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energy modelling platform for africa (emp-a)

Concept Note

1. **Context**

Attaining Africa’s transformation for sustainable and inclusive development – as framed by the African Union’s Agenda 2063 and the UN 2030 Agenda for Sustainable Development – will require secure, adequate and reliable access to huge amounts of modern energy forms and services for livelihoods and industrialization, while being resilient to the shocks posed by climate change.

Against a background of increased energy demand for structural transformation, rising population, the need for sustainable livelihoods, as well as the adverse impacts of climate change on the continent, many African countries are discovering new reserves of fossil fuels on a continent endowed with abundant renewable energy resources – wind, solar, hydropower, geothermal, ocean and bioenergy. This calls for urgent action to support African countries to strengthen their capacities in energy planning so as to be able to optimise investments in energy production and services, banking on the continent’s abundant renewable energy resources, falling technology prices, and increasing availability of free open source and robust energy planning models, data and interfaces for customized applications to the needs of each country.

Furthermore, many African countries have included renewable power generation in their Nationally Determined Contributions (NDCs) to climate action under the framework of the Paris Agreement on climate change, while some have conducted their technology needs assessments (TNAs) that feed into their nationally appropriate mitigation actions (NAMAs) under the United Nations Framework Convention on Climate Change (UNFCCC). Also, a number of African countries have defined National Action Plans under the framework of the Sustainable Energy for All (SE4All) initiative, as well as renewable energy readiness assessments (RRA) in collaboration with the International Renewable Energy Agency (IRENA).

The prominence of renewable energy in these actions, coupled with Africa’s abundant renewable energy resources – including variable renewable energy sources (wind and solar) - and the urgent need to mobilise investments to meet a huge energy deficit on the continent requires strategic assessment and planning to ensure (i) enough generation capacity and expansion of supply to meet demand, (ii) system flexibility to accommodate increased shares of renewables, (iii) adequate transmission capacity to dispatch power to demand centres, (iv) grid stability to accommodate short time frame variations, (v) appropriate and effective off-grid systems, and (vi) optimized investments that capitalize on falling costs of low-carbon technologies to minimize the risk of stranded underperforming energy infrastructure assets into the future.

However, there is a huge deficit in human and institutional capacity on the continent to effectively use models and modelling tools for energy supply, demand and investment planning and management. This constraint of energy planning capacity is further exacerbated by the lack of dedicated centres of excellence on energy and investment planning for long term capacity and skills development on the continent.

1. **Objective**

The overall objective of the Energy Modelling Platform for Africa (EMP-A) is to contribute to optimized investments for the energy transition in Africa for a low-carbon, inclusive and climate-resilient development pathway for the continent.

The specific objectives of the platform are:

* Bring together the energy planning and modelling community in Africa to share experiences, models and data
* Support human and institutional capacity in Africa for integrated energy modelling and investment planning
* Support the development of center’s of excellence energy planning in Africa
* Promote efficient and widespread use of open source modelling tools in support of implementation of the SDGs, the Paris Agreement and Africa’s Agenda 2063

1. **Structure of the meeting**

The Energy Modelling Platform for Africa event will take place in January 2018, at the United Nations Conference Centre in Addis Ababa, Ethiopia. The event will be structured as follows:

**Day 1**

* Introduction to EMP-A and the EMP-A Partnership
* ‘Show and tell’ that focuses on policy and investment relevant outputs various countries
* Launch of the modular training programme for energy demand and supply planning and management in Africa

**Day 2**

* Presentations and discussions on energy planning models
* Focus on open source tools

**Days 3 - 5**

* Training in open source modelling and freely available toolkits. Participants will be allowed to choose between OnSSET (see Annex A) and OSeMOSYS (see Annex B).

Stakeholders interested in participating in the event are asked to contact the organizers at [africa2017@energymodellingplatform.org](mailto:africa2017@energymodellingplatform.org), stating which days they would like to be present, whether they are interesting in giving a presentation and identifying which tool they would like to be trained in, if they so choose.

