



Sustainable Energy for Africa (SE4A 2021)

International conference co-organized by RAOS and ANSALB
8 - 11 November 2021, Cotonou, Benin

<http://www.se4a.africa/>

Concept note (version June 2020)

(1) Background (previous SE4A 2017 conference / 3 days in October 2017, Brussels)

The first edition of the international conference "Sustainable Energy for Africa" (SE4A 2017 in short), organised by the Royal Academy of Overseas Sciences of Belgium (RAOS), took place in Brussels (23-25 October 2017, Palace of the Academies).

The following messages were delivered as conclusion:

- **Science:** Energy is a value chain aimed at providing services to society, households and industry, based, for each region of the world, on an optimal mix of secure (24/7/365 supply), affordable and sustainable primary energy sources.
- **Politics:** Energy, together with circular economy, is a primary driver for development - research and innovation as well as education and lifelong learning for all are crucial; international collaboration in the field of energy - climate must be encouraged.
- **Follow-up edition in Africa in 2021:** academia, industry, policy makers and civil society should meet again in conference, this time in Africa, to report on the latest developments and discuss joint actions in the energy - climate sector.

The final programme of the previous conference (SE4A 2017, 23-25 October 2017) and the audio/video recordings of all presentations are available on the following website:

- https://www.kaowarsom.be/documents/Conferences/Energy/RAOS_programme_sustainability_energy4Africa.pdf
- https://www.kaowarsom.be/en/SustainableEnergy4Africa_presentations%26videos.

(2) Follow-up edition : SE4A 2021 / 4 days, Monday 8 to Thursday 11 November 2021, Cotonou)

The second edition of the international conference "Sustainable Energy for Africa" (SE4A 2021 in short) will take place in Cotonou, Benin, from Monday 8 to Thursday 11 November 2021 and is jointly organized by

- the Royal Academy of Overseas Sciences of Belgium (RAOS in English ; ARSOM in French ; KAOW in Dutch) - <https://www.kaowarsom.be/en/home>
- the National Academy of Sciences, Arts and Letters of Benin (ANSALB) - <https://academie-sciences.bj/>

The following five topics will be discussed during the first three days (Monday to Wednesday) of the SE4A 2021 conference, addressing an international audience concerned with issues related to socio-economic development and energy access :

- **Energy is crucial for achieving the Sustainable Development Goals in Africa**
 - (1) *Energy access and social & economic development are primary drivers*
(*"Agenda 2030", UN 2015 and "AGENDA 2063 - The Africa We Want", AU 2015*)
 - (2) *Energy systems that are secure, sustainable, competitive and affordable for all*
(*while minimising raw materials and energy used in all transformation processes*)
- **Energy value chain (including conversion and end-use technologies)**
 - (3) *Power and storage technologies, aiming at providing energy services for all*
(*while optimising efficiency, from households to industry, from kWh to TWh*)
 - (4) *Development and economics of power system (e.g. reliability of the electricity grid) and of heating/cooling sector*
- **Research, innovation & education in connection with the energy-intensive sectors**
 - (5) *Exploring the role of scientific resources and capacity building as a response to the needs of emerging countries in the sectors of transport, residential, industry, services*
- how can Africa's natural resources benefit all citizens ?

This second international conference SE4A 2021 will bring together a large number of scientific, technological and political experts from Africa and Europe, from the public and private sectors, who are interested in energy-climate issues in Africa.

The expected outcome of this conference is:

- provide an opportunity for African youth to participate in scientific debates and engage in actions concerning improvements in the energy-climate sector
- jointly design a response adapted to the energy-climate challenges specific to Africa, based in particular on research, innovation and education
- focus on international cooperation (South-South, West-East and North-South) in this area, in particular by exploring different funding mechanisms.

Speakers are invited to choose a theme in line with this "concept note". They will present their topic in plenary session for about 20 minutes, preferably in English. Sufficient time will be allocated for questions and answers with the audience. At the end of each session, the authors selected for the posters will have the opportunity to present their work in plenary for three minutes in English or French. All conference documents (invited papers and posters) will be peer reviewed before being presented at the Cotonou conference and then published in the proceedings (which will be distributed to all participants and interested parties).

