generation as well as cooking, heating, and cooling systems at household level. The central role of women in energy must also be better acknowledged– not only in the energy use, but also in entrepreneurship, policy making, and scientific research.

The role of academia in advancing renewable energy market development cannot be emphasised enough. Academia can lead the development and implementation of new technologies, innovative mechanisms as well as policies and strategies. Only a very limited number of research proposals at the symposium addressed energy policy related aspects. Research projects should not end with the publication of a scientific paper, but rather the roll-out of technologies and approaches by translating science into practical and bankable solutions. This will ensure a positive impact on markets and livelihoods while also contributing to the financial sustainability of research institutions. Universities

should also take more initiative in training people in the dissemination and application of developed renewable energy solutions.

The role of national governments and public institutions is essential in promoting the people-centred approach and fostering foreign investment in the private sector. Energy strategies for the people need Local Empowerment and ownership. Empowerment bringing about a more equitable sharing of power, increasing the political awareness of disadvantaged groups, and improving their capacities to take more control of their own futures. In the process of decentralization, more power should then be given to local collectivities, since energy is henceforth recognized as human right, to be able to initiate and manage community off-grid projects on renewable energy in Africa. In the other hand, matching speeds of public and private sector by thinking win-win should be a challenge for national governments.

International partnerships with universities and the private sector industry are key success factors for research projects. Africa-EU and regional research cooperation enables real knowledge transfer, capacity building and joint use of facilities, and creates new opportunities for accessing funding sources. A number of available initiatives and platforms for cooperation were presented at the symposium; most of them are open-access and invited all participants to engage in their activities. Private sector players should be involved in all stages of a research project, to ensure that research meets actual market needs; with economically viable outputs that can be scaled-up into real projects, resulting in tangible impacts on the ground. In order to conduct market research and assist in the development of institutional partnerships, an implementation of policies, procedure, and organizational structures should be adopted.

Financing renewable energy research in Africa remains a challenge, though funds are available. Lack of awareness, difficult application procedures and limited capacities often hinder access to available funding sources such as Horizon 2020. Dedicated calls for proposals and procedures must meet the needs and capacities of the scientific community, and reach out through appropriate channels. [CAAST-Net Plus](#) and [DAAD](#) presented several funding opportunities and support mechanisms tailored to respective needs at the symposium. Joint research proposals with international partner institutions that ensure mutual contributions and benefits can substantially increase chances for

All research projects presented at the symposium are available in the [book of short abstracts](#); the symposium organisers are currently working on the facilitation of publicising the conference proceedings. All participants are encouraged to continue the dialogue to establish concrete partnerships and new projects – through bilateral exchange, by joining the presented initiatives, and platforms for cooperation, including: the [PAUWES Community of Practice](#), the [Africa-EU Energy Partnership](#) and [Renewable Energy Cooperation Programme](#), the [African Renewable Energy Alliance](#), the [Low Carbon Energy for Development Network](#), [REN21](#), [EUROSUNMED](#), [ANSOLE](#), [UniPID](#), [REELCOOP](#), and [AfDB's open data for Africa](#). The organisers will continue to share upcoming opportunities for research and cooperation. The outcomes of this symposium will feed into upcoming events and programmes, thus contributing to the sharpening of the role of academia and research in advancing renewable energy development in Africa.



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Day 1, Tuesday, 8th March

The theme of the first day was **“Renewable Energy Research and Innovation Needs in Africa”**.

In their keynote speeches, prof. Emanuela Colombo and Prof. Izael da Silva addressed the African energy paradox (rich in resources, poor in energy) can be turned into the African energy power and the need to take into account the human and socioeconomic dimension by **“focus on energy for people, with people and by people”**. Furthermore, the need to concentrate on the numerous and powerful examples of projects uniting key stakeholders in using research and training to change the lives of people was pointed out. The necessity of training initiatives and research in access to finance as well as awareness and technical support were also highlighted, enabling environments of outstanding and lasting results.

