SEMINAR ON SOLAR PV SOLUTIONS FOR SUSTAINABLE ENERGY DEVELOPMENT IN AFRICA

SE4A 2021 Cotonou November 11/2021

Preamble

Africa is endowed with high solar irradiation, a potential power of 10 TW (10.000 GW) (*)

Aim of the seminar

To present / discuss the various solar energy solutions (well-established or innovative) available for energy projects in Africa in order to provide/ improve access to electricity with secured stability for all with regards to sustainable development (i.e. security of supply, low cost , pollution-free), from off-grid to on-grid projects, and to inform about best practices in investment, funding opportunities, business & financing models, and regulation as well as on private-public partnership and on collaboration between European & African Institutions.

Expected audience

Energy decision-makers, industrialists, R&D sector (including PhD young applicants), academic & university world, high ranking officials, public and private investors, financial institutions, foundations, development agencies, business development funds, consultants, energy related NGO's.

Approach

To present to the African participants the state-of-the-art of the solar energy solutions : basic physics , advantages and limits/disadvantages , specifities such intermittent operation and need for substitution solutions such as storage in batteries or connection to other energy sources (biomass, fossil, hydro) , typical applications of solar energy, internal costs & external costs , appropriateness of solar solutions on basis of a relevant analysis of availability/accessibility of other local energy resources , of existing energy policy regulation as well as of specific climate, environment and population conditions.

While targeting positive and direct impacts on the energy poverty alleviation/eradication and the welfare of the communities as well as on the growth and the sustainable development of the economy.

(*) IEA source

Physics of the solar technology

2 types of solar panels

Thermal : panel-shaped water heater based on solar energy to heat conversion, only for heating purposes (hot water production), not appropriate for electricity generation

Photovoltaïc : photovoltaic based panels very appropriate for electricity generation

- Photovoltaic (PV) principle : electron removal by colliding photon which converts solar light to electricity (CC voltage) mainly thru polycristalline silicon + dopant elements (P,As,Sb or B)-based sensing cells (0.15 mm thick, semi-conductors P/N) ; others like Ga-As
- Peak power = max power per surface unit : from 1 kwp to several kwp /unit surface
- Energy output : usually given in kwh/wp.yr
- Layout : PV cells connected in serie or in parallel and enclosed in fixed or mobile panels made of sealed glass & aluminum flat boxes (to be installed on ground or roof)
- Active needed panel surface : from a few mm^2 cm^2 for small solar kits to km^2 for big solar farm (1 GW per 30 km^2) or CSP (1 GW per 15 km^2) (CSP : concentrated solar power)
- Efficiency : 15%+ : decreases with increasing temperature and with decreased angle relative to sunlight incidence direction
- Materials required : high purity silicon + dopant nano-elements (inorganic solution)
- Life time : 10+ years depending of service conditions
- Development : flexible panels on a-silicon films, new coatings on glass or steel rigid surfaces, floating PV panels, organic new photovoltaic sensors, tropicalisation of solar panels and associated electrical control devices
- Others : hybrid panels combining thermal and PV principles to avoid PV panel heating

Note : the seminar is mainly focusing on PV solar energy solutions (which are widening fast across Africa), therefore the following sections are elaborated accordingly.

Advantages & Drawbacks of the PV solar approach

- Advantages : affordable cost, usually easy and rapid to install,

- Drawbacks : mainly intermittence (no power by night, cloudy skies, rain , fog and snow) which request hybrid solutions (battery storage, other energy sources…), requested surface panel, maintenance, dust cleaning , ageing due to weather conditions, subject to vandalism and stealing ,difficulty of recycling (due to diversity of components to be separated), high dependency of PV cells on a few limited fabricants (China, Germany) , several significant external costs (see specific section)

Types of PV solar solutions

All solar energy solutions covering different aspects such as production, transport, distribution, in rural or urban areas, with electrical power facilities from a few KW thru several tens or hundreds of MW.

- **Generation** : stand-alone (portable LED lamp, portable phone), solar PV (household, domestic), solar farm and CSP , hybrid solutions with gas (natural,CNG, LNG), oil (diesel generator), coal , geothermal….

- **Transmission/Distribution** : micro-grid (solar home solution) , mini-grid (off-grid) approach for electrification of rural isolated communities and business entities (agriculture, farming, agro-food processing, small industries, commerce) and macro-grid electrification (on-grid) for regional/national electrification with relevant issues like stability, losses avoidance, expansion, renovation, trans-regional connection.

- **Storage** : batteries, pumping mode & turbine mode units, heat pumping units, compressed air tank, UPS charging stations, and others.

Internal and external costs of PV solar solutions

- internal costs : purchase, installation & operation

- external costs : inverter (CC to AC conversion), AC breakers, surge protection devices, grid connection, digitalisation, transmission, regulation, training, maintenance, dismounting and replacement after life time or irreversible damage

Typical Applications of PV Solar Energy

- Power for Clean Cooking
- Power for Lighting
- Power for Cooling/Heating
- Power for Telecom (mobile, e-banking, internet, TV)
- Power for Healthcare
- Power for Education
- Power for Safety (isolated communities and individuals) & Security (traffic control)
- Power for micro-economy such as farming, agriculture, agro-food processing, commerce & small industry

PV Solar Energy African References and Case Studies

- Desertec
- Centrales Senegal, Burkina Faso, Togo
- Benin 50MWp MCA Benin II

Electricity tariff policy

- Cost calculation for structuring on-grid solar electricity tariffs
- Affordable price policy for all consumers to combine with attractivity for investors
- Avoidance of tariff discrepancies thanks to harmonization and advocacy
- Subsidies: limited to development, not for production to avoid unfair competition

Solar Energy Stakeholders

Expected Solar Energy Stakeholders to participate as contributors and attendants would-be as follows :

- Specific Development Agencies : to support the private sector or the public sector or both (PPP partnership) and/or the civil society
- Equipment Suppliers & Plant builders : to present their technical solar solutions
- Government Agencies, International Banks and Financial Institutions : to support projects with their specific rules
- Micro-finance Institutions
- R&D Organizations/Companies and Universities
- Service Providers : consultancy, project development, partnership building, engineering, maintenance, education & training, capacity building

Seminar programme on November 11 from 9 :00 to 11 :00

Lecture (EN or FR) by each contributor will be limited to 10/15 minutes and 30 minutes are scheduled for Q&A.

Ample time will be given for in-depth discussion with the audience.

Panelists

Below the key panelist hosted to lead the seminar:

- Autorité de Régulation de l'Electricité (*Présidence de la République*) : **Mr Claude G. GBAGUIDI** (*Président*)
- Millennium Challenge Account Benin II (MCA Benin II) : **Mr Gabriel DEGBEGNI** (*Coordonnateur National*)
- GIZ Benin : **Mr Mario MERCHAN** (Responsable) du Projet EndeV
- Societe Beninoise de Production d Electricité : **Mr Eméric TOKOUDAGBA** (*Directeur*)
- Consultant International, Expert et Researcher (*UAC ; 2IE*) : **Mr Alain TOSSA** (*PhD*)
- ISMAST ENERGY : Mme **Ismene AHAMIDE** (*Directrice*)

Bernard MAIRY

bernard.mairy@live.be +32.475.85.73.49

Leonide M. SINSIN

mickael.sinsin@gmail.com +229 94252020

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