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The EU Global Technical Assistance Facility for Sustainable Energy (GTAF)

Concept Note & Agenda

Training on SPLAT-Africa

Fourth session (A4): Finalizing CMP scenarios and sensitivity analyses

Kigali, Rwanda

13 – 17 March 2023

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Background

In 2018, the African Union Specialised Technical Committee (STC) on Transport, Transcontinental and Interregional Infrastructure, Energy and Tourism (STC-TTIIET) decided to develop a Continental Power System Masterplan (CMP) to serve as a blueprint for the African Single Electricity Market (AfSEM). The CMP aims to provide a strategic road map for connecting Africa's five power pools. The specific objectives of the CMP include the identification of priority power generation projects to meet the demand of the continent by 2040, and the establishment of a continental transmission system that will interconnect the regional transmission networks (CAPP, COMELEC, EAPP, SAPP and WAPP). Besides the AfSEM, the CMP builds synergies with the AfDB's New Deal for Energy in Africa, the African Union Agenda 2063, the United Nations Sustainable Development Goals and the IRENA-led initiative for Clean Energy Corridors in Africa. The first part of the CMP was implemented during the period February-November 2020 and produced five deliverables (reports), including the baseline of the five power pools and the project inception report.

The second part of the CMP (CMP II) includes modelling the continental masterplan together with the modelling partners: International Renewable Energy Agency (IRENA) and International Atomic Energy Agency (IAEA). It will build on three quantitative analyses: (i) demand assessment, (ii) capacity expansion optimization, and (iii) network analysis. The IAEA and IRENA's MESSAGE-SPLAT tool has been chosen to perform generation and inter country transmission capacity expansion optimization. The MESSAGE-SPLAT modelling framework includes the following components:

- MESSAGE software – a mathematical optimization software used to input data for modelling energy scenarios. In the context of the CMP II, it is used in the background as a model generator.
- **SPLAT-Africa model** – a model that IRENA developed using the MESSAGE software. Reference energy systems that define the energy flows within a country's power system have been configured for each African country, and the links between country models are configured with transboundary transmission lines.
- SPLAT model database and Excel utilities – the database contains the required input data and various key parameters used in the SPLAT-Africa model. The Excel utility works as an interface between the database and the MESSAGE model generator and allows bulk model-update.
- Renewable resources databases – geospatially referenced database with RE resource- and location-specific temporal profiles of power generation (solar, wind and hydropower).
- Online repository – Github-based system to manage and track the model versions developed by different members of the model development team.

The modelling partners are entrusted to provide a training series within CMP II that aims at equipping the AUDA-NEPAD and Power Pools technical team with skills to (1) develop the SPLAT-CMP model from IRENA's SPLAT-Africa model, (2) to develop CMP scenarios and analyse them, (3) to institutionalize the model maintenance process, and (4) to obtain model approval by the experts from Power Pools and future endorsement by the STCs. The first training, that followed a one-week online MESSAGE e-learning, introduced the participants the key elements of SPLAT-Africa model as starter-kit. The 2nd training explained the participants on how to develop a reference scenario and how to interpret the scenario results. The 3rd training explained the participants on how to develop alternative scenarios of interconnecting national grids at intra-regional and continent wide scale.

In this fourth training, the participants will learn to analyse in-depth the different scenarios refined on the basis of Power pools feedback, and to perform sensitivity analyses of the results.

The training will cover:

- In-depth analysis of scenario implications (capacity mix, costs, dispatch, interconnections)
- Deep dive on sensitivity analysis and implications for the model
- Developing key messages
- Major lessons learnt towards conclusions for CMP

After this training, the participants will be able to clearly assess the main drivers of least cost expansion pathway for Africa and improve the robustness of CMP scenarios in context to known uncertainties of key CMP components. The training will be followed by discussion sessions, organized by IRENA and IAEA, to support the AUDA-NEPAD team with developing and interpreting the scenario results and documenting the results. To conclude the training programme, a continental consultative workshop will be organized by AUDA-NEPAD expert team for the presentation of the analytical report from the CMP analysis to the relevant stakeholders, to collect feedback for finalization of the analytical report as well as key messages.