The following panel discussion raised the following key issues: To conduct **high-quality research**, African universities require improved facilities and software, review of curricula to adapt to specific context, input of business views and private sector needs. Over and beyond the importance of advancing RE technologies, it is crucial to include **social and holistic human development** aspects in advancing RE research. Researchers are required to deliver **tangible solutions**, ability to turn complex findings in simple practical steps for action and a focus not just on-grid but also on also off-grid and household appliances.

The subsequent discussion in the audience evolved around the **topic of private sector involvement**. Firstly, a need was identified to **translate science into practical solutions** and practical steps, combined with an appeal to go to industry before the end of the research project - ideally from the beginning. The **need to conduct work on energy for poor people in order to create business cases** was highlighted, pointing at business associations at Universities, e.g. Strathmore in Kenya. The syndrome of energy was mentioned, describing approaches limited to the grid sector only, and the lack of facilities in Africa where laboratories might be existing, however, where there is no appropriate software for e.g. energy modelling.

A key role for Africa-EU cooperation is to **get African institutions out of isolation, considering that EU institutions can facilitate and support** African institutions while the knowledge and networks are intrinsically African. The idea came up to **create an African journal of applied sciences in the framework of AEEP and RECP**, reminding academics of their duty to produce publications and advance theoretical knowledge. At the same time, however, it is their key role to find a balance between this activity and obtaining results with the private sector, eventually changing people’s lives.

To achieve this objective, a **paradigm shift** is necessary to think always in terms of **win-win situations** (with regards to Africa-EU, academia-private sector) as this will allow for real **partnerships in research, innovation and business**. The AUC brings together ministers for Africa for concrete action as one voice - having acknowledged the lack of training, for example, has resulted in the Pan-African University and with it the PAUWES Institute. **Incubators**, together with energy desks, are **promising success factors** in the **necessary entrepreneur-oriented education** where universities are required to go beyond their traditional set up. This concept also includes becoming more flexible about

admission requirements: even those not yet in a possession of a degree, but interested in a start-up, should be allowed to go to higher education institutions and benefit from the research being conducted there. Lastly, all panellists agreed on the **importance for African states and institutions to co-finance research** in order to keep control over their research agenda and be in real partnership projects.

The discussion was concluded with each panellists' wish or expectations for the symposium outcomes:

- Information on co-financing Africa-EU for research, and intra-institutional learning
- Inclusion of social context dimension of research, also in technical sessions
- Establishment of a knowledge platform to work on a daily basis, resulting in mutual learning
- Sincere and deepened interaction to further cooperation
- Enable participants' connection to the private sector
- Support private sector in exploring research collaboration

Session 1, the Energy-Water-Food Nexus, focused on the links between the sectors water energy and agriculture. The session started with a presentation highlighting that, from an electrification perspective, **holistic solutions are needed, taking into account local livelihoods and resource potential** in contrast to solely providing electricity. The session continued with presentations on biochar. It was discussed how biochar from floating fixed-bed gasification processes influences plant growth and which effects biochar types and applications have on maize yields in Ghana. The session continued with the investigation of the potential for biochar from bone pyrolysis in Ethiopia. Overall, the debate highlighted the **potential for biochar applications as a prime example for the nexus approach**.

Session 2, Power Generation I, focused on the **potential for comparative studies and technologies**. Based on the presentations, the usability of Fresnel for low power applications compared to solar towers or parabolic troughs was discussed as well as the possibility to evaluate modular techniques for local content development in future storage solutions/batteries aiming at a solar thermal test facility for smart grids. The groundwork for storage efficiency, taking into account both resource efficiency and economic feasibility for the environmental impact was also acknowledged before concluding that **more results ought to be expected from collaboration and partnership**.

