Open source Nexus modelling tools for Planning sustainable Energy Transition in Africa

This project has been funded by the European Union, Grant Agreement n. 101084127

ONEPlanET Project Overview

ONEPlanET is a Horizon Europe funded project, started on the 1st of November 2022

12 partners, 8 European and 4 African partners

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Project Goal

ONEPlanET project aims **at empowering African policy makers, research & academia**, investors and **citizens** with the necessary tools and know-how **to increase clean energy generation** and sustainable **use of resources in Africa** while **reducing inequalities and cultural/socio-economic gaps**.

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Mission

- ONEPlanET will **co-design** and test a **Toolkit**, built upon existing WEF Nexus models and methodologies, that allows to simulate scenarios optimizing existing resources with the most appropriate policies considering social, climate, economic and biophysical constrains.
- User engagement and co-design methodologies.
- Creation of a **Knowledge Hub** including a set of capacity building materials will be developed.

ONEPlanET aims to become **the Toolkit supporting decision-makers** in their day-to-day work. It will provide **open-source tools**, models and materials to help them to make informed decisions, considering social, economic and environmental parameters.

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Why Nexus in Africa

"African leaders have made clear their commitment to attaining **inclusive and sustainable economic growth** and development in **the Agenda 2063**, still it is necessary to support them in the definition of effective energy policy choices and to provide them with the scientific knowledge for de-risking investments in RES projects"

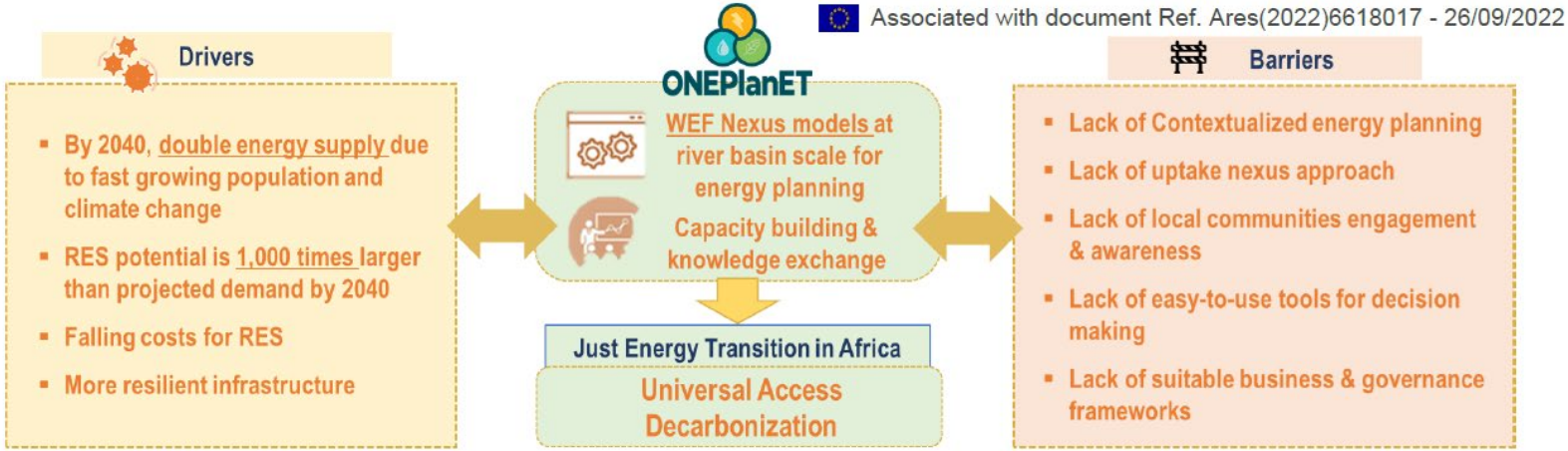

Figure 1 - ONEPlanET vision

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Project Pillars

ONEPlanET aims at **becoming the Toolkit supporting decision-makers in the energy** field in their day-to-day work. It will provide open-source tools, models and materials helping them to take informed decisions, considering social, economic and environmental parameters.