1. **Partners**

**Core organising group**: UNECA, UNDESA, Cambridge, KTH.

**African Centers of Excellence**: UN ECA training institute (IDEP) Dakar, the Africa Capacity Building Foundation, University of Cape Town, Pan African University.

**Other partners**: The World Bank Group (WBG), National Renewable Energy Laboratory (NREL), FEEEM.

1. **Agenda**

Day 1: Investment Outlooks and Scenarios

* Invitation: AfDB, World Bank, NEPAD/AU
* Outlooks from joint work: TEMBA and GETTIT
* Invitation: Power pool presentations
* Invitation: Open to countries and partners

Day 2: Models, Analysis and initiatives

* UNECA resources and analysis
* Invitation: IRENA mapping and resources
* Invitation: Open to countries and partners

Day 3-5: OSeMOSYS.org, OnSSET.org and Energydata.info training

* Key individuals from African centres of excellence
* Invitee’s from UNDESA/UNDP country capacity building

1. **Meeting size**

This will be determined as a function of budget available.

* The zero order meeting is simply a Video conference with partners who can funding themselves to be at the UNECA.
* This will be extended to include centers of excellence participants, national analysts (and more trainers) as function of budget (and room availability).

1. **Longer term**

* EMP-Africa 2019 Meeting to be hosted by an African center of excellence. Likely University of Cape Town.
* There will be targeted integration with the Annual ICTP event.
* There will be targeted harmonisation of curricula and distance learning material for:
  + Centers of excellence
  + Country capacity building

# Annex A - OnSSET training session

## Introduction

Reliable energy-related data are essential in electrification planning. Information concerning settlements’ size and locations, distance from existing and/or planned infrastructure (transmission network, power plants, roads) economic activity, local renewable energy flows etc. can convey useful information and help take the right decision regarding the most effective pathway for electrification. However, it is usually the case that in countries where universal electrification is still to be achieved, such information is scarce and difficult to access[[1]](#footnote-1). The paucity of such information is one of the reasons hampering energy planning activities and particularly electrification, in currently unserved areas.

This situation is gradually changing with the increasing availability of new data and analytical tools, especially in the field of geospatial analysis. Geographic Information Systems (GIS) and remote sensing techniques are becoming openly available and can now provide a range of location-specific information that has not been previously accessible. These, in combination with new open source modelling tools[[2]](#footnote-2) have set up new ground in the field of electrification planning accelerating progress against the achievement of SDG7[[3]](#footnote-3).

The Energy Modelling Platform for Africa (EMP-A) provides an excellent opportunity to bring together the energy planning and modelling community in Africa and share experiences, models and data, especially in the newborn field of geospatial analysis. Moreover, this will strengthen the efforts for a paradigm shift; a shift that will establish the use of open (geospatial) tools as a reliable and cost-effective way to support electrification efforts in areas that need it.

## Scope & Purpose

Within the framework of this event the Open Source Spatial Electrification Tool (**OnSSET**) will be introduced to the participants. OnSSET has (and is) been developed by the KTH-division of Energy Systems Analysis team and community partners and serves as an open source, spatial, electrification tool that estimates, analyses and visualizes the most cost effective electrification option between grid extension, mini-grid (PV, Wind, Hydro, Diesel) and stand alone (PV, Diesel) systems. The tool has been developed so as to support efforts towards the achievement of SDG7 and thus suggest electrification pathways that will allow access to affordable, reliable, sustainable and modern energy for all by 2030. The tool has been applied to more than 50 countries worldwide including 44 Sub-Saharan African countries. Its results are openly accessible on various sources ([UNDESA](http://un-desa-modelling.github.io/electrification-paths-visualisation/index.html), [energydata.info](https://energydata.info/), [IEA](http://www.iea.org/energyaccess/), [onsset.org](http://www.onsset.org/) to name a few).

