EMERGE: ENERGY SYSTEM MODELLING FOR GREEN DEVELOPMENT OF AFRICA

INITIATE Event: Croatian Energy Transition: Innovation and Opportunities through EU Projects

Presenter: Nikola Matak, PhD

25th April, 2025

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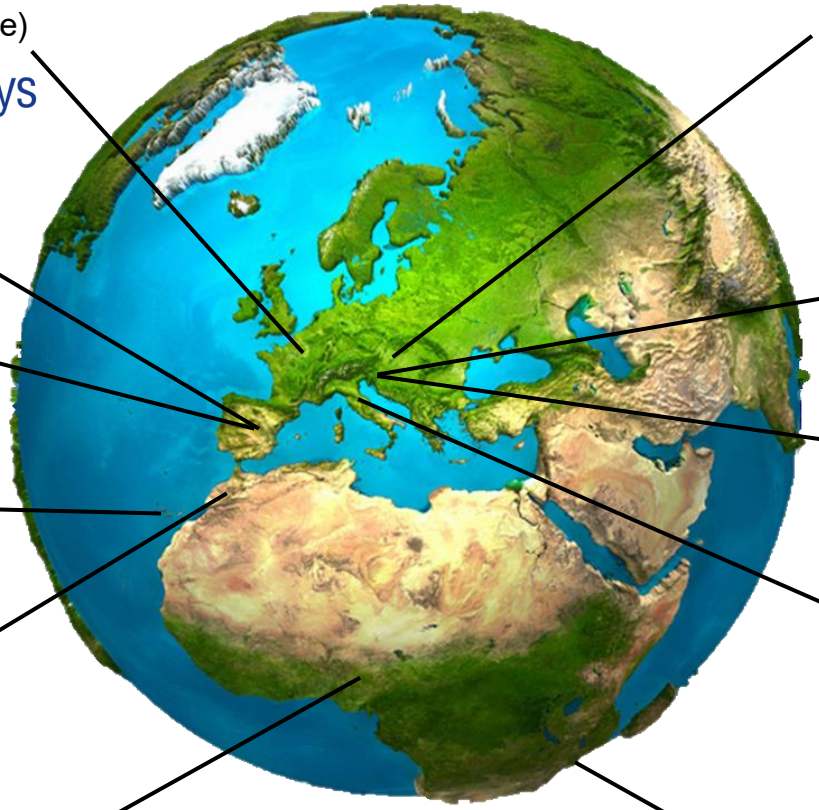
ENERGY SYSTEM MODELLING FOR GREEN DEVELOPMENT OF AFRICA

Emerge is a verb meaning move out of or away from something and become visible, apparent or prominent.
This verb has a Latin origin - *emergere* means to "bring forth, bring to light"

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Consortium



Artelys (France)

CIRCE (Spain)

Cartif (Spain)

ECREEE (Cabo Verde)

UMP (Morocco)

AfriLabs (Nigeria)

UEM (Mozambique)

EnGreen Srl (Italy)

BrainIT (Croatia)

UNIZAG FSB (Croatia)

ESEIA (Austria)

Key numbers and figures

11 partners from 9 countries

Start: December 1st, 2023

End: November 30th, 2026

Duration: 36 months

Coordinator: UNIZAG FSB

Grant: 2.49M €

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EMERGE project goal

- The EMERGE project is dedicated to advancing sustainability in Africa by providing key stakeholders with essential tools and knowledge.
- Focused on clean energy production and responsible resource use, EMERGE aims to bridge cultural and socioeconomic gaps for a united approach to development.