Session 3, Energy Access and Poverty I, featured a presentation about the need to resolve energy issues by working with people according to the motto of "**They don't need light; they need energy**". In addition, the **public-private sectors will need to be connected**. The difference between a binary and a multi-tier approach was highlighted with the example of SE4All now being in favour of the latter. General remarks included to ensure that the context of the research project is not left out, that the choice of variables and weighting is justified, that the distribution model (e.g. how many households are being served) is well described and that applicability and potential use by other partners are being considered in the presentations and comments.

Session 4, Renewable Energy Scenarios and Potential Assessment I, started with discussing sustainable habitats, followed by wind potential assessments for northern Cameroon and an analysis on the potential of jatropha production sites in Ethiopia. Overall, it was noted that research on assessments and scenarios, though sound, is limited by local data availability. Likewise, preparing



sound business cases and thereby proving bankability of projects is a difficult task. Furthermore, it was highlighted that the **socioeconomic dimension must be accounted for with each technology use.**

Session 5, Power Generation II, triggered, among others, the question whether the **technology** introduced in the first presentation could be used for **cars with hydrogen** as starting point in the reaction as a catalyzer. It is currently in the preparation to be upscaled and a patent is under consideration. Likewise, the second presentation about PEM fuel cell technologies raised **questions of the business perspective and data availability** with the reply offering a good existing cooperation aspect, including the benefit of knowledge transfer. However, clarification is needed on public data availability and technical details.

Session 6, Energy Access and Poverty II, included a **discussion on the factor of household size, radius, and load pattern changes** on the basis of the first presentation dealing with electrification modelling.

General remarks addressed to presenters were to ensure a description of how cases were selected, to explain household size assumptions and to comment on affordability. Moreover, the **description of the failures is to be followed by a systematic analysis and generalizable conclusions.**

In the first day's **wrap-up session**, the PAUWES Director mentioned the high quality of presentations, some of which with examples of EU-Africa partnership in the light of **"there is no RE programme without cooperation"** (quoting Kofi Annan), the assessed need to learn how to be able to be innovative, the issue of visibility by the question of what is the impact to be asked by each and everyone, the focus on private sector partnerships where **universities in particular are required to take an active role**, having recognised its influence and potential.

Day 2, Wednesday, 9th March

The second day of the symposium, entitled **"African and European Partnerships in Renewable Energy Research and Innovation"** started with a session on Initiatives and Platforms of Cooperation. The objective of this first half of the day was to get to know available initiatives and platforms for cooperation and learn to both how to benefit from them and how to relate to them.

The following initiatives were presented by their respective representatives:

- Africa-EU Energy Partnership (AEEP): <http://www.africa-eu-partnership.org/en>
- Pan African University Institute of Water and Energy Sciences (including Climate Change) (PAUWES): <http://pauwes.univ-tlemcen.dz/>
- African Renewable Energy Alliance (AREA): <http://area-net.org/en/home/>
- Low Carbon Energy for Development Network (LCEDN): <http://lcedn.com/>
- Renewable Energy Policy Network for the 21st Century (REN21): <http://www.ren21.net/>
- Euro-Mediterranean cooperation on research and training in sun-based renewable energies (EUROSUNMED): <http://www.eurosunmed.eu/>
- African Network for Solar Energy (ANSOLE): <http://www.ansole.org/>

- Finnish University Partnership for International Development (UniPID): <http://www.unipid.fi/>
- Renewable Electricity Cooperation (REELCOOP): <http://www.reelcoop.com/>

The subsequent debate was triggered by an issue raised by a PAUWES student: **the current academic focus on exams only without emphasis on practical capacity-building in particular is not favourable**. In addition, **future leaders are not equipped with in-depth SDG knowledge**. Overall, there is the **need for a shift in thinking as the African definition of universities is still only to educate researchers** whereas there should be an acknowledgement of **Universities of Applied Sciences** with their **linkage to industry**, too. The trend that good former Polytechnics are now becoming “National University of Science and Technology” is typical of the fact that a needs assessment for Africa has not been taken into account yet. The negative impact of corruption in government becomes apparent in **policies** by the fact that **funding is generally either not available or has disappeared**. Likewise, there is an issue of **framework conditions** as the **motivation** of lecturers and PhD students **in teaching is often low**. The morning sessions ended with an appeal to distribute the Call for Students and Academic Staff at PAUWES in participants’ networks.