- ONEPlanET ambition lies in these 4 main pillars:

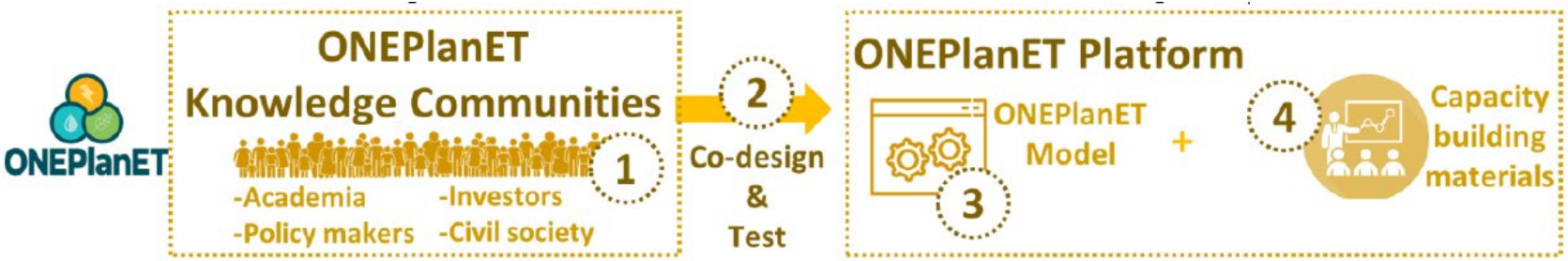

Figure 2 - ONEPlanET pillars

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1: Community and stakeholders

ONEPlanET aims at building knowledge communities around the Nexus initiative mixing experts and future users of the platform from the EU and AU. The project will not build a network from scratch in the AU, but will use of the African partners, particularly the network of members in Mali, South Africa and Malawi/Tanzania.
The knowledge communities will also build on the existing networks of the EU and AU partners, particularly linked to the UNESCO institutions and collaborations,

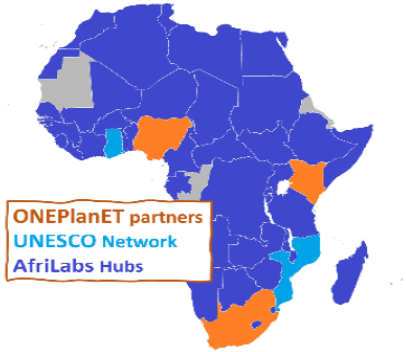

Figure 3 - ONEPlanET Network

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2: User engagement and co-design methodologies to build the ONEPlanET Toolkit

Building the ONEPlanET Toolkit with knowledge from Local Communities, will allow to design the user experience of the whole **Toolkit adapted to real problems and challenges.**

The Toolkit development process encompasses:

1) **User research** that will be carried out in each basin and its region, to map current problems for these stakeholders → stakeholders engagement

2) **Co-creation of the user experience and the capacity building materials**. The main pains and challenges of policy makers, utilities and investors will be used to build the most adapted user experience of the Toolkit

3) **Creation of the model, user interface, training materials** and testing process. Everything will be exchanged/shared with users through different loops to ensure that it is still addressing the needs and challenges identified

4) **Final validation.** The Toolkit will get feedback from the four target audiences

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3. Novel Nexus model for African continent

Most of the existing models simulate the WEF Nexus in a one-way direction rather than fully investigating the feedbacks and interconnections of each element.

The major missing aspects in existing models, and covered by ONEPlanET are:

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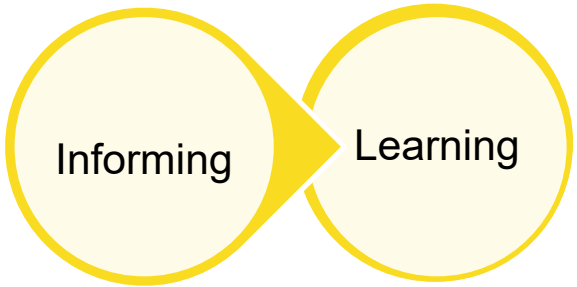
4. A comprehensive capacity building approach to build skills and knowledge on the Nexus

- **Capacity building** enables organizations and more in general actors involved in the Nexus to develop competencies and skills that can make them more effective and sustainable in the use of resources.
- It helps to fosters a sense of ownership and empowerment

- ONEPlanET capacity building strategy has been conceived at two main levels:



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MODELLING THE WEF NEXUS

ONEPlanET

Objective:

- Develop an open-source WEF Nexus for African case studies that aims to anticipate the cross-sectoral impacts of energy infrastructure policies.
- By simulating the feedbacks between energy infrastructure deployment and water & food systems, the model will equip policymakers and Nexus experts with insights to ensure sustainable and integrated resource management.

CASE STUDIES

WHERE?