(3) Day 4 of SE4A 2021 (training programme and funding instruments)

The fourth day (Thursday) will be devoted to six seminars (in parallel) at the higher education level. These seminars will be organised by interested stakeholders with the aim of transferring knowledge and skills in areas such as:

- 1 - Energy, climate and sustainable development in Africa: Local Institutional Capacity Development (by UDP = UN Environment Programme /UNEP/- DTU - Partnership)
- 2 - Solar energy - tapping into solar energy resources to drive electricity access in Sub-Saharan Africa
- 3 - Modular energy production (e.g. mobile gas turbines in response to sudden demands) and/or cogeneration plants (heat - electricity)
- 4 - Design and development of small hydropower plants, taking advantage of the enormous untapped potential of rivers and small dams
- 5 - Exploring the role of scientific resources and capacity building as a response to needs of emerging countries in the sectors of transport, residential, industry and services
- 6 - Innovative financing mechanisms in Africa for projects related to energy access, including circular economy (material recycling and energy recovery).

Finally, a number of cultural and/or technical visits to Benin are scheduled during the week for conference participants and accompanying persons.

(4) SE4A 2021 CALL FOR PAPERS

Participants are invited to submit abstracts for an oral or a poster presentation related to one of the above-mentioned themes – see conference announcement on ARSOM- KAOW website: https://www.kaowarsom.be/documents/Conferences/SE4A2021/CALLFORPAPERS_EN.pdf

Details about Programme available in Annex 1 and about Organising committee in Annex 2.

Annex 1 — Elaboration of the five above-mentioned topics (focus of SE4A 2021)

(a) Energy is crucial for achieving the Sustainable Development Goals in Africa

(1) Energy access and social & economic development are primary drivers ('Agenda 2030', UN 2015 and "AGENDA 2063 - The Africa We Want", AU 2015)

Energy is crucial (*actually it is necessary but not sufficient*) for achieving the Sustainable Development Goals /SDGs/ adopted by the United Nations in 2015 ("Transforming our World: the 2030 Agenda for Sustainable Development"). Energy is a prerequisite for achieving many of the 17 SDGs. The focus here is on clean energy: SDG 7 ("Ensure access for all to affordable, reliable, sustainable and modern energy").

In addition, energy has a multiplier effect on two SDGs of particular interest to Africa:

- Sustainable Cities - SDG 11 ("Making cities and human settlements inclusive, safe, resilient and sustainable") - As African cities grow, the challenge will be to ensure access for all to adequate, safe and affordable housing and basic services. Transport, in particular, is an essential component of overall sustainable development.

- Climate Action - SDG 13 ("Urgent action to combat climate change and its impacts") Food production threatens to be the main victim of climate change (FAO) - How to simultaneously address the challenges of climate change and development on the African continent?

(see « *Africa 2019 SDG Index and Dashboards Report* » regarding 54 countries' performance by SDGs – <https://sdgindex.org/reports/2019-africa-sdg-index-and-dashboards-report/>).

"Africa has an unlimited potential of solar, wind, hydroelectric and geothermal energy resources. We must unleash Africa's energy potential - both conventional and renewable. Unleashing Africa's enormous energy potential for Africa will be a major priority for the African Development Bank (AfDB).

"Lighting and Powering Africa" is indeed one of the central themes of many funding organizations in Africa that share the ambitious goal of universal access to energy by 2025.

(2) Energy systems that are secure, sustainable, competitive and affordable for all (while minimising raw materials and energy used in all transformation processes)

In most countries of the world, national energy consumption is divided into four main sectors:

- residential (heating, lighting and household appliances)
- commercial (lighting, heating and cooling of commercial buildings, and provision of water and sewer services)
- industrial users (agriculture, mining, manufacturing and construction)
- transportation (passengers, freight and pipelines).