Session 7, Renewable Energy Scenarios & Potential Assessment II/Economics and Finance I, started with an analysis on renewable energy adoption in Nigerian states. It was discussed that policies on income diversification away from oil rents and towards incentivizing **collaboration between stakeholder groups are crucial for promoting RE**. In a similar fashion, it was highlighted by an example from South Africa that **small-scale RE projects deliver more benefits for local economic development**, but investments are low due to a lack of credit reporting systems. The session continued with presenting **financing schemes for mini-grids** by adopting a tier approach, taking into account the ability of a customer group to pay for electricity and link it to the availability of electricity. The session was concluded with **an outlook on efforts for Algerian renewable energy policies in a mixed approach based on export possibilities** generated from a solar field with storage and hybridization.

Session 8, Power Generation III, started with a discussion on **Input vs. Output costs** with the remark that they cannot be used to compare installed capacity. Replying to the question about **patent versus open source, free use in Africa is possible**. The environmental impact is standard exhaust gases (CO₂+ Water) with some fuel flexibility. Pelletization is also possible. In the case of Uganda, the Mini Hydropower Association was not approached as they focus on grid supply contrary to the technology presented. In addition to the risks and possibilities of the start of the system and the way to exit the system with DC voltage, a wind technical-economical is needed. Overall, the question was raised whether **gasification reducing GHGs is a technology for Africa**. Lastly, the **use of wind energy** in the **Tlemcen region** was debated.

Session 9, Energy Access and Poverty III, discussed cost analysis and its difficulties, the **need for fieldwork to inform research in the first phase so as to avoid adapting reality to laboratory conditions** and the **need to address the uncertainties of investors** while at the same time taking into account farmer’s income in a finetuning phase after financial security. It was mentioned that **possible cultural barriers could hinder the spread** of specific products designed for use in a particular region



or country. Likewise, **social aspects and the practicability** will need to be considered in the solar cooking heat storage unit presented.

Session 10, Renewable Energy Economics and Finance II, commenced with a rather provocative presentation about the PSS quality framework for solar home systems. It was stated that **larger SHS perform better with lower-cost battery and higher maintenance**. Furthermore, local technologies should be favoured to push businesses, with **more research to be geared towards incentives for adequate local technical operations and maintenance activities**, to develop sustainable solutions. The session continued with an economic analysis and comparison between grid extension and mini grids based on the distance from the established grid, and in the following discussions the **need for close collaboration between private and public sector** was highlighted. In a similar fashion, a financial assessment of RE-powered mini-grids in Uganda was presented, during which it became evident that Uganda's **financial markets are underdeveloped when dealing with mini-grid financing**. The session concluded with pointing out that allocating financial risks to different investor groups, i.e. **risk clustering, as a financing concept for rural electrification** might attract additional private investments, but still has to be proven a viable option in the African context.

Session 11, Power Generation IV, placed the **emphasis on chemical and physical processes**. The first presentation promised high efficiency together with stability. The second dealt with creep behaviour on the basis of a simulation before implementation and pointed out that the **determining factor was the person who is either going to use or who is manufacturing the component**. In addition, a failure should be considered even before the actual breaking. The third presentation featured analysis techniques of polymeric encapsulant materials for photovoltaic modules, which triggered many technical detail questions, before interest was raised by the last presentation on dual voltage micro electrical grids including a self-made bulb sample. The audience commented that this work would benefit from putting it in a specific context. More specifically, **a techno-economic analysis would be needed to test whether the modular system was still viable with grid**. The main use is not necessarily lighting as was assumed but rather productive use as well as cost-effective minigrids.