- In Bani River as part of Niger basin
- Songwe River Basin East Africa
- Inkomati-Usunthu Water Management Area

WHY?

- By 2040, doble the energy supply (population growth and climate change)
- RES potential is 1000 times larger than projected demand by 2040
- Falling costs for RES
- More resilient infrastructure

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MODELLING THE WEF NEXUS

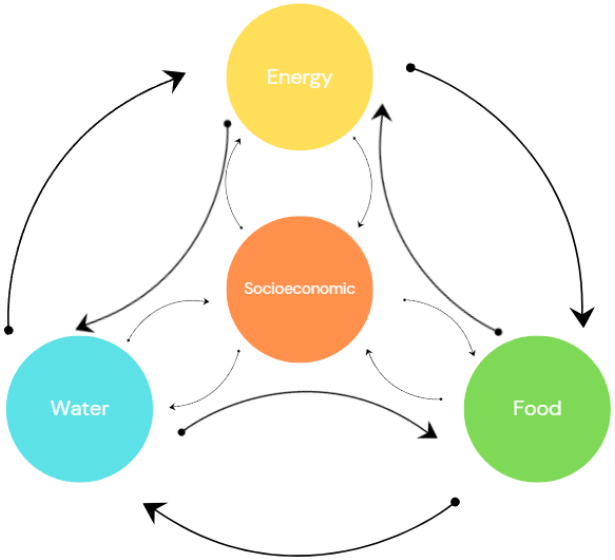
WHEN?

Simulations to provide plausible future results until 2050

HOW?

- Integrated Assessment Models (WEF-H Nexus)
- System Dymanics Modelling

THE WEF NEXUS



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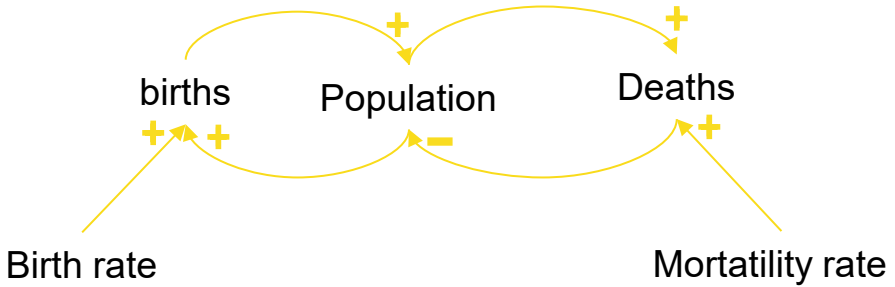
HOW TO MODEL THE WEF NEXUS?

SYSTEM DYNAMICS

Methodology and mathematical modelling technique to frame, understand, and discuss complex issues and problems (Racdzicki et al., 2008)

Causal Loop



Source: Own Elaboration

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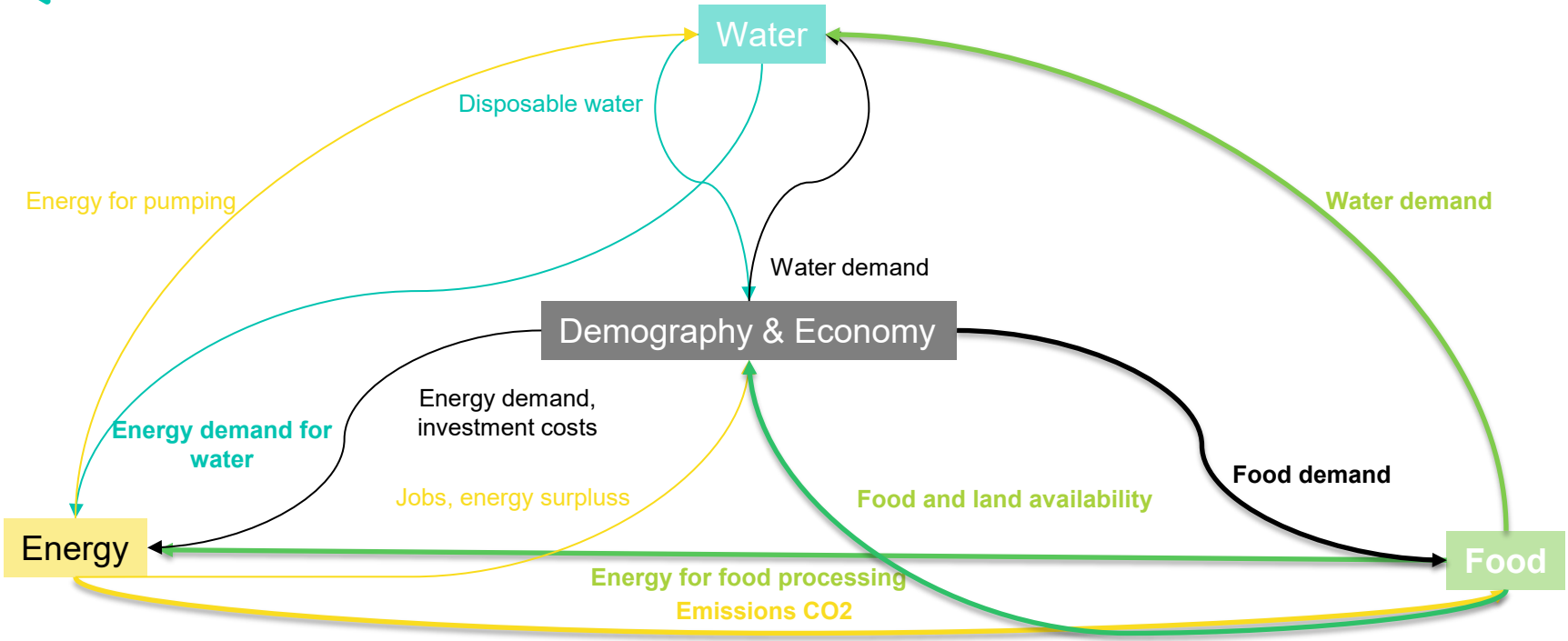
HOW TO MODEL THE WEF NEXUS?