Most of the energy used in the four sectors mentioned above in the world (and, in particular, in Africa) comes from fossil fuels. A small fraction of primary energy sources - about 20% - is consumed as electricity, but this fraction could grow dramatically in the coming decades due to the massive electrification of society (source: International Energy Agency).

It should be recalled that per capita electricity demand in Africa is about 620 kWh (still ten times lower than the European average). Paradoxically, the majority of sub-Saharan African countries have untapped energy resources. New electrification strategies and power systems are being studied in many African countries, particularly those facing high rural-urban migration and high population growth.

As far as the electricity supply chain is concerned, particular attention should be paid to the discussion of advantages and disadvantages with regard to:

- centralized generation, generally based on monopolistic systems designed for traditional power plants (fossil fuel, hydroelectric or nuclear fission power plants)
- decentralised generation, generally based on micro or mini-grids mainly designed for renewable energy resources - a mix of the two types of production could be the best solution.

keeping in mind, however, that mini-grids nowadays can be connected to the main grid, using appropriate technology (e.g. smart metering).

(b) Energy value chain (including conversion and end-use technologies)

(3) Power and storage technologies, aiming at providing energy services for all (while optimising efficiency, from households to industry, from kWh to TWh)

When studying the ideal energy mix, the political and industrial challenge is multiple: security of supply (24/7/365 for electricity) of energy carriers that are physically and economically accessible to all, and whose environmental impact is limited (in line with the objectives of a low-carbon society).

To meet these requirements, countries generally develop "integrated energy planning" strategies, taking into account all key elements of the energy value chain, namely:

- 1 - the three primary energy sources (renewable energies, fossil fuels, nuclear fission - these are the three forms of energy available in nature)
- 2 - conversion technologies (to make energy usable and easily transportable)
- 3 - secondary energy carriers (such as electricity, refined petroleum products, heat,... and hydrogen in the distant future)

- 4 - end-use technologies and infrastructures (in particular electricity transmission and distribution networks)
- 5 - energy services (kitchen, domestic comfort, lighting, transport, mobility, communication, etc.).

Moreover, it is quite clear that energy, peace and stability go together : for example, when assessing and implementing energy security, special care should be taken of regulatory quality and political stability (absence of violence).

In this context, it is worth recalling the AU key document "Agenda 2063 - A Common Strategic Framework for Inclusive Growth and Sustainable Development". This document was prepared through a broad consultation of experts and was adopted in 2015 in Addis Ababa, Ethiopia, by the 24th Assembly of Heads of State and Government of the AU, after 18 months of extensive consultations with all actors in African society. Consultations were held with the following stakeholder groups: private sector; academics and think-tanks; civil society; planning experts; sectoral ministries; etc.

In the first 10-year implementation plan 2014-2023 of the "Agenda 2063", there are ambitious political and industrial commitments related to energy, aimed at "improving living standards" and "contributing to industrial / manufacturing growth and the comfort of African citizens". It is also proposed that cities recycle at least 50% of the waste they produce.

Three objectives of "Agenda 2063" (referring to 2013) are of particular interest in the energy-climate field:

- increase the share of renewable energies in total energy production;
- reduce the share of fossil fuels in total energy production;
- electricity supply and connectivity will increase by 50%.

(<http://www.un.org/en/africa/osaa/pdf/au/agenda2063-first10yearimplementation.pdf>)

(4) Power system development and economics (sustainability in the electricity grid and heating/cooling sectors)

Paradoxically, many countries are rich in natural resources, but their populations remain poor. The analysis indicates that Africa is indeed rich in energy resources but poor in access to energy:

- 66% of the population of sub-Saharan Africa has no access to electricity, with a wide disparity between urban and rural areas.
- 66% of energy investments in sub-Saharan Africa are for export rather than domestic use.

Population dynamics in Africa will affect many development sectors. The African population will migrate and become highly urbanized, feeding the current megacities and their slums.

One of the main challenges is the sustainable supply of energy, water and food products ("nexus" approach) in large cities, which are the main centres of consumption and growth.