Session 12, Behavioural and Social Issues, first of all debated a **dual approach** after the initial topic of "The Role of Academia in Capacity-Building for Sustainable Energy Development": **1. Engineer-based, 2. Policy-based**. The following presentation about synergies of interdisciplinary teaching and cooperation was well received yet raised questions of the costs of such courses. Likewise, the presentation on employment from renewable energy and energy efficiency in Tunisia triggered the **issue of applicability of this methodology to other countries in Africa and other contexts**, e.g. **last mile social entrepreneurship**. The major bottleneck remains the requirement of skills match in the labour market. The final presentation dealing with prospects for the uptake of renewable energy technologies in rural Tanzania concluded that **information dissemination is the crucial issue in a country open for investment**. Last but not least, **culture is a determining factor for technology and resources are to play a role in pattern and methodology**. The session was also deemed interesting for the private sector representatives present.

Day 3 Thursday, 10th March

The third and final day of the symposium asking the question: **“Research Symposium – How can Renewable Energy Research and Collaboration be Promoted?”** started with a feedback from the private sector representatives on the thematic sessions. Panellists mentioned first of all to have seen very interesting and relevant work throughout the symposium. Sessions were sometimes very technical; the **focus should be on finding solutions for the implementation of research models**. Missing, however, was the consequent link to the private sector, i.e. recommendations on how to scale up the research ideas. Nevertheless, described methods are relevant to other areas of work, too, for example, job impact with adaptability to last-mile entrepreneurship. The **appeal to involve the private sector early in one’s research** was directed to the audience. In general, it was highlighted that **social aspects such as the acceptance of technologies should always be integrated**, especially, but not limited to, predominantly technical research in order to **ensure daily-life relevance and the impact on the broader economy**, such as job creation, which also contributes to well-being. In addition, donors sponsoring research should also incentivise links by researchers to the private sector. The **policy perspective - energy and other, hindering or promoting the spread of RE- was overall not sufficiently taken into account**. In fact, **financing as a political factor is the biggest challenge**. Therefore, close collaboration is needed right from the start as investors are ignorant in using RE technologies. Lastly, it was reiterated that the **social, economic and environmental sustainability are key success factors in all RE projects**.

In the following discussion, the audience took up the statement of linking RE to the general economy by necessarily **involving policy makers in order to have research results and data - as a prerequisite for scale-up - be used by decision-makers at the local/national/regional and continental level**. As the local level is different from the top, social studies must be carried out to learn about the local culture, e.g. cooking habits. Hence, **if there are no data, social scientists will need to go in the field to collect data and feedback first**. Learning with regards to entrepreneurship should be fostered and studying the market before or alongside developing the technologies is crucial for them to be applied and sold on the market after a risk analysis. To facilitate these learning outcomes, an **input/output model** is helpful, employing a unit of calculation which everyone understands, i.e. money. It is furthermore recommended to conduct **object-oriented research** of which the first step is niche development according to the idea that **“it is good to produce something, better to sell it, and still better to make it to the market”**. To conclude, the impact of conferences such as this symposium to business ideas, which are developed from networks, was highlighted: **participants need to position themselves in the market value chain as well as in the relevant international communities** before assessing the **socio-economic impact of one’s research alongside with the next steps for industry**. This is a helpful clarification process for any researcher indeed.

The second-last session on **“Support Mechanisms and Funds for Renewable Energy Research and Cooperation in Africa”** sparked a lot of interest from the audience. At first, participants were informed about a booklet on **EU initiatives on research and innovation and opportunities for Technical Vocational Education and Training (TVET)**. Thereafter, **challenges of systematically finding**

EU partners to take part in calls and get seed funding were debated. In this context, **the symposium can be considered a full success only if resulting in joint programme activities**. The need to publish for awareness-raising of achievements and resources required was highlighted in the framework of **tapping the knowledge bank and capacity-building approaches especially in the field of higher education of the AfDB**, among others. Networking like taking place during the symposium is also very important. Actually, there are **many bilateral funding opportunities but there is no awareness so information must also be shared with partners** who were unable to attend the symposium. Overall, the **need to be proactive and interact rather than wait and/or rely on the government** was identified. In the end, presenters and participants agreed to **work towards the perception of the African continent as an actor rather than as a receiver**, which includes building up research, and on the fact that **Africa-EU research cooperation is the way forward**.