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Water Module

01

Key Features:

- Water availability (surface and groundwater);
- Demand by sector (agriculture, industry, domestic);
- Water quality;

02

Interconnections:

- **Food:** Impact of irrigation on water availability.
- **Energy:** Water demand for hydropower and thermal power generation.
- **Socioeconomic:** Population growth and urbanization increasing water demand.

03

Data needs:

- Water resource availability
- Data on precipitation
- Runoff
- Groundwater resources
- Water quality
- Water demand

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Energy Module

Key Features:

01

- Energy technologies for electricity production (renewable and non-renewable);
- Energy demand by sector;
- Greenhouse gas emissions;
- Electricity generation;

02

Interconnections:

- **Food:** Energy consumption for food production and processing, land requirements for energy production.
- **Water:** Water availability for hydropower generation, energy intensity for treatment and pumping.
- **Socioeconomic:** Economic growth driving the energy demand.

03

Data needs:

- Detailed assessments of solar, wind, hydropower, and biomass potential.
- Energy balance
- Grid extensions
- Energy demand

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Food Module

01

Key Features:

- Land-uses;
- Crop yields and food production;
- CO2 emissions and GHG balance;
- Food demand and diets;

02

Interconnections:

- **Water:** Availability and quality of water for irrigation.
- **Energy:** The agriculture sector relies heavily on energy for various processes, impacting overall energy demand.
- **Socioeconomic:** Food demand driven by population growth and income.

03

Data needs:

- Information on crop yields
- Livestock production
- Fisheries
- Dietary patterns
- Land uses

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Socioeconomic Module

01

Key Features:

- Population growth,
- GDP,
- Employment,
- Investment;
- Consumption;

02

Interconnections:

- **Food:** Dietary shifts and consumption patterns impacting food demand.
- **Energy:** Increased energy demand due to economic development and rising living standards.
- **Water:** Population and economic growth driving water demand.

03

Data needs:

- Population growth
- Migration
- Urbanization rates
- Economic activities
- GDP
- Resources demand

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Data challanges

Data Challenges:

•**Data scarcity:** Limited availability of reliable and up-to-date basin-level data for many variables.

•**Data quality**: Issues with data accuracy, consistency, and comparability across different sources.

•**Downscaling complexities:** Challenges in downscaling regional or global datasets to the basin level.

•**Data harmonization:** Ensuring consistency and comparability across different datasets and indicators.

•**Collaboration & access:** Overcoming barriers to accessing data held by various institutions and stakeholders.

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Bibliography

Michael J. Radzicki and Robert A. Taylor (2008). "Origin of System Dynamics: Jay W. Forrester and the History of System Dynamics". In: *U.S. Department of Energy's Introduction to System Dynamics*. Retrieved 23 October 2008.

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Thank you!

Do you have any questions?

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