Among the most populated urban areas in Africa are Lagos in Nigeria (>22 million inhabitants), Cairo in Egypt (>20 million inhabitants), Kinshasa in the Democratic Republic of Congo (>17 million inhabitants) and Gauteng (Johannesburg and Pretoria,) in South Africa (>12 million inhabitants).

(c) Research, innovation & education in connection with the energy-intensive sectors

(5) Exploring the role of scientific resources and capacity building as a response to the needs of emerging countries in the sectors of transport, residential, industry and services - how can Africa's natural resources benefit all citizens ?

Human capital training is another major challenge. Research, innovation and education clearly have a role to play in development and it is important to understand their global impact on multiple components of society. Education and lifelong learning programmes are particularly necessary to support energy development policies, aimed at providing robust solutions to the many challenges facing emerging economies. For example, sub-Saharan African countries will have to create about 18 million new jobs each year over the next quarter century, equivalent to the current population of Burkina Faso.

“Agenda 2063” also contains a number of proposals in the field of higher education, including an African virtual online university with open, distance and online learning resources, and an African education accreditation agency with a common system of university qualifications (similar to the student and teacher exchange programme Erasmus in Europe).

Special attention also should be devoted to the supervision and coordination of research and training institutions, setting their priorities and developmental needs, monitoring and finalizing their research programmes and valorizing their findings and results.

Finally, since countries cannot solve all problems on their own (especially in the fields of energy, water and food), international scientific cooperation (South-South, West-East and North-South) is necessary. Concerted efforts are needed to foster global exchanges of knowledge and skills, which will contribute to improving external relations and developing diplomacy through science.

"To succeed, we must work together.

"If you want to go fast, go alone. If you want to go far, go together."

Annex 2 – SE4A 2021 Organizing Committee

(1) Experts proposed by ANSALB - BENIN – African Union

- **Mahouton Norbert HOUNKONNOU** (Prof.), Mathematical sciences, President of National Academy (ANSALB), President of Network of African Science Academies (NASAC)
- **Hippolyte AGBOTON** (Prof. Med. Dr.), Secrétaire Perpétuel de ANSALB
- **Maxime Da CRUZ**, Recteur de l' Université de Abomey-Calavi /UAC/ Linguiste, faculté des Lettres, Arts et Communications
- **Jean-Claude HOUSSOU**, Ministre de l'Énergie du Bénin et Président du bureau exécutif du réseau des Ministres de l'Énergie Ouest Africain (CEDEAO) (à confirmer)
- **Éléonore YAYI LADEKAN**, Ministre de l'Enseignement Supérieur et de la Recherche Scientifique (à confirmer)
- **Brice SINSIN** (Prof. Dr Ir.), Agronomic Sciences, member of two Academies (ANSALB and RAOS), former Rector of Abomey-Calavi University (2011 – 2017)
- **Raofou N. BADAROU**, Directeur Général Energie du Ministère des mines et de l'Énergie
- **Arnaud Yémalin ZANNOU**, Présidence de la République, Unité Chargée de la Politique de Développement des Energies Renouvelables (UC/PDER)
- **Siengui Apollinaire KI**, Secrétaire Général WAPP (West African Power Pool), Cotonou
- **Joël AKOWANOU**, Directeur opérations de MCA (Millenium Challenge Account) Bénin
- **Gabriel DEGBEGNI**, Coordonnateur MCA Bénin
- **Faustin DAHITO**, Président de AISER-Bénin (Association Interprofessionnelle des Spécialistes des Energies Renouvelables) et Directeur du Groupe ENERDAS, Cotonou
- **Monique OUASSA KOUARO**, sociologue–anthropologue Université d'Abomey-Calavi, Directrice Laboratoire d'Anthropologie Appliquée et d'Education au Développement Durable
- **Jackie Olang KADO**, Executive Director of the Network of African Science Academies (NASAC), Nairobi, Kenya
- **Rajaâ CHERKAOUI EL MOURSLI**, Secrétaire Perpétuel de l'Académie Hassan II des Sciences et Techniques, Rabat, Maroc
- **Issa SOME**, vice-recteur chargé de la R&D à l'université de Ouagadougou au Burkina Faso
- **Catherine JEANDEL**, présidente du conseil académique de l'Université Fédérale Toulouse Midi-Pyrénées, Directrice de recherches CNRS (géophysique) à Toulouse
- **Roland Gbaguidi** (ANSALB)
- **Badr IKKEN**, Directeur général de l'Institut de Recherche en Energie Solaire et Énergies Nouvelles (IRESEN), Rabat, Maroc *
- **Prem JAIN**, UNESCO Chair in Renewable Energy and Environment, Department of Physics, University of Zambia (Lusaka) *
- **Kossi NAPO**, UNESCO chair in Renewable Energies, Université de Lomé (Togo) *