Meeting venue

Hôtel des Mille Collines, Kigali

Rwanda

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Agenda

Day 1: CMP scenarios and scenario results

Monday 13 March 2023

Time (Local)	Session	Speaker / Moderator
9:00–9:30	Coffee	
9:30–10:00	**Welcome and opening** - Orientation to training setup (room, zoom call, online workspace, housekeeping) - Round with participants	Bilal HUSSAIN (IRENA)
10:00–10:30	**Recap of previous training & scheme for this training**	Bilal HUSSAIN (IRENA)
10:30–12:30	**Presentation of CMP scenarios** - Feedback from last consultative sessions - Scenario definitions and story line (Baseline vs reference vs intra-regional vs inter-regional) - Region wise prominent scenario design highlights (if any)	AUDA-NEPAD
12:30–13:30	Lunch	
13:30–15:00	**Presentation of CMP scenario Results (Focus- Countries)** - Country level reference scenario results viz a viz baseline (focusing capacity/energy mix, trade, emission, and cost trajectories) - Open discussion	Presentation and *Discussion moderated by AUDA-NEPAD*
15:00–15:15	Coffee	
15:15–17:15	**Presentation of CMP scenario Results (Focus-Regions)** - Continental and region wise reference scenario results viz a viz baseline (focusing generation/transmission techs of intra-regional & inter-regional significance) - Open discussion	Presentation and *Discussion moderated by AUDA-NEPAD*
17:15–17:30	**Conclusion and program for the following day**	Bilal HUSSAIN (IRENA)

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Day 2: Developing key messages

Tuesday 14 March 2023

Time (Local)	Session	Speaker / Moderator
9:00–9:30	Coffee	
9:30–9:45	**Recap of previous day**	Bilal HUSSAIN (IRENA)
9:45–10:30	**Known drivers of least cost expansion pathways** - Role of variable renewables as low-cost resource - Role of inter-region resource complementarity to improve energy security. - Role of cross-border trade in lowering operational costs - Role of storage in improving system flexibility	Sebastian STERL (IRENA)
10:30–12:30	**[Hands on exercise]** Participants chose one region of interest; check consistency of CMP results with known drivers of least cost expansion by comparing baseline with reference scenario; share their thoughts/raise their questions for open discussion	IRENA & IAEA
12:30–13:30	Lunch	
13:30–14:00	**CMP to the next set of priority action projects (PAP) in the Program for Infrastructure Development in Africa (PIDA)**	*Crispen ZANA (AUDA-NEPAD)*
14:00–15:00	**Insights from CMP modelling on selected infrastructure projects** - Solar PV and Wind sites/countries (top producers/contributors to domestic peak demand etc.) - Transmission projects with increased significance compared to past studies - Others if any (e.g. hydro, biomass, battery storage etc)	Presentation and *Discussion moderated by AUDA-NEPAD*
15:00–15:15	Coffee	
15:15–17:15	**[Hands on exercise]** Participants analyze results and make their own list of top three high interest generation or transmission options and share their merits of evaluation	ALL
17:15–17:30	**Conclusion and program for the following day**	Bilal HUSSAIN (IRENA)

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Day 3: Ensuring robustness of CMP scenarios (Sensitivity analysis)

Wednesday 15 March 2023

Time (Local)	Session	Speaker / Moderator
9:30–9:45	**Recap of previous day**	Bilal HUSSAIN (IRENA)
9:45–10:15	**Sensitivity analysis in energy planning (Introduction)** - Objectives and approach - Examples and good principles to identify/shortlist sensitivity parameters	Mario TOT (IAEA)
10:15–10:45	**Designing sensitivities around fuel price and technology evolution** - Significance of sensitivity parameter; overview of various sensitivities possible; tips on designing appropriate/plausible sensitivities	Bilal HUSSAIN (IRENA)
10:45–11:00	Coffee	
11:00–11:15	**[Demonstration]** Preparing and visualizing fuel price sensitivities in SPLAT	Himalaya Bir SHRESTHA (IRENA)
11:15–12:30	**[Hands on exercise]** Create, run & analyze fuel price sensitivity in SPLAT mini-model	IRENA & IAEA
12:30–13:30	Lunch	
13:30–13:45	**[Demonstration]** Preparing and visualizing technology evolution sensitivities in SPLAT	Bilal HUSSAIN (IRENA)
13:45–15:15	**[Hands on exercise]** Create, run & analyze sensitivity on technology evolution in SPLAT mini-model	IRENA & IAEA
15:15–15:30	Coffee	
15:30–16:00	**Update on cost differentiation of generic cross border interconnectors** - Present the cost dataset and methodology - Orientation to the excel tool that enables customization of interconnector voltage level and other factors	Himalaya Bir SHRESTHA (IRENA)
16:00–17:00	**[Hands on exercise]** Participants take stock of the of messaging from the latest full integration scenario results and provide feedback	IRENA & IAEA
17:00–17:15	**Status brief on SPLAT web guide**	Himalaya Bir SHRESTHA (IRENA)
17:15–17:30	**Conclusion and program for the following day**	Bilal HUSSAIN (IRENA)