The symposium was officially concluded by a closing session. Organizers and host institution representatives all addressed their closing remarks to the attentive audience. Among those was first of all a warm thank you on behalf of the participating institutions and the announcement that this symposium ought to be not the last but the first of a few Symposia to follow. **All participants' quality work was acknowledged, which had continuously exceeded even high expectations and which is sure to have a future impact in research and collaboration**. In addition, there were appeals to **continue cooperation and to inform each other about the overall as well as individual outcomes**. The AEEP Stakeholder Forum in mid-May will be an excellent way to keep the momentum created here. **The University of Tlemcen expressed their pleasure that Algeria and Tlemcen are at the centre of Africa-EU cooperation**. Likewise, as the EU representative stated, the **EU remains the biggest development partner in the area of energy** with the European Commission alone managing a portfolio of over 3.5 billion Euros in energy cooperation. Finally yet importantly, the latest good news were shared: there will be a **publication of reviewed symposium abstracts in Elsevier Energy Procedia**.

Side Event Project Cycle Management In Writing Research Proposals

The Symposium benefitted from a specific training on Project Cycle Management, designed and delivered on the occasion by Professor Emanuela Colombo of Politecnico di Milano. The workshop aimed at supporting the writing of research proposals through the Project Cycle Management (PCM) frame, following the whole life-cycle of a project, from the initial idea to its completion. This was highlighted as crucial in applying for research funds, ensuring that reporting to funding bodies is correct, and of course conducting high quality research. Participants with experience in proposal writing, PCM and implementing EU research funds contributed important insights to the session.

Professor Colombo stressed that the PCM frame ensures the consultation of stakeholders and the definition of key decisions, requirements and responsibilities during the process. Moreover, the final evaluation and lessons learned eventually contribute to the design of future programmes and projects. Five key phases of the PCM were presented and discussed: Programming, Identification, Formulation, Implementation, and Evaluation & Audit. The PowerPoint presentation is available on the Symposium webpage of EUEI PDF.



Following the presentation and key inputs from the experienced audience, a practical case study was presented. Participants engaged directly and worked in groups on the case study, in a very dynamic atmosphere of discussion, competition and cooperation.

The workshop was very well received and participants applauded the capacity building aspect of conducting such training alongside the Symposium. As was mentioned during the plenary sessions, people's abilities and knowledge are crucial to any wider success.

Side Event Role, Potential And Cooperation In The Field Of Distance Education In Renewable Energy Higher Education In Africa

Based on the mapping conducted by Dr. Erick Tambo from the United Nations University Institute on Environment and Human Security (UNU-EHS) on “**Renewable Energy Distance Learning in African Higher Education**”, the side event workshop presented the first findings. It also enabled representatives from the AfDB and AU-HRST to inform participants about on-going initiatives related to eLearning in their respective institutions as well as giving an outlook on cooperation fields for interested and suitable partners. In the second part, the workshop initiated **group work on three core challenges pertaining to eLearning in RE in Africa and translated the challenges into possible projects** for further consideration. One direct outcome of the workshop was that three groups had developed three individual project ideas in the field of distance education in renewable energy higher education:

- Group 1: Quality and Accreditation
- Group 2: Content, Didactic and Lab Experiments
- Group 3: Change Management, Awareness and Networking

Discussions on the projects will be continued on the PAUWES Community of Practice where groups have already been established: www.pauwes-cop.net.

List of Participants

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