## Outcome

KTH will prepare and deliver a two-three day workshop on the OnSSET tool. The workshop aims at getting the participants familiarized with:

1. Basic concepts of geospatial analysis (data types and standard format, processing environment, projection systems and basic GIS functions).
2. Operational aspects of the OnSSET tool (model functions, code principles, data requirements, output processing and analysis).
3. Interpretation of the model’s results into policy formulation and strategy development for electrification.

The workshop will be a combination of tutoring presentations and hands-on sessions using the interactive interfaces that have been developed for/with OnSSET. Groups may consist of participants of various backgrounds so as to allow interpretation of the results with different perspectives. The workshop will end with the participants running their own electrification analysis with OnSSET and presenting results and key findings.

# Annex B - OSeMOSYS training session

## Introduction

A secure supply of reliable energy services at affordable prices is essential to promote economic development. Access to electricity enhances the level of educational and health services offered. It is one of the key concerns of businesses in Sub-Saharan Africa, where frequent power outages lead to substantial value losses as compared to sales. Sub-Saharan Africa is home to 13% of the world's population, of which 37% live in urban communities and yet just 32.5% have access to electricity [4]. According to the IEA’s World Energy Outlook 2016, the Gross Domestic Product (GDP) of Africa is expected to increase by 4.4% annually from 2014 to 2040, while electricity demand for the continent is projected to almost triple during the same period in a New Policies scenario. To meet the rising electricity demand and achieve universal access to electricity (SDG7), investments in generation, as well as transmission and distribution infrastructure are needed. This is especially the case since demand and supply are typically in different areas. However, reaching decisions for energy infrastructure investments that are sustainable and cost-efficient is not trivial.

Arguably, energy system models are useful in informing long-term energy planning. OSeMOSYS (Open-Source energy MOdelling SYStem) is such a tool that can provide valuable insights. OSeMOSYS is a long-term dynamic energy systems model that minimizes overall system cost to meet a set of externally defined demands.

## Scope & Purpose

Participants at the EMP-A will have the opportunity to follow an introductory training session focused on OSeMOSYS. The aim of the training will be to provide trainees with the required background knowledge and skills required to construct a simple model of a national energy system and subsequently conduct relevant analyses. Examples will be provided within the training sessions to allow the representation of entire energy chains within OSeMOSYS.

## Outcome

OSeMOSYS will be used via the interface MoManI (Modelling Management Interface) for the development of a model representing selected elements from the energy system of the country participants. Particular focus will be given to the electricity sector. The main objectives of the first training in energy systems modelling are to:

* Introduce the basic concepts of energy systems modelling;
* Understand the basic concepts of linear programming to facilitate the manipulation of OSeMOSYS;
* List and recognize the main elements in the model development of the electricity supply sector using OSeMOSYS via the MoManI interface;
* Learn how different elements of the energy system can be represented in OSeMOSYS;
* Learn how to navigate and use the interface MoManI for the development of an energy model;
* Manipulate parameters and sets in the energy model to explore pathways for the implementation of strategic policies and investments in the energy sector.

The training sessions will take place over a period of days, in which the first two will be dedicated to the basic concepts of energy systems modelling, the functioning of OSeMOSYS and the use of MoMAnI. Participants are expected to engage in several exercises along these sessions to consolidate the concepts being introduced. The results will be analyzed to understand the system dynamics for the formulation of energy policies. In the last day of the workshop, the participants will be requested to present their work and provide suggestions for future work that could be useful in the context of their national energy planning.

1. Note: Such data are up to recently not covered by standard national energy statistics. [↑](#footnote-ref-1)
2. The most comprehensive efforts in terms of coverage available have been lead by the consortium for the [IEA](http://www.worldenergyoutlook.org/resources/energydevelopment/) and [UNDESA](https://un-desa-modelling.github.io/). Note that these efforts are powered by [OnSSET.org](http://www.onsset.org/). [↑](#footnote-ref-2)
3. [Sustainable development Goal 7](https://sustainabledevelopment.un.org/sdg7) [↑](#footnote-ref-3)