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Day 4: Ensuring robustness of CMP scenarios (Sensitivity analysis)

Thursday 16 March 2023

Time (Local)	Session	Speaker / Moderator
9:00–9:10	**Recap of previous day**	Bilal HUSSAIN (IRENA)
9:10–9:40	**Designing sensitivities around hydro variability** - Significance of sensitivity parameter; overview of various sensitivities possible; tips on designing appropriate & plausible sensitivities	Sebastian STERL (IRENA)
9:40–10:00	**Designing sensitivities around 'delay in key projects'** - Significance of sensitivity parameter in African context; tips on designing appropriate & plausible sensitivities	Mohammed Bassam BEN TICHA (IAEA)
10:00–10:30	**[Demonstration]** Preparing and visualizing hydro and project delay sensitivities in SPLAT (+ recap of other sensitivities)	Bruno MERVEN (IRENA)
10:30–10:45	Coffee	
10:45–11:45	**[Hands on exercise]** Create, run & analyze hydro variability and project delay sensitivity in one country	IRENA & IAEA
11:45–12:30	**[Group work session] Create CMP sensitivity scenario** Participants to make four sensitivity topic wise groups. Each group to design the CMP (all-continent) sensitivity. Group lead to create the sensitivity on SPLAT and run the all-continent model on cloud solver	IRENA & IAEA
12:30–13:30	Lunch	
13:30–15:00	**[Group work session Continued]**	IRENA & IAEA
15:00–15:15	Coffee	
15:15–17:15	**[Group Work session continued] Analyse CMP sensitivity scenario results.** Groups will jointly analyze the sensitivity results and prepare the presentation of results	IRENA & IAEA
17:15–17:30	**Conclusion and program for the following day**	Bilal HUSSAIN (IRENA)

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Day 5: Discussion & way forward

Friday 17 March 2023

Time (Local)	Session	Speaker / Moderator
9:00–9:05	**Objective of last day and recap of previous days**	Bilal HUSSAIN (IRENA)
9:05–9:20	**Status brief on SPLAT web guide**	Himalaya Bir SHRESTHA (IRENA)
9:20–9:50	**Presentation & discussion - tech. evolution sensitivity**	ALL
9:50–10:20	**Presentation & discussion - low/high fuel price sensitivity**	ALL
10:20–10:30	Coffee	
10:30–11:00	**Presentation & discussion – hydro variability sensitivity**	ALL
11:00–11:30	**Presentation & discussion - 'delayed project' sensitivity**	ALL
11:30–12:30	**Refining messages out of CMP scenarios in light of sensitivity analysis insights**	*Discussion moderated by AUDA-NEPAD*
12:30–13:30	Lunch	
13:30–14:45	**Group discussion on next steps and homework** - *Next milestones of AUDA-NEPAD modelling team until continental consultative workshop* - *Concept of continental consultative workshop* - *IRENA/IAEA and AUDA-NEPAD's discussion sessions after training 4 – Expectations from modelling partners*	*Discussion moderated by AUDA-NEPAD*
14:45–15:00	**Participants fill the end of training survey**	
15:00–15:15	Coffee	
15:15–15:30	**Quick review of survey results**	Sebastian STERL (IRENA)
15:30–16:30	**Towards sustainable governance of continental planning: Major lessons learnt** (open discussion) - Discuss the strengths and challenges of the operational scheme adopted for CMP project and is it scalable/repeatable for future purposes. - Topics may cover, but not limited to, the stakeholder engagement approach for data collection and reviews, model update tracking approach, data management approach etc.	*Discussion moderated by* Crispen ZANA (AUDA-NEPAD)

16:30–17:00	**Closing** - Conclusion of the training series - Closing statements from the partners	