(2) Experts proposed by ARSOM / KAOW - BELGIUM – European Union

- **Georges VAN GOETHEM** (Dr Ir), Royal Academy of Overseas Sciences of Belgium (RAOS), main organiser of previous SE4A 2017 event (Brussels, 23-25 October 2017) *
- **Bernard MAIRY** (Ir), Executive Director, Europ. Society of Engineers and Industrialists *
- **Marc LOBELLE** (Prof. Dr Ir Emeritus), Ecole Polytechnique de Louvain (Belgium), expert in e-Infrastructure and e-Services (with long-standing experience in Benin) *

- **Philippe GOYENS** (Prof. Med. Dr.), Permanent Secretary of RAOS (ARSOM – KAOW)
- **Patrick VAN DAMME** (Prof. Dr Ir), UGent, Centre for Sustainable Development (RAOS)
- **Jean-Pierre Tshibangu** (Prof. Dr Ir), génie minier, Univ. Mons, Belgium (RAOS)
- **Eric PIRARD** (Prof. Dr Ir), Mineral Processing & Recycling, Univ. Liège, Belgium (RAOS)
- **Hervé JEANMART** (Prof. Dr Ir), Energetics, Biomass, alternative fuels, EPL-UCLouvain
- **Patrick HENDRICK** (Prof. Dr Ir), Aero-Thermo-Mechanics, Ecole Polytechnique ULB
- **Emanuela COLOMBO** (Prof. Dr Ir), Dep't of Energy, Politecnico di Milano (Italy), Rector's Delegate to Cooperation, UNESCO Chair in Energy for Sustainable Development
- **Emmanuel K. ACKOM**, PhD, UNEP DTU (Copenhagen), Senior Energy & Climate Expert
- **Pépin TCHOUATE HETEU** (Dr Ir), DEECC Consulting, expert in energy access & security
- **Benoît LEGRAND**, Coordinator Climate Unit, Enabel, Belgian Development Agency
- **Fadila BOUGHANEMI**, Commission Européenne, DG Recherche et Innovation, International Cooperation II (Asia, Africa, Middle East & External Relations) (RTD.H.2).

Addresses of the two organising Academies : RAOS (Belgium) and ANSALB (Benin)

- **Royal Academy of Overseas Sciences of Belgium (RAOS in English)**
 / Académie royale des sciences d'outre-mer (ARSOM in French)
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ARSOM-KAOW (Belgium) - Aims and objectives

As a tool dedicated to overseas countries the Academy contributes to the progress of scientific knowledge about overseas regions. It acts as a meeting place for communication between North and South and represents an independent reference. It also promotes research and the dissemination of knowledge concerning overseas countries, both inside these countries and within Belgium. The Academy organizes or patronizes seminars or symposia (<https://www.kaowarsom.be/fr/conferences>).

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ANSALB (Benin) - Aims and objectives

ANSALB is uniquely positioned to bring scientific knowledge to bear on the policies/strategic direction of the country, and is also dedicated to the development and advancement of Science, Technology, and Innovation (STI), arts and letters in Benin Republic. The aims and objectives of the Academy are to promote the growth, acquisition, and dissemination of scientific knowledge, and to facilitate its use in solving problems of national interest. (<https://academie-sciences.bj/srce/about/>).