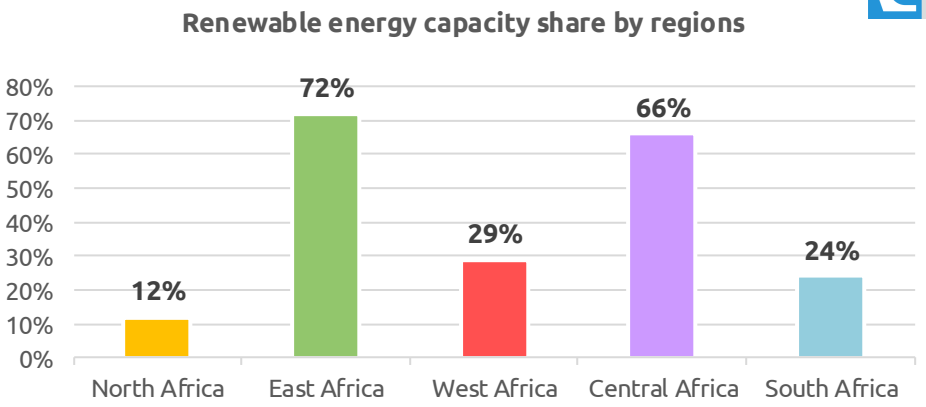


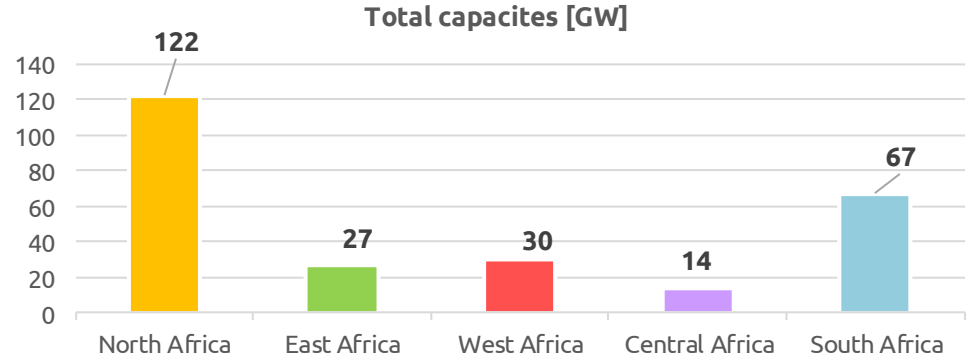
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Renewables in Africa







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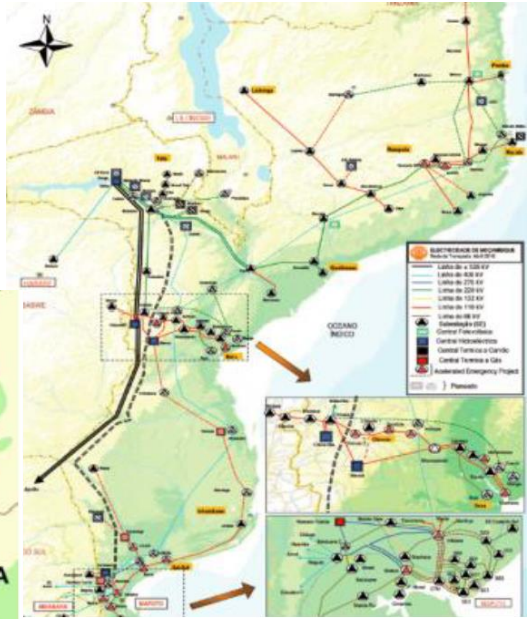
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EMERGE demo sites









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EMERGE approach

EMERGE Toolbox

- CEPIA
- Hosting Capacity
- Optimal Storage Placement Tool
- Calliope
- PowSyBI
- GREENADVISE

Stakeholders inclusion

- Social inclusion via co-design workshops
- Stakeholders engagement via consultation and feedback
- Education and investment advisor through gamification
- Study visits AU-AU
- Knowledge exchange and training AU-EU
- Stakeholder Group
- Webpage and capacity building materials

Policy and regulations

- Policy analysis
- Public consultation
- Scenario identification – use cases
- R&I and Policy Labs
- Steering policy recommendations
- Action plans
- Roadmap

EMERGE GREEN AFRICA

Universal Energy Access & Decarbonization Energy Transition in EU/AU

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Toolbox development

Successfully transition to a clean energy system and preserve resources



Provide a comprehensive toolbox



Modelling African energy systems



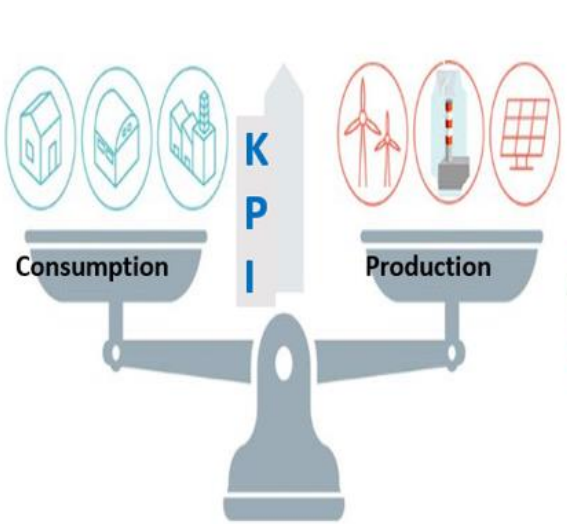
Economical
Social
Environmental

Assist with energy planning

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Hosting Capacity – CIRCE



Flexibility

circe
Hosting Capacity

Hosting capacity helps to increase the observability, controllability and automation of network systems to improve both network security and resiliency.

a dynamic approach allows cycling through different production expansion scenarios to achieve optimal economic and environmental KPIs.

= Optimal scenarios

Emissions reduction / Minimum investment cost

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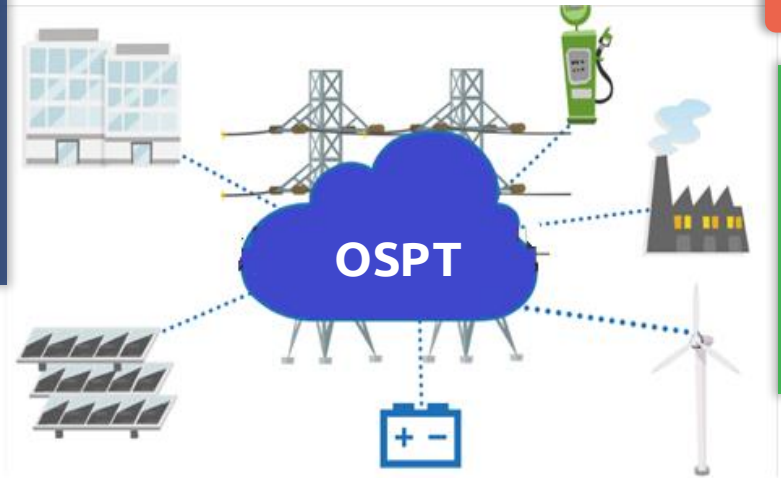
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Optimal Storage Placement Tool – CIRCE

The Tool will provide

a visualization dashboard, showing energy and flows as well as power network parameters such as voltage.



the tool will establish

the link between the storage location and environmental and economic KPIs in addition to existing economic parameters

By connecting to the database and knowledge base, energy modeling experts will be able to compare different scenarios and find an optimal storage location to maximize benefits in terms of additional environmental, technical and economic parameters.

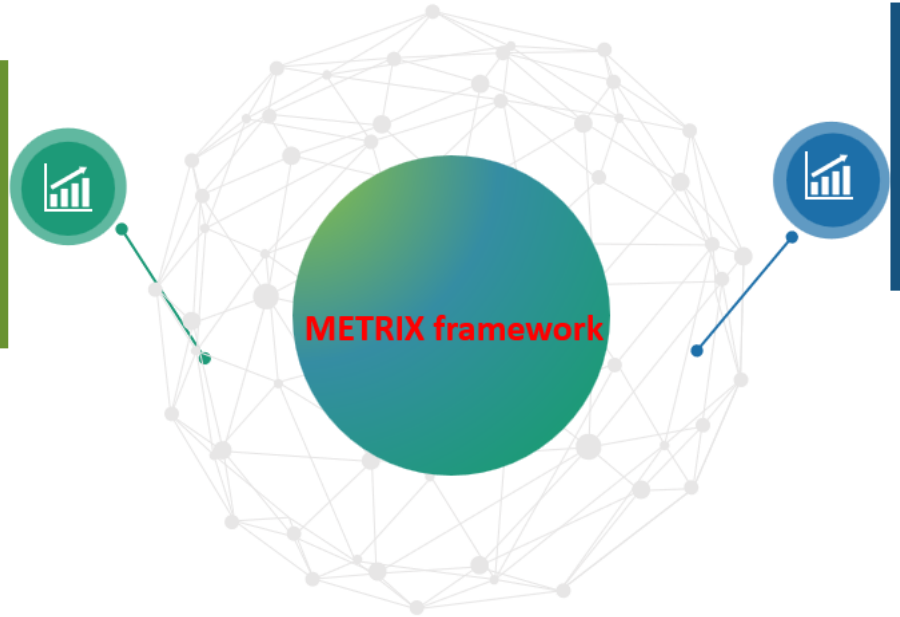
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PowSybl – Artelys

will use the PowSyBl tool to improve the METRIX software to include it in the modeling of grid flexibility solutions, such as battery storage.

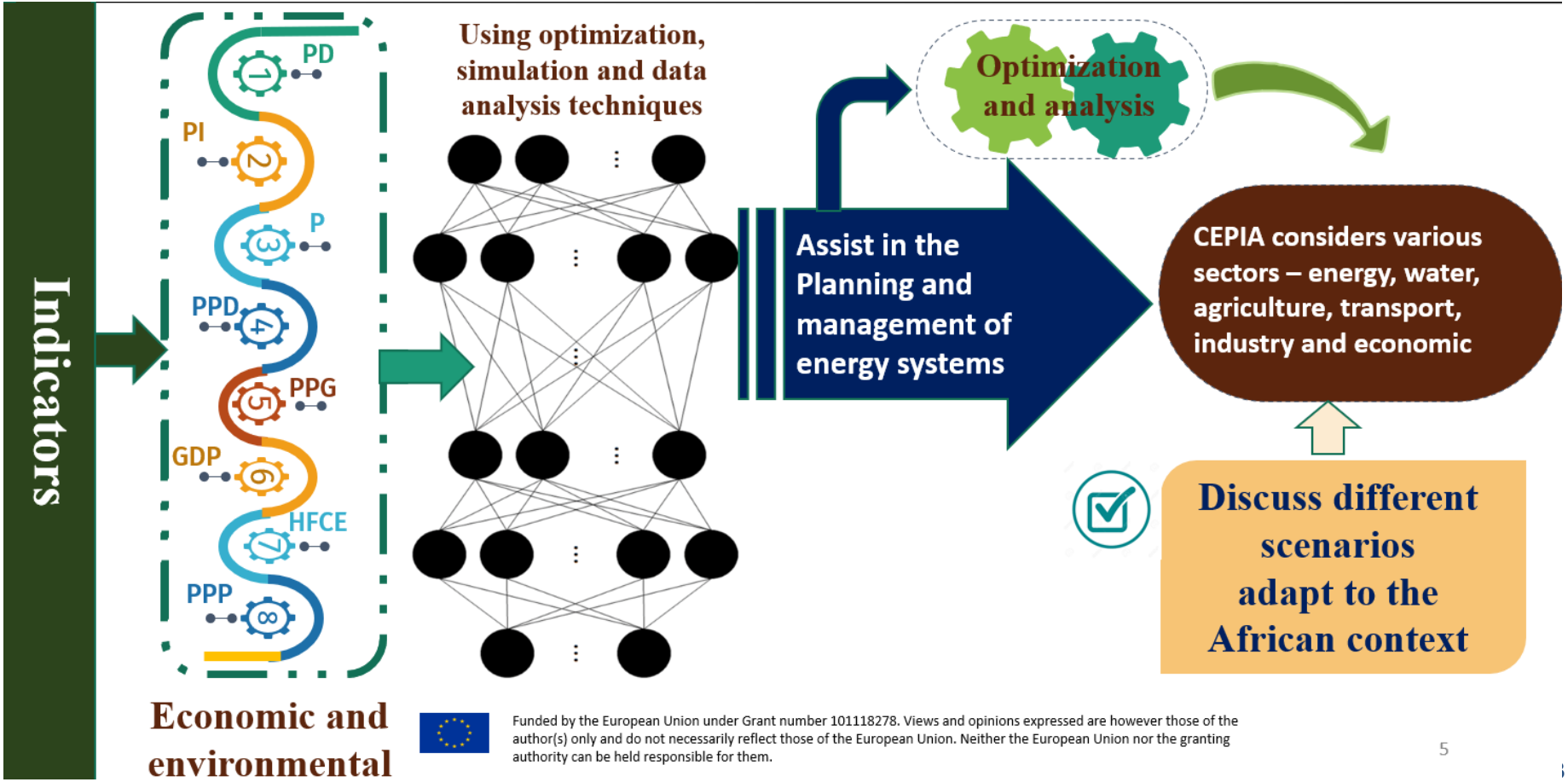


will develop an additional module to integrate temporal coupling into the evaluation of flexibility solutions on network flows.

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CEPIA - Artelys

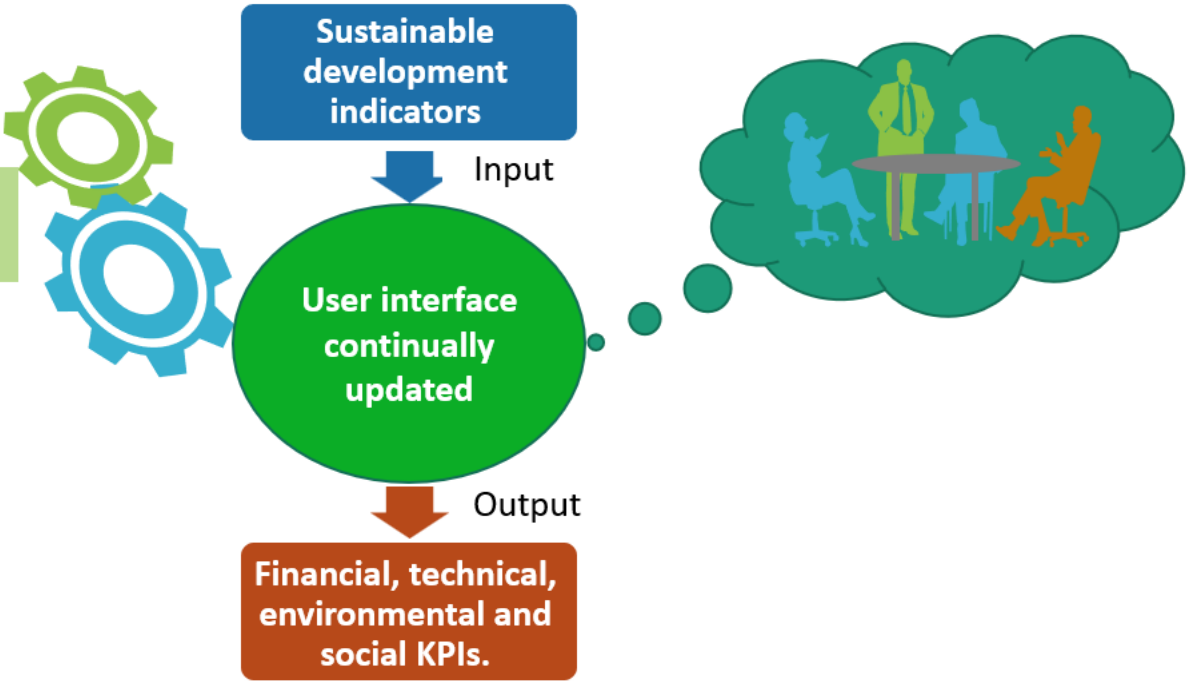


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GREENADVISE – UNIZAG FSB

GREENADVISE

With robust and stochastic algorithms **UNIZAG will develop**



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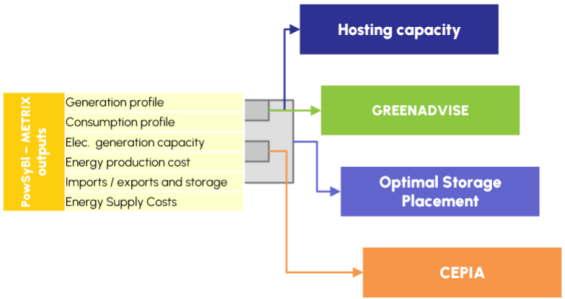
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Key results – CSA and tools interaction

- CSA definition → Model classification, Features mapping, and ToolBox soft-linking

Features description		
	Energy	Energy Access
		Energy Demand
		Energy Supply
		Resource availability
	Other	Water
		Land Use
		Demography
		Economic Performance
		Environmental impact

Tool / Feature	Hosting Capacity	Optimal Storage Placement	GREENADVISE	CEPIA	PowSyBl - METRIX
Electricity system reliability	■	■	■	■	■
Electricity generation technology mix	■	■	■	■	■
Electricity generation capacity	■	■	■	■	■
Total national energy demand	■	■	■	■	
Net imported energy	■	■	■	■	
Energy Production	■	■	■	■	
Energy demand per sector	■	■		■	
Topology of the network	■	■			■
Generation profile	■	■			■
Consumption profile	■	■			■
Energy import, export and storage	■	■	■		
Net exported energy	■	■	■		
Energy production cost			■	■	■
Energy Supply Costs			■	■	■
Energy Import			■	■	
Final Energy Demand			■	■	
Energy demand per capita			■	■	
Energy losses			■	■	■
Net available land	■	■			
Greenhouse gas emission			■	■	
Other emissions			■	■	
Electrification				■	
Primary energy demand				■	
Heat Generation			■		
Heat generation capacity			■		
RES Availability			■		
Energy intensity per source				■	
Fuel price			■		
Energy Price			■		
Population (per age range)				■	
Average annual growth rate				■	
GDP				■	
GDP per capita				■	
GDP growth rate				■	

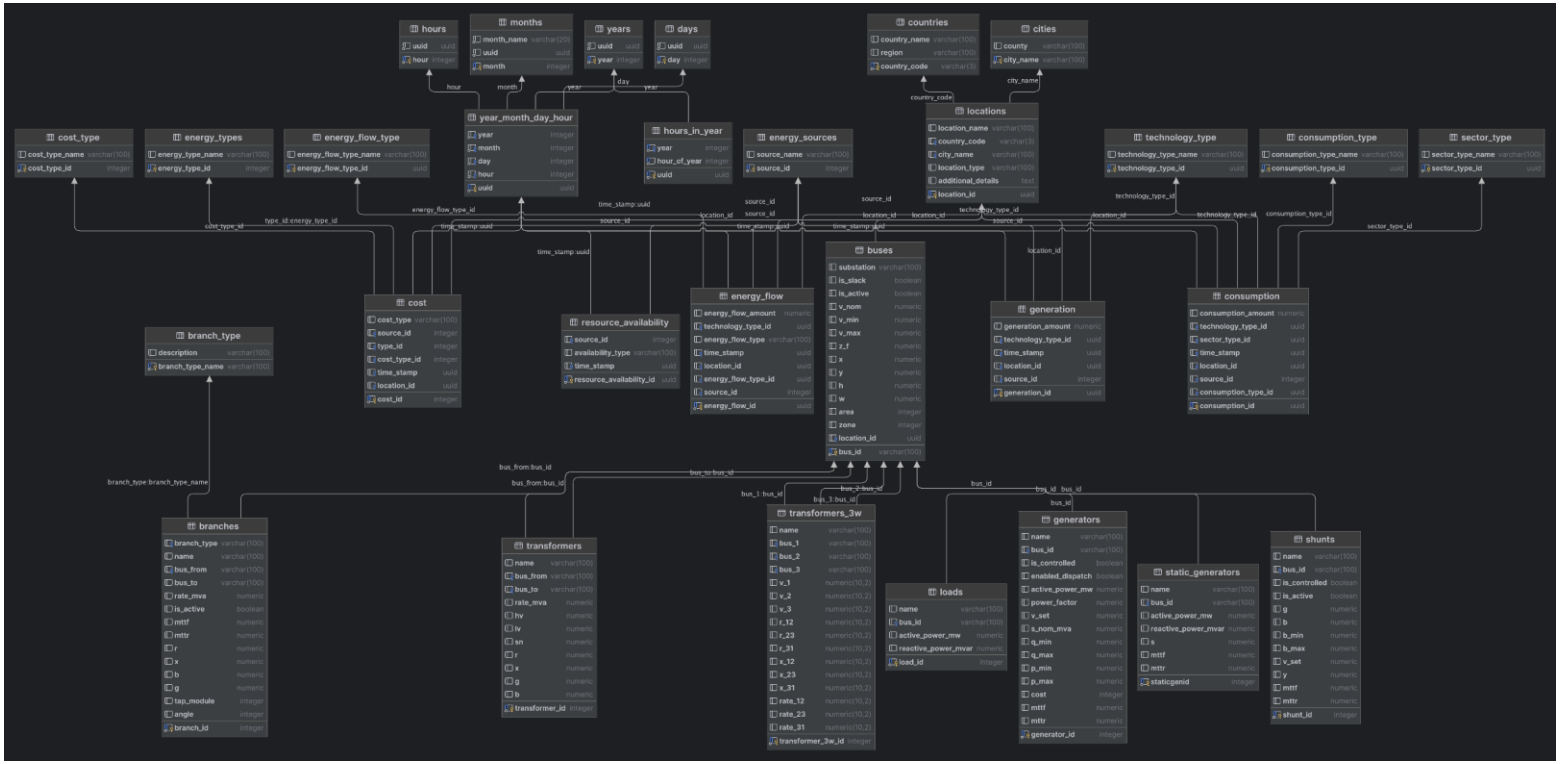


Connect the outputs of one tool that could be input of another one

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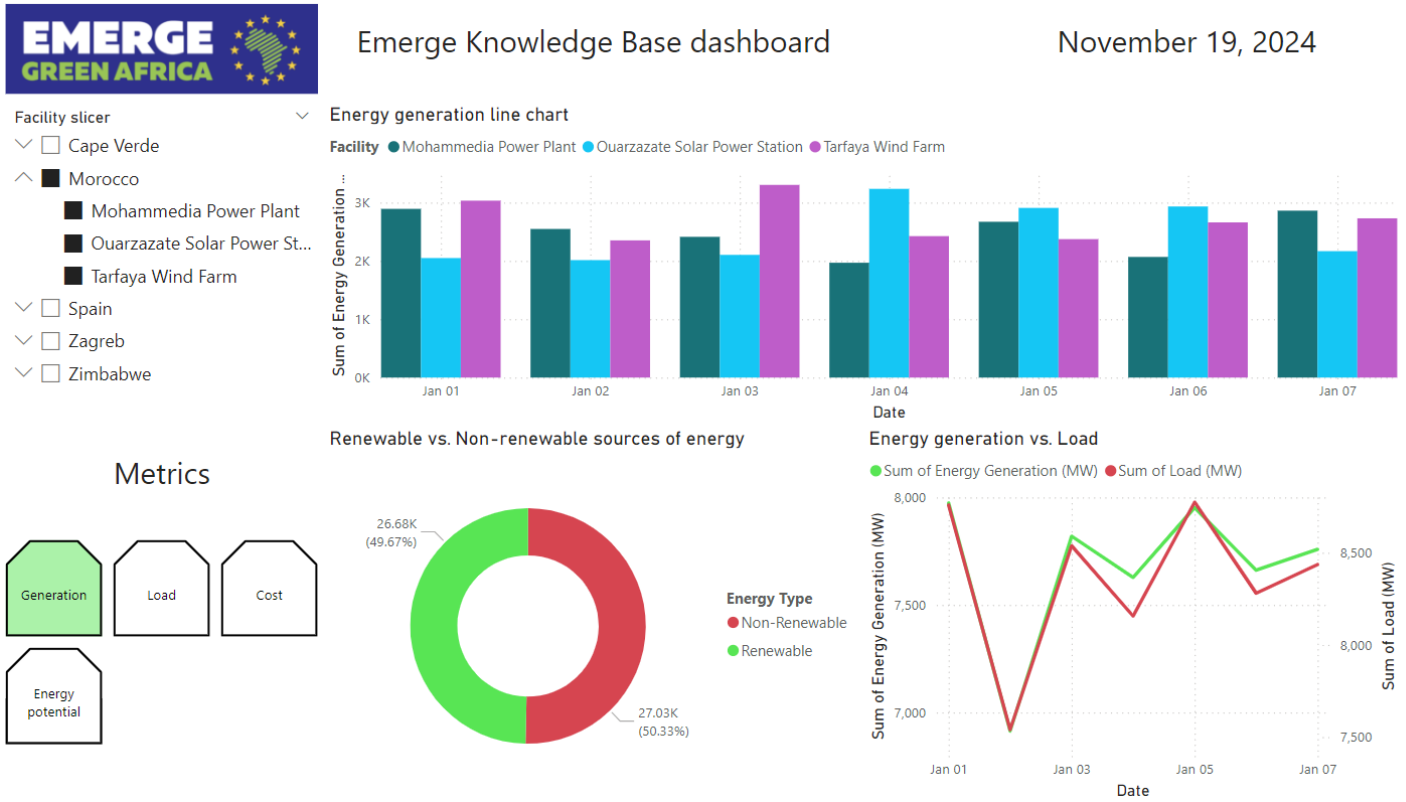
Key results – Preliminary central database schema



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Key results – EMERGE Knowledge Base dashboards



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Key results – Initial Stakeholder engagement

- During spring and summer 2024 initial workshops in Morocco, Mali and Mozambique





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Key results – Initial Stakeholder engagement

Survey and feedback from stakeholders on energy modelling

Topics covered:

- DATA COLLECTION
- ENERGY MARKETS
- REGULATORY, ADMINISTRATIVE AND LEGAL SUPPORT
- INFRASTRUCTURE ASPECTS
- METHODS AND TECHNICAL & FINANCIAL TOOLS
- VALUE AND NEEDS OF CITIZENS AND COMMUNITIES ON A SOCIAL LEVEL

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Key results – Co creation workshop

- Tools presentation and demonstration:
  - CEPIA: Presented by Artelys, this tool evaluates clean energy production and integration possibilities.
  - Hosting Capacity: Introduced by CIRCE, it focuses on maximizing grid hosting capacity for renewable energy sources.
  - GREENADVISE: Demonstrated by UNIZAG FSB, offering strategic guidance for sustainable energy initiatives.



- Knowledge Exchange Session:
  - addressed policy barriers, best practices, and actionable recommendations specific to the African context, with a special emphasis on Morocco
- Participant Feedback
  - on the tools and the workshop through brief surveys

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Key results – AU-EU exchange – Tool trainings

- In-depth training sessions on CEPIA and METRIX, two critical tools for energy planning.
- AfriLabs, the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE), UMP, and UEM
- Further developing their CEPIA and METRIX applications









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Key results - SDEWES AFRICA conference in Morocco in May 2025, from 27th to 31th



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Next steps

- **AU-EU tool trainings in Spain (CIRCE)**
- **AU-AU exchange in Abuja, Nigeria (Afrilabs)**
- **Special session on SDEWES Conference in Morocco in May**
- **Joint event in Cabo Verde with OnePlanET project in October**
- Knowledge Base dashboards finalisation
- Database refinement and update, interlinking with the toolbox
- Finalising the toolbox based on the continuous partners and stakeholder's feedback
- Identify and evaluate regulatory frameworks and potential opportunities for clean energy technologies integration in African countries

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Contacts:

info@emerge4green-africa